Kennedy/Jenks Consultants

2828 SW Naito Parkway, Suite 250
Portland, Oregon 97201
503-295-4911
503-295-4901 (Fax)

Remedial Investigation, Risk Assessment, and Feasibility Study Report (RI/RA/FS Report) Former Strebor Facility Tetra Pak Materials

August 2004

Prepared for

Tetra Pak Materials
1616 West 31st Street
Vancouver, Washington 98660-1201

K/J Project No. 016066.11

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List of Abbreviations/Acronyms

ARAR	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
Bay West	Bay West Environmental Services
BHIP	Beecham Home Improvement Products
Cadet	Cadet Manufacturing Company

List of Abbreviations/Acronyms Cont'd

Cascade	Cascade Drilling
CDD	Chlorinated Dibenzo-p-dioxin
CDF	Dibenzofuran
Chromium VI	Hexavalent Chromium
CLARC	Cleanup Levels and Risk Calculations
COC	Chemicals of Concern
COPC	Chemicals of Potential Concern
CVOC	Chlorinated Volatile Organic Compound
DCE	Dichloroethene
DOT	Department of Transportation
Ecology	Washington Department of Ecology
EPC	Exposure point concentration
FID	Flame Ionization Detector
FS	Feasibility Study
MCL	Maximum Contaminant Level
µg/l	Micrograms per liter
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
msl	Mean Sea Level
MTCA	Model Toxics Control Act
OCDD	Octachlorodibenzodioxin
OD	Outside Diameter
Payne Reimer	Payne Reimer Group
PCE	Tetrachloroethene
PCP	Pentachlorophenol
ppm	Parts Per Million
PVC	Polyvinyl Chloride
RA	Risk Assessment
RCRA	Resource Conservation & Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RI/RA/FS	Remedial Investigation, Risk Assessment, and Feasibility Study
RME	Reasonable Maximum Exposure
Site	Former Strebor Facility
SLRA	Screening Level Risk Assessment
SVOC	Semi-Volatile Organic Compound
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCE	Trichloroethene
TCP	Trichlorophenol
TEF	Toxicity Equivalency Factor
TEQ	Toxicity Equivalent
Tetra Pak	Tetra Pak Materials, LP
USEPA	United States Environmental Protection Agency

List of Abbreviations/Acronyms Cont'd

UST	Underground Storage Tank
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
yd^3	Cubic Yards
95% UCL	95 percent Upper Confidence Limit

Section 1 – Remedial Investigation

Section 1: Remedial Investigation

1.1 Introduction

This report presents the results of a remedial investigation (RI) conducted at the former Strebor facility (site) located in Vancouver, Washington. This RI was performed under the Voluntary Cleanup Program (VCP) in accordance with Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) regulations published in Washington Administrative Code (WAC) 173-340.

The purpose of this RI was to identify the distribution of constituents of concern in site soil and groundwater from past operations by prior site owners. Additionally, potential impacts to air were evaluated.

1.1.1 Site Location and Description

The site is located on approximately 3.7 acres in the lowland valley of the Columbia River at an elevation of approximately 50 feet above mean sea level (msl). A vicinity map is included as Figure 1 and the general site layout is shown on Figure 2. The site is located at 3125 Thompson Avenue in Vancouver, Washington in the SW ¼, of the NE ¼ of Section 21, Township 2 North, Range 1 East. There is one structure on the property, a 14,000-square foot (approximate) building constructed in 1974. Land use in the vicinity of the site is commercial, industrial, and residential.

The current legal owner/operator of the site is:

Tetra Pak Materials, LP
1616 West 31st Street
Vancouver, WA 98660
Contact: James Kinane – Quality Assurance Manager
Contact Telephone: (360) 690-1218

1.1.2 Regional Geology and Hydrogeology

The site is located in the Portland Basin, a northwest-southeast trending structural basin filled with consolidated and unconsolidated sedimentary and volcanic deposits ranging in age from late Miocene to Holocene. The Portland Basin is approximately 20 miles wide and 45 miles long (Swanson et al. 1993, Turney 1988).

Eight major hydrogeologic units have been encountered in the Portland Basin (Swanson et al. 1993). An unconsolidated sedimentary aquifer (Unconsolidated Aquifer) is the uppermost unit in the area and is underlain by the Troutdale Aquifer. The Troutdale Aquifer is reportedly the primary potable groundwater source for Clark County (Swanson et al. 1993, Turney 1988).

The maximum thickness of the Unconsolidated Aquifer is approximately 300 feet in the Portland Basin and approximately 50 feet thick or more in the vicinity of the site (Swanson et al. 1993). It includes Pleistocene and Holocene sedimentary deposits derived from the catastrophic glacial flooding of former Lake Missoula, and alluvial deposits derived from the Columbia River and tributaries. In addition, floodplain, glacial outwash, and terrace gravel deposits occur locally within this unit. The Unconsolidated Aquifer includes sedimentary material ranging in size from boulders to silt, with coarse sand and gravel being most common.

The Troutdale Aquifer is late Pliocene to Pleistocene in age and is composed of interstratified conglomerates, gravels, sandstones, and volcanics, including lava deposits. The uppermost portion of the Troutdale Aquifer is locally weathered to clay. Regionally, the unit has a maximum thickness of approximately 400 feet.

According to the Payne Reimer report, the Unconsolidated Aquifer is thought to be in hydraulic communication with the underlying Upper Troutdale formation. The groundwater flow in the Troutdale generally flows toward the Columbia River and the Salmon Creek. Due to the proximity of the site to the Columbia River, the groundwater is expected to be influenced by changes in the flow of the Columbia River.

In 1989, trichloroethene (TCE) and tetrachloroethene (PCE) were detected in two process wells at Great Western Malting Company located in an industrial area at the Port of Vancouver in Vancouver, Washington (Ecology 2000). Ecology subsequently completed a study to identify the potential source(s) of the TCE and PCE groundwater contamination in this industrial area west of downtown Vancouver which is identified at the Vancouver West Industrial District. This industrial district lies generally between 4th Plain Boulevard to the north and the Columbia River to the south, and west of "old" downtown Vancouver and Interstate 5. This work was carried out under a Site Assessment Cooperative Agreement between Ecology and the United States Environmental Protection Agency (USEPA) Region 10 between 1 July 1999 and 30 June 2000.

The results of Ecology’s study indicated that seven sites located within the industrial area have documented chlorinated solvent soil and/or groundwater contamination (Ecology 2000). Cadet Manufacturing Company (Cadet), ST Services, a property located at 2001 NE Roosevelt (Vancouver Drum) and the Port of Vancouver Building 2220 were identified as sources of TCE and/or PCE soil contamination, and. At the Cadet facility, TCE was detected at concentrations as high as 3,000 micrograms per liter (µg/l), and PCE at concentrations as high as 930 µg/l. Cadet is located at 2500 West Fourth Plain Boulevard, approximately 0.3 miles south of the Strebor property.

Different studies completed in this area show groundwater flowing in different directions. In its report, Ecology states that groundwater generally flows in a westerly to southerly direction from the foothills of the Cascades toward the Columbia River in the Clark County area. However, the results of another study summarized in Ecology’s report indicate that groundwater flow direction in the study area is toward the west to northwest.

1.1.2.1 Historic and Current Site Uses

The following subsections discuss historical and currents uses of the site. Historical information presented in the following subsections is based on reports prepared by others that are listed in the References section of this report and on interviews conducted with Tetra Pak Materials, LP (Tetra Pak) personnel.

1.1.2.2 Past Facility Operations

Prior to 1974, the site was undeveloped rural land and was owned by the former Burlington Northern Railroad (now the Burlington Northern and Santa Fe Railway Company) (Shannon and Wilson, 1989). Roberts Consolidated Industries constructed a facility on the site in 1974 to formulate wood treatment products. The facility included a 14,000-square foot building, a railroad spur and underground storage tanks (USTs). The building included offices, mixing room, filling room, and a product storage area. A number of home improvement products were also stored at and distributed from the facility, including adhesives, cements, glues, and solvents (CH2M Hill 1991). Pentachlorophenol (PCP) crystals and solutions containing PCP were used in products that were produced at the facility (Shannon and Wilson 1989). When production of PCP-containing wood preservatives for home use was discontinued in about 1984, solutions containing tributyltin oxide were produced at the facility.

Roberts Consolidated Industries closed the facility in March 1986 (Bay West 1988). The property was transferred to Beecham Home Improvement Products (BHIP) in 1986 (which merged with DAP Inc. on 20 July 1987) and to Strebor Incorporated in late 1987. Tetra Pak purchased the property in 1989.

Until 1986, site operations consisted primarily of receiving raw material, and mixing, packaging and storing of wood-treating solutions. Raw material was delivered to the site by trucks, tanker trucks, and rail tanker cars (Shannon and Wilson 1989). The railroad spur on the east side of the facility was primarily used for receiving bulk shipments of petroleum hydrocarbon-based raw materials such as naphtha and mineral spirits (Bay West 1988). The raw materials were transferred from USTs, blended in the mixing room, and then returned to USTs for storage. (CH2M Hill 1991). The resulting products were packaged into one-gallon and 5-gallon containers and drums for commercial sale (Shannon and Wilson 1989). The wood-treating solutions mixed and packaged at the facility typically contained less than 5 percent PCP (CH2M Hill 1991). The bulk of the product mixed at the site consisted of 91.0 percent naphtha, 6.4 percent water repellents and inert materials, approximately 2.0 percent PCP, 0.2 percent other chlorinated phenols, and 0.3 percent bis tributyltin oxide (Bay West 1988).

Thirteen 10,000-gallon USTs were used to store product and raw materials. Eleven of the USTs were located in a tank farm area north of the building and two USTs were located under the mixing room floor. The tank farm area is elevated approximately three feet above the adjacent railroad spur and paved driveway entrance and parking.

The two USTs located under the mixing room were abandoned in place in 1986 by rinsing with mineral spirits and filling with a cement grout (Bay West 1988). The USTs in the tank farm were removed in 1986 (Payne Reimer, 1987). It is understood that some contaminated soil associated with the tank farm USTs may have also been removed; however, there is no documentation available that discusses specific soil removal activities.

1.1.2.3 Current Facility Operations

The site is zoned commercial/industrial. Tetra Pak uses the existing building for office space, maintenance activities, storage of parts and equipment, and certain photolithographic processes. The former tank farm area is paved and used as a temporary storage area for pallets and miscellaneous equipment and employee parking.

The ground surface of the site is relatively level with the paved sections of the property draining to four catch basins at the locations shown in Figure 2. Each catch basin is connected to an individual dry well that is located immediately adjacent to the catch basin. The area north and east of the tank farm is unpaved. The southern portion of the property is covered by grass that is routinely mowed as a part of grounds maintenance activities, but is otherwise unused. Stormwater in these areas infiltrate underlying soil.

1.1.3 Known and Suspected Releases

Historical information available at Ecology documents that spills of PCP and other organic compounds occurred at the site prior to Tetra Pak's acquisition of the property in 1989. Information provided by Tetra Pak includes copies of past environmental reports prepared for the site and copies of correspondence between previous site owners, contractors, and Ecology regarding spills and follow up activities. Additional information was obtained from Ecology files. The following known or suspected spills are documented in the reports and correspondences:

- Spill of 100 to 200 gallons of wood-treating solution 1980. A tank was reportedly overfilled and the solution was released to an unsealed earthen sump below the tank. Based on the available information, it is not known if the tank was underground or above ground. Additionally, information regarding the tank and the sump location is not available.

- Spill of 40 to 100 gallons of wood-treating solution at an unknown location in March 1983.

- Spill of approximately 17 gallons of wood-treating solution containing PCP in the tank farm in February 1984.

- Spill of 40 to 45 gallons of wood-treating solution containing PCP when a tanker truck was overfilled in June 1984. The product reportedly flowed into one of the catch basins west of the tank farm area.

- Spill of 40 gallons of wood-treating solution containing PCP in the tank farm in March 1985.

- Spill of 15 gallons of wood-treating solution containing PCP in the tank farm in October 1985

- A spill of up to 5,000 gallons of wood-treating solution reportedly occurred sometime prior to 1987. Much of the spill apparently flowed into the dry wells located in the parking lot.

1.1.4 Previous Investigations

Ecology (in 1985 and 1990), Beecham Home Improvement Products (1985), Payne Reimer Group (in 1987) and Bay West Environmental Services (in 1988) evaluated soil and/or groundwater conditions at the site from 1985 to 1990. The results of these activities indicated the presence of detectable concentrations of PCP, aromatic hydrocarbons, aliphatic hydrocarbons, and octachlorodibenzodioxin (OCDD) in soil. Chlorinated volatile organic compounds (CVOCs), arsenic, chromium, and lead were detected in groundwater at the site. The results of these investigations are summarized below. The results of analytical testing of soil and groundwater samples obtained during these studies are summarized in Tables 1 and 2, respectively.

1.1.4.1 Ecology – 1985

In response to the March 1985 spill of 40 gallons of wood-treating solution in the tank farm, Ecology collected soil samples near the standpipe of one of the tank farm USTs and from a topographic low spot along the railroad spur. PCP was detected at a concentration of 0.62 milligrams per kilogram (mg/kg) in the soil sample obtained from the tank farm. PCP was also detected at a concentration of 330 mg/kg in the soil sample collected from a topographic low spot in the vicinity of the railroad spur. The approximate location of the topographic low spot is shown on Figure 3. Based on these results, Ecology requested that BHIP conduct an investigation of the site and provide a proposal for site cleanup (Ecology 1985).

1.1.4.2 Beecham Home Improvement Products – 1985

At the request of Ecology, BHIP collected additional soil samples in the area where the results of Ecology's sampling activities indicated the presence of PCP and in areas not previously sampled. PCP was detected in shallow soil samples collected from the topographic low spot along the railroad spur, from the soil bank immediately east of the tank farm, and within the tank farm area. The maximum concentration of PCP detected in the samples collected from the topographic low near the railroad spur was 7.14 mg/kg and from the tank farm was 35.3 mg/kg.

1.1.4.3 Payne Reimer Group - 1987

At the request of DAP, the Payne Reimer Group (Payne Reimer) completed seven borings at the site. One boring was completed through the floor of the mixing room and six borings were completed outside the building; one of the outside borings was completed within the tank farm; one surface soil sample was collected in a stained area along the railroad spur. Monitoring wells MW-5-16 and MW-5 were installed in two of the borings. Monitoring well MW 5-16 was completed at the southwest corner of the building and MW-5 at the west side of the facility adjacent to Thompson Avenue. Total aliphatic hydrocarbons and total aromatic hydrocarbons (590 mg/kg and 300 mg/kg, respectively) were detected in a soil sample obtained from a depth interval of 9.0 to 10.5 feet below ground surface (bgs) in a boring completed in the tank farm. Total aliphatic and total aromatic hydrocarbons (2,800 mg/kg and 1,070 mg/kg, respectively) were also detected in a sample collected at 6.5 to 7.0 feet bgs in a boring completed through the mixing room floor. PCP and OCDD were detected at concentrations of 15,200 mg/kg and 0.05 mg/kg, respectively, in a sample collected at approximately 7 feet bgs from the same boring.

Monitoring well MW-5-16 was screened from approximately 10.8 feet to 15.8 feet bgs in an apparent saturated zone; however, the well was dry following installation. The screen in monitoring well MW-5 was set at from approximately 44 to 49 feet bgs. Payne Reimer obtained a groundwater sample from this well for analysis of volatile organic compounds (VOCs) and PCP. Dichloroethene (DCE), TCE, and PCE were detected in the groundwater sample from well

MW-5 at concentrations of 26, 11, and 11 µg/l, respectively. PCP was not detected above the laboratory method reporting limit of 10 µg/l.

Payne Reimer attempted to conduct an in-situ permeability test using monitoring well MW-5 to determine aquifer properties. No measurable drawdown occurred during the test, suggesting a high hydraulic conductivity in the water-bearing zone. Payne Reimer reports that testing of wells in the vicinity showed specific capacities ranging from 30 to 125 gallons per minute per foot.

1.1.4.4 Bay West Environmental Services - 1988

At the request of Strebor, Bay West Environmental Services (Bay West) completed seven borings at the site in 1988 and installed three monitoring wells (wells MW-1, MW-2, and MW-3). Five borings were completed through the floor of the mixing room and two borings were completed in the tank farm. PCP was detected at concentrations up to 890 mg/kg in soil samples obtained from depths of 12.5 to 21 feet bgs from explorations completed in the vicinity of the mixing room USTs. PCP was not detected in soil samples obtained from the two borings completed in the tank farm. Volatile organic compounds were not detected in the soil samples that were analyzed from the borings.

Groundwater samples were obtained from wells MW-1, MW-2, MW-3 and MW-5 and analyzed for the presence of PCP and VOCs. PCP was not detected in any of the groundwater samples. PCE (1.1 to 4.1 µg/l), TCE (3.2 to 16 µg/l), 1,2-DCE (1.2 to 5.3 µg/l), 1,1,1-trichloroethane (1.5 to 5 µg/l), and 1,2-dichloropropane (1.8 µg/l) were detected in the groundwater samples. The groundwater flow direction was determined to be toward the west-northwest at a relatively flat gradient of 1.9 to 2.6×10^{-4} feet/foot.

1.1.4.5 Ecology - 1990

In April 1990, Ecology obtained a groundwater sample from monitoring well MW-3 as a part of an area wide groundwater quality investigation. The sample was analyzed for VOCs and metals. Chromium, arsenic, and lead were detected at concentrations above 1990 proposed MTCA groundwater cleanup levels. Thallium was detected above the federal maximum contaminant level (MCL) of 2 µg/l. Cis-1,2 DCE, 1,2 DCE, and TCE were detected at concentrations of 200 µg/l, 2 µg/l, and 6 µg/l, respectively.

1.2 RI Purpose and Objectives

The purpose of Kennedy/Jenks Consultants' services was to supplement existing information and evaluate the nature and extent of soil and groundwater contamination from past owners and operations at the site. A work plan and sampling and analysis plan for these activities (Kennedy/Jenks 2001) were submitted to Ecology for review and comment in December 2001. With minor changes, the plans were adopted and were followed during our field activities which began in February 2002.

The objectives of the RI are as follows:

- Define the lateral and vertical extent of contaminated soil that remains in the former underground storage tank farm and in the areas of reported past spills.

- Evaluate the lateral and vertical extent of contaminated surface and subsurface soil in the vicinity of the railroad spur, east of the building.

- Evaluate groundwater quality at the site by installing new monitoring wells and collecting groundwater samples from existing and new monitoring wells for laboratory analyses. Additionally, collect reconnaissance groundwater samples from exploratory borings for laboratory analyses.

- Determine groundwater flow direction.

- Evaluate the potential presence of contaminated sediment in the onsite dry wells and the four stormwater catch basins.

- Consider potential impacts to air quality at the site resulting from the presence of subsurface contamination.

1.3 RI Scope of Work

The RI field investigations were conducted by Kennedy/Jenks Consultants between February 2002 and February 2003. Field investigation activities included the following:

- Conducting ground penetrating radar survey of the former Tank Farm area and dry wells to confirm the removal of the USTs and ancillary piping as well as locate dry wells and utilities.

- Completing reconnaissance-level explorations using direct-push (Geoprobe®) drilling equipment at eight locations along the railroad spur, at nine locations within and outside of the former tank farm, and five borings adjacent to the drywells.

- Obtaining soil samples from the reconnaissance explorations for field screening and/or laboratory analyses.

- Obtaining groundwater samples from three reconnaissance explorations and submitting the samples for laboratory analyses.

- Redeveloping the existing monitoring wells.

- Installing new groundwater monitoring wells MW-6, MW-7, and MW-8.

- Obtaining groundwater samples from all on-site monitoring wells and submitting the samples for laboratory analyses.

- Obtaining sediment samples from the catch basins associated with each of the four drywells for field screening and analytical laboratory testing.

- Measuring depths to groundwater and determining groundwater flow direction beneath the site. To facilitate our understanding of site conditions for preparing the work plan and prior to initiation of the RI activities, depths to groundwater and organic vapor concentrations were measured in October 2001 in the existing monitoring wells.

- Evaluating whether the presence of subsurface contamination could result in potential impacts to air quality at the site.

1.3.1 Ground Penetrating Radar Survey

Geopotential Environmental & Exploration Geophysics was contracted to conduct a ground penetrating radar survey of two areas at the site: the areas around the dry wells and within the former Tank Farm. The purpose of this survey was to: confirm the removal of the USTs and ancillary piping in the Tank Farm, locate the dry wells within the driveway and parking lot area west of the Strebor building, and locate utilities in the areas of subsurface investigations.

Four separate pits were identified within the area of the former Tank Farm. There was no indication of remaining USTs or ancillary piping in this area. Buried debris and a pipe were noted in an area immediately north of the Tank Farm. The locations of the dry wells in respect to each catch basin were also identified. The results of the survey are included in Appendix A.

1.3.2 Reconnaissance Soil Borings

Surface and/or subsurface soil samples were collected from the vicinity of the railroad spur, within and surrounding the former tank farm, and adjacent to the catch basins and associated dry wells using direct-push drilling equipment. Soil samples were visually classified and logged using the Unified Soil Classification System. Detailed logs of the borings are included in Appendix B. The locations of the reconnaissance explorations are shown on Figure 3.

Soil samples were screened in the field for the potential presence of PCP using the EnSys Soil Test System™ from Strategic Diagnostics, Inc and for VOCs using a flame ionization detector (FID). The EnSys Soil Test System™ test kit has a detection limit of 0.5 parts per million (ppm). The test kit gives a positive or negative result at or above the 0.5 ppm detection level. The test kits were used to focus analytical efforts on those samples that indicated a positive presence of PCP. In general, if a positive detection of PCP was indicated by the test kit in a sample obtained from a boring, the boring was advanced at five-foot intervals and samples were obtained for field screening until the test kit results indicated a negative result. In those borings with positive detections of PCP, select samples with positive detections and the first underlying sample with a negative detection were submitted to Severn Trent Laboratory in Tacoma, Washington under standard chain-of-custody procedures for laboratory analyses. If all samples from a boring tested negative for PCP using the test kit, the deepest sample was sent to the laboratory for analyses.

It has been documented that industrial grade PCP contains traces of dioxin compounds. Samples indicating a positive presence of PCP above the 0.5 ppm detection level were also sent to the laboratory and analyzed for dioxin compounds.

Two shallow soil samples were collected to determine background metals concentrations in shallow soil at the site.

Select samples obtained from explorations completed in the vicinity of the rail spur, within the former Tank Farm area, adjacent to the dry well/catch basins, and background sample locations were submitted for the following analyses:

- Semi-volatile organic compounds (SVOCs) using EPA Method 8270C,
- Qualitative petroleum hydrocarbon analysis using Northwest Method NWTPH-HCID,
- VOCs using EPA Method 8260B,
- Total metals including lead, chromium, thallium, and arsenic using EPA Method 6020,
- Hexavalent chromium (chromium VI) using EPA Method 7195, and dioxins using EPA Method 1613 for samples with positive PCP detections with the field test kit. Samples with negative PCP detections using the field test kit were not analyzed for dioxins.

1.3.2.1 Railroad Spur

Eight reconnaissance-level explorations (borings RS-1 through RS-8) were completed along the railroad spur at locations corresponding with stained areas and areas of PCP spills near the former tank farm. The locations of the borings are shown on Figure 3. Shallow surface soil samples (from ground surface to one foot bgs) were obtained from the borings where materials would yield an appropriate sample. Subsurface soil samples were collected from depths of 2, 5, and 10 feet bgs at each location for soil classification and field screening purposes, with one exception. Due to a positive detection of PCP from the field test kit in the samples obtained from 10 feet in boring RS-4, additional samples were collected at depths of 15 and 20 feet.

1.3.2.2 Former Tank Farm

Nine reconnaissance-level explorations (borings TF-1 through TF-9) were completed in and around the former tank farm area. The locations of the borings are shown on Figure 3. The boring locations were selected to correspond to locations near tanks that contained PCP, near spill areas, and to provide a spatial coverage of the area adjacent to the tank farm. Due to the additional drilling and sampling required at RS-4 (see above) and the negative PCP screening at TF-3, soil boring TF-4 was not completed as indicated in the work plan (Kennedy/Jenks 2001).

The lateral and vertical extent of the 1986 UST removal excavation was not defined prior to the initiation of drilling activities. Therefore, in those borings completed within the apparent tank excavation backfill area, samples of the fill material were collected at 5 feet bgs and samples of native soil were collected where first encountered, if the fill/native soil interface was apparent, and every five feet thereafter to a depth of 25 feet bgs. As discussed in Section 4 - Subsurface Soil and Groundwater Conditions, the apparent base of the tank removal excavation was encountered at approximately 10 feet bgs.

Samples obtained from the borings were field screened for the potential presence of VOCs and PCP. For locations inside the tank farm where all samples from a boring tested negative for PCP using the field test kit, the sample obtained from 15 feet bgs, approximately 5 feet below the base of the tank removal excavation, was submitted for analyses. For locations outside the tank farm where all samples from a boring tested negative for PCP using the test kit, the deepest sample was submitted for analyses.

1.3.2.3 Dry Well/Catch Basin Locations

The construction details of the dry wells and catch basins are unknown, however each drywell has one catchbasin. One boring was advanced immediately adjacent to each of the four catch basins and associated drywells at the locations shown on Figure 3, with one exception. Two borings (borings DW-3A and DW-3B) were advanced at the catch basin/dry well located near the northwest corner of the building due to proximity of this catch basin/drywell to the former UST area and the mixing room. Borings DW-1, DW-2 and DW-4 were completed adjacent to the other three catch basins/dry wells (refer to Figure 3).

For the five borings completed adjacent to the catch basins/dry wells, soil samples were collected at depth intervals of 5 feet starting at 10 feet bgs to approximately 25 feet bgs. Each sample was field screened for the potential presence of VOCs and PCP.

1.3.3 Background Samples

A location was selected to provide site background metals concentrations for lead, chromium, thallium, and arsenic in shallow soil (Figure 3). A composite soil sample was collected from the top foot of soil and an additional background sample from a depth of two feet. The background soil sample was located due north of the employee parking lot (Figure 3).

1.3.4 Catch Basin Sampling

Sediment samples (SED-1 through SED-4) were collected using a hand auger from the catch basins and screened in the field for the potential presence of PCP; all samples tested positive using field-screening techniques for the presence of PCP. These samples were submitted for SVOC analyses using EPA Method 8270C.

1.3.5 Reconnaissance Groundwater Sampling

Reconnaissance groundwater samples were collected from borings RGW-1, RGW-2, and RGW-3 completed at the locations shown on Figure 4. Hollow-stem auger drilling equipment owned and operated by Cascade Drilling (Cascade) was used to advance the borings. Groundwater was encountered at an approximate depth of 45 feet bgs. Soil samples were also collected from these three borings for classification purposes, for visual and olfactory evidence of chemicals of concern and for field screening using a FID.

Groundwater samples were collected directly from inside the auger flights from the three reconnaissance explorations using a dedicated disposable bailer and were placed in sample containers (containing preservative, where appropriate) provided by the analytical laboratory. Samples were submitted to Severn Trent Laboratory in Tacoma, Washington under standard chain-of-custody procedures for the following analyses:

- SVOCs using EPA Method 8270C
- VOCs using EPA Method 8260B
- Diesel-range hydrocarbons using Northwest Method NWTPH-Dx
- Total and dissolved metals including lead, chromium, thallium, and arsenic using EPA Method 6020 (field filtered for dissolved metals)
- Total and dissolved chromium VI using EPA Method 7195 (field filtered for dissolved chromium VI).

1.3.6 Monitoring Well Redevelopment

The wells installed during previous field investigations in 1987 and 1988 (MW-1, MW-2, MW-3, and MW-5) were redeveloped by Cascade in February 2002. Monitoring well MW-1 was located a few yards away from a damaged pipe that was previously thought to be a monitoring well. MW-1 was determined to be in good condition.

Each well was surged with a vented surge block for approximately 20 to 25 minutes. Following surging, the water in the casing was purged using either a stainless steel or disposable bailer. Depending on the recharge rate, between 6 and 10 well casing volumes were purged from each well. All purge water was placed in a DOT-approved 55-gallon drum.

1.3.7 Monitoring Well Installation

Monitoring well MW-6 was installed on 12 April 2002 in reconnaissance boring RGW1 following the collection of the reconnaissance groundwater sample. Monitoring well MW-7 was installed adjacent to reconnaissance boring RGW2 on 29 July 2002, following receipt of the reconnaissance groundwater analytical results indicating the potential presence of PCP. Monitoring well MW-8 was installed on 14 February 2003 at the northern property boundary, north of the former UST tank farm (Figure 4).

Monitoring wells MW-6, MW-7, and MW-8 were constructed to depths of 55 feet bgs. The monitoring wells were constructed using two-inch diameter polyvinyl chloride (PVC) well casing. The lower fifteen feet of each monitoring well casing is machine-slotted (0.010-inch slot width) to allow water to enter the well casing. The top of the well screen was set approximately five feet above the static water table from 40 feet to 55 feet bgs. Medium sand (10-20 Colorado Sand). was placed in the borehole annulus surrounding the slotted well screen from 38 feet to 55 feet bgs . A bentonite chip seal was placed above the sand filter pack to the ground surface in the borehole annulus to minimize the potential for movement of water or cross-contamination of surface impacts. The bentonite seal was hydrated following placement. Both monitoring wells were completed with flush-grade surface monuments and watertight lids. The boring logs and well construction diagrams are included in Appendix B.

Following construction, the wells were developed to remove any water or drilling fluid that may have been introduced into the wells during drilling activities, to the stabilize the filter pack and formation materials, and to minimize the amount of fine-grained sediment entering the wells.

Each well was hydraulically stressed by moving a surge block up and down inside the screened section of the casing. Following surging, water was removed using either a stainless-steal bailer or a submersible pump. During well development, field personnel recorded measurements of temperature, specific conductance, and pH. Additionally, observations of turbidity, color, and the presence of odor were recorded. Well development continued until the field measured parameters stabilized (within 10%) and the well produced water of relatively low turbidity.

1.3.8 Well Survey and Depth to Groundwater Measurements

The top-of-well casing elevation (relative to mean sea level) and horizontal location of each monitoring well were surveyed by Otak, of Lake Oswego, Oregon and Ronald Bush of Kennedy/Jenks Consultants. This information was used in conjunction with water level depth data to assess the direction and magnitude of the hydraulic gradient at the site.

Depths to groundwater were measured in the existing wells on October 2001 and then on a monthly basis beginning in February 2002 and continuing through May 2002. One well (well MW-1) was not accessible at the time of the October 2001 site visit. Beginning in May 2002, the wells were monitored on a quarterly basis through February 2003. The three new monitoring wells (MW-6, MW-7, and MW-8) were added to the monitoring program following their installation. Depths to groundwater are measured in all site wells using electronic water level depth probes and are converted to elevations using the surveyed top-of-casing elevations.

1.3.9 Groundwater Sampling

Four consecutive quarters of groundwater sampling was conducted as part of the RI. Unless otherwise stated, groundwater samples were collected using dedicated, stainless steel, 1-inch outside diameter (OD) bladder pumps and dedicated polyethylene tubing. A minimum of three well casing volumes of groundwater was purged from each monitoring well prior to sample collection. Temperature, specific conductance, and pH were measured during purging and recorded on groundwater purge and sample forms. Copies of the groundwater purge and sample forms are provided in Appendix C. Samples were collected after the above indicators stabilized within 10%. All purge water was placed in a DOT-approved 55-gallon drum and stored onsite. Groundwater samples were collected and transferred to laboratory-prepared containers (containing preservative where appropriate). Sample containers were filled completely to minimize headspace. Samples were submitted to Severn Trent Laboratory in Tacoma, Washington under standard chain-of-custody procedures. A summary of each sampling event is provided below:

On 18 April 2002, the dedicated bladder pumps were installed in monitoring wells MW-1, MW-2, MW-3, MW-5, and MW-6. The first round of quarterly groundwater samples were collected from these wells on 18 and 19 April 2002. Samples from each well were submitted to Severn Trent Laboratory for the following analyses:

- SVOCs using EPA Method 8270C
- VOCs using EPA Method 8260B
- Diesel-range petroleum hydrocarbons using Northwest Method NWTPH-Dx

- Total and dissolved metals including lead, chromium, thallium and arsenic using EPA Method 6020

- Total and dissolved chromium VI using EPA Method 7195.

Reconnaissance groundwater samples collected in April 2002 contained detectable levels of PCP. An additional monitoring well, MW-7 was installed on 29 July 2002 and sampled on 7 August 2002. Groundwater samples from this well were submitted to Severn Trent Laboratory for analysis of SVOCs using EPA Method 8270C.

The second round of quarterly groundwater sampling was conducted on 20 and 21 August 2002. Based on analytical results from the April 2002 sampling event and follow-up discussions with Ecology, the groundwater analyses were modified to:

- PCP and trichlorophenol (TCP) using EPA Method 8270C

- VOCs using EPA Method 8260B

- Total and dissolved chromium using EPA Method 6020.

The third round of quarterly groundwater sampling was conducted on 18 and 19 November 2002.

Based on groundwater sampling and monitoring results from the third quarterly sampling event, monitoring well MW-8 was installed on 14 February 2003. The fourth round of quarterly groundwater sampling was conducted on 24 and 25 February 2003. Due to slow recharge rates and low water levels, the bladder pumps were not effective in efficiently purging and sampling the monitoring wells. Therefore it was necessary to collect some of the groundwater samples using disposable polyethylene bailers. Monitoring wells MW-3 and MW-6 were purged and sampled with the dedicated bladder pumps. Monitoring wells MW-1, MW-2, MW-5 were purged and sampled with disposable bailers. Then monitoring wells MW-7 and MW-8 were purged with disposable bailers and sampled with the bladder pump due to turbidity issues in these samples.

1.3.10 Air Quality

As stated in the work plan, the non-volatile nature of PCP eliminates PCP as an air contaminant concern. Additionally, because of the relatively low VOC concentrations detected in soil and groundwater and the depth to groundwater beneath the Site (approximately 45 to 50 feet bgs), volatilization of VOCs from groundwater to outdoor air is estimated to be low.

During the RI field activities, appropriate dust control measures were taken, as necessary, to protect personnel and to prevent offsite migration of PCP. Field monitoring equipment was used to monitor ambient concentration of VOCs as defined in the site Health and Safety Plan.

1.4 Subsurface Soil and Groundwater Conditions

This section summarizes the soil and groundwater conditions observed at the site during our investigation activities.

1.4.1 Soil Conditions

Soils that appear representative of the Unconsolidated Aquifer were encountered during drilling at the site. With the exception of the former tank farm area, the top of the Unconsolidated Aquifer was encountered at approximately 1 foot to 4 feet bgs, underlying anthropogenic fill. In the elevated former tank farm area, the Unconsolidated Aquifer lies under approximately 10 feet of apparent tank backfill material. The soil at the site generally consists of brown silt, silty sand and sandy silt extending to a depth of approximately 15 to 20 feet bgs. These finer grained sediments are underlain by coarse sands and gravels. The sands and gravels extend to 55 feet bgs, the total depth of exploration. The Troutdale Formation was not encountered during site investigation activities.

1.4.2 Groundwater Conditions

Since the first monitoring wells were installed at the site in 1987, the wells have been referenced under different names. For consistency, Kennedy/Jenks Consultants has included the following table for cross reference purposes.

Current Well Designation	Other Designations	Notes
MW-1	BW-1	Monitoring well installed in boring BW-1 during 1988 Bay West field activities.
MW-2	BW-2	Monitoring well installed in boring BW-2 during 1988 Bay West field activities.
MW-3	BW-3	Monitoring well installed in boring BW-3 during 1988 Bay West field activities.
MW-5	3-49, PR-3, B-3	Monitoring well installed in boring B-3 during 1987 Payne Reimer field activities.
MW-6	RGW-1	Monitoring well in boring RGW-1 during April 2002 Kennedy/Jenks Consultants field activities.
MW-7	RGW-2	Monitoring well installed near boring RGW-2 during July 2002 Kennedy/Jenks Consultants field activities.
MW-8	Na	Monitoring well installed at northern property boundary, north of the former UST tank farm, in February 2003, Kennedy/Jenks Consultants field activities.
5-16	B-5	Monitoring well installed in boring B-5 during 1987 Payne Reimer field activities. This well is still present; however, it remains dry.

1.4.3 Groundwater Flow

Water level data collected during the June 1988 investigation conducted by Bay West indicated that groundwater elevations beneath the site ranged from 7.29 feet to 7.34 feet msl. Groundwater was determined to flow in a north-northwesterly direction toward Vancouver Lake and the Columbia River. Kennedy/Jenks Consultants collected an initial round of groundwater elevations in October 2001, prior to the beginning of the current RI activities. Additional groundwater elevations were collected monthly beginning in February through May 2002 and quarterly thereafter.

Depths to groundwater measured in the wells between February 2002 and February 2003 ranged between 38.92 and 50.28 feet bgs (11.02 and 3.10 ft msl, respectively). Depth to groundwater measurements and groundwater elevations are summarized in Table 3. Based on the groundwater elevation data, the groundwater flow direction during February, March and April 2002 was toward the southeast to south-southeast. The groundwater flow direction during May and August 2002 was toward the north-northwest. Groundwater flow direction during November 2002 and February 2003 was to the west to west-southwest. In general, groundwater elevations at the site were highest at the time of the April 2002 measurements and lowest in November 2002. Groundwater gradients beneath the site are flat with gradients approximately 0.0002 ft/ft during both the fall and spring. Groundwater elevation data collected at the site wells is typically within 0.05 feet across the site, which is problematic in evaluating groundwater flow direction during each season.

1.5 RI Results

This section summarizes the results of the RI. The RI sampling locations are shown in Figures 3 and 4. Constituents detected in soil, groundwater and sediment are summarized in Tables 3 through 10. Laboratory reports are included in Appendix D.

1.5.1 Data Quality Assessment

The RI analytical data were reviewed and qualified as necessary. Standard data qualifiers used by the analytical testing laboratory include “J” (estimated concentration), “D” for results based on a secondary dilution, and “B” for analytes detected in the associated method blank. A portion of the RI data set required qualification based on the data review. None of the data was rejected. The qualified data can be used for decision-making purposes; however, the limitation identified by the applied qualifiers should be considered when using the data.

1.5.2 Soil Sampling and Analysis Results

As described in Section 3.1, surface and/or subsurface soil samples were collected from the vicinity of the railroad spur, in and around the former tank farm, and adjacent to the catch basins and associated dry wells for field screening and laboratory analyses. Additionally, near surface soil samples were obtained for background metals determination. The results of laboratory analyses of VOCs, SVOCs, metals and dioxins are summarized in Tables 4, 5, 6, and 7, respectively.

1.5.2.1 PCP Test Kit Results

A total of 94 soil samples were field screened for the potential presence of PCP using the EnSys® Soil Test System. The user’s guide is included in Appendix E. Of the 94 soil samples that were collected, 20 tested positive for the potential presence of PCP at a concentration greater than 0.5 ppm. These 20 samples were submitted for laboratory analyses.

As discussed in Section 1.3.1, if all of the samples from a boring tested negative for the potential presence of PCP, one sample was selected and sent to the laboratory for confirmational analysis. Two samples that tested negative for PCP using the test kit contained detectable levels of PCP, however the concentrations were below the 0.5 ppm screening level of the test kit.

Table 8 summarizes the comparison of test kit and laboratory results. The results of the field screening test kit compared favorably with the laboratory analytical testing results with the exception of two samples. Two soil samples, RS-5-10 and TF-1-20, indicated a positive value from the test kit which indicates that PCP is not present. Laboratory analytical results from these two samples indicate PCP detection of 192 µg/kg and 41.4J µg/kg.

1.5.2.2 Railroad Spur

Eight reconnaissance explorations were completed along the railroad spur. The results of analytical testing of soil samples from these explorations are summarized below:

- VOCs: The potential presence of VOCs was not indicated during field screening of soil samples using the FID obtained from the railroad spur explorations. Laboratory analytical results indicate that VOCs either were not detected or were detected at concentrations significantly less than the MTCA preliminary screening criteria listed in Table 4.

- SVOCs: SVOCs, including PCP, was either not detected or detected at concentrations less than the MTCA preliminary screening criteria in the samples submitted for analyses (Table 5).

- Metals: Arsenic was detected in all samples analyzed at concentrations exceeding the MTCA Method B screening level (Table 6). However, the concentrations of arsenic in soil are near or less than the naturally occurring background concentration (Washington State Publication #94-115) and the site background arsenic concentrations. Other metals were either not detected or detected at concentrations less than the preliminary screening criteria.

- Dioxins: Dioxin compounds were detected in soil samples obtained from borings RS-1, RS-4, RS-5, RS-6 and RS-7. In accordance with Ecology guidance, the detected concentrations of the individual compounds were multiplied by toxicity equivalency factors (TEFs) to compare the relative toxicity of individual dioxin-like compounds to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The resulting TEF values are added for each sample and the resulting value is termed the toxicity equivalent (TEQ). Dioxins (as TEQ values) were detected at concentrations exceeding one or more of the preliminary screening criteria listed in Table 7 in soil samples obtained from borings RS-1 at a depth of 2 feet bgs; RS-4 at a depth of 2 feet bgs; RS-5 at depths from 0 to 1 foot bgs, 2 feet bgs and 5 feet bgs; RS-6 at a depth of 0 to 1 foot bgs; and RS-7 at depths of 0 to 1 foot bgs and 2 feet bgs. Dioxin concentrations (as TEQ values) were less than the preliminary screening criteria in the remaining samples analyzed for dioxins.

- Petroleum hydrocarbons: Petroleum hydrocarbons were not detected in those samples submitted for laboratory analysis.

1.5.2.3 Former Tank Farm

Nine reconnaissance-level explorations were completed within and around the tank farm. The results of analytical testing of soil samples obtained from these explorations are summarized below:

- VOCs: The results of field screening using the FID did not indicate the presence of VOCs during sampling activities. Laboratory analytical results indicate that VOCs were either not detected or detected at estimated concentrations significantly less than the MTCA preliminary screening criteria.

- SVOCs: SVOCs, including PCP, were either not detected or detected at concentrations less than the MTCA preliminary screening criteria.

- Metals: Arsenic was detected in all soil samples at concentrations ranging between 1.21 and 10 mg/kg exceeding the MTCA Method B screening level (Table 6). However, the concentrations of arsenic that was detected are all near or less than the naturally occurring background concentration (Washington State Publication #94-115) and the site background concentrations. Other metals were either not detected or detected at concentrations less than the preliminary screening criteria.

- Dioxins: Dioxins (as TEQ values) were detected at concentrations exceeding one of the preliminary screening criteria listed in Table 7 in the soil sample obtained from TF-1 at a depth of 10 feet bgs. Dioxin concentrations (as TEQ values) were less than the preliminary screening criteria in the remaining samples analyzed for dioxins

- Petroleum hydrocarbons: Petroleum hydrocarbons were not detected in those samples submitted for analysis.

1.5.2.4 Dry Wells/Catch Basins

One boring was advanced immediately adjacent to each of the four drywells, with the exception of DW-3, as discussed previously. The results of analytical testing of the samples obtained from these explorations are summarized below:

- VOCs: The results of field screening did not indicate the presence of VOCs during sampling activities. Laboratory analytical results indicate that VOCs were not detected in the soil samples submitted for analysis.

- SVOCs: SVOCs, including PCP, were either not detected or detected at concentrations less than the preliminary screening criteria.

- Metals: Arsenic was detected in all samples analyzed at concentrations ranging between 1.13 and 1.78 mg/kg with the exception of the sample submitted from boring DW-4. The detected concentrations slightly exceed the MTCA Method B screening level

(Table 6). Detected arsenic concentrations are less than the naturally occurring background concentration (Washington State Publication #94-115) and the site background concentrations. Other metals were either not detected or detected at concentrations less than the preliminary screening criteria.

- Dioxins: Dioxins (as TEQ values) were detected at concentrations exceeding both of the preliminary screening criteria listed in Table 7 in the soil sample obtained from boring DW-3A at a depth of 20 feet bgs. The dioxin concentration (as a TEQ value) detected in the other sample analyzed from this area was less than the preliminary screening criteria.

- Petroleum hydrocarbons: Petroleum hydrocarbons were either not detected or detected at estimated concentrations less than MTCA Method A cleanup levels in those samples submitted for analysis.

1.5.3 Catch Basin Sediments

One or more SVOCs, including PCP, were detected at elevated concentrations in sediment samples (SED-1, SED-2, and SED-3) from drywells DW-1, DW-2, and DW-3 (Table 9). As an interim remedial action, Tetra Pak contracted with West Coast Marine Cleaning to remove and properly dispose of the sediment materials from each of the four catch basins in October 2002.

1.5.4 Background Metals

Background soil samples were collected from depths of one and two feet bgs and analyzed for chromium, arsenic, lead, and thallium. Thallium was not detected in the background samples. At the one foot depth, chromium, arsenic, and lead were detected at concentrations of 18.7 mg/kg, 7.5 mg/kg, and 14.3 mg/kg, respectively. At the two foot depth, chromium, arsenic, and lead were detected at concentrations of 24.6 mg/kg, 11.2 mg/kg, and 14.6 mg/kg, respectively. These metals concentrations are similar to the naturally-occurring background concentrations listed in Washington State Publication #94-115.

1.5.5 Groundwater Sampling and Analysis

As described in Sections 1.3.4 and 1.3.8, groundwater samples were collected from reconnaissance explorations and existing and new monitoring wells between February and August 2002. The results of laboratory analyses of these samples are summarized in Table 9.

1.5.5.1 Reconnaissance Groundwater Results

Reconnaissance groundwater samples were collected from borings RGW-1, RGW-2, and RGW-3 during field activities in April 2002. The results of analytical testing of the groundwater samples obtained from these explorations are not compared to any screening criteria because groundwater samples obtained from reconnaissance-level explorations are typically biased high because of excessive turbidity associated with the sampling method. Groundwater samples were collected from these borings to assist in the placement of the new groundwater monitoring wells. The results of analytical testing of the reconnaissance groundwater samples are summarized below and presented in Table 10:

- VOCs: Only TCE was detected above the laboratory detection limit and only in RGW-1. The remaining VOCs were either not detected or qualified by the laboratory below the detection limit.

- SVOCs: One or more SVOCs were detected in the three reconnaissance groundwater samples.

- Metals: Total and dissolved chromium, and total arsenic, lead, and thallium were detected in each sample.

- Petroleum hydrocarbons: Diesel-range petroleum hydrocarbons were detected at estimated concentrations (below the laboratory reporting limit) in each sample.

1.5.5.2 Monitoring Well Results

This section summarizes the results of analytical testing of groundwater samples collected in April and August 2002 from existing and new monitoring wells. Monitoring well MW-7 was integrated into the monitoring program beginning in August 2002. The results of analytical testing of the groundwater samples collected from the monitoring wells are summarized below and presented in Table 2.

1.5.5.2.1 Quarter 1 – April 2002

- VOCs: TCE and PCE were detected in samples collected from monitoring wells MW-3, MW-5, and MW-6 at concentrations above the MTCA preliminary screening criteria.

- SVOCs: SVOCs, including PCP, were either not detected or detected at concentrations less than the MTCA preliminary screening criteria.

- Metals: Total and/or dissolved arsenic, chromium, chromium VI and lead were either not detected or detected at concentrations less than the preliminary screening criteria.

- Petroleum Hydrocarbons: Diesel-range petroleum hydrocarbons were not detected.

1.5.5.2.2 Quarter 2 – August 2002

- VOCs: PCE was detected in samples collected from monitoring wells MW-5 and MW-6 at concentrations above the MTCA preliminary screening criteria.

- PCP/TCP: PCP was detected in samples collected from monitoring well MW-1 at a concentration greater than the preliminary screening criteria.

- Total and dissolved chromium: Total and dissolved chromium were detected at concentrations less than the preliminary screening criteria.

1.5.5.2.3 Quarter 3 – November 2002

- VOCs: PCE was detected in samples collected from monitoring wells MW-3, MW-5 and MW-6 at concentrations above the MTCA preliminary screening criteria.
- PCP/TCP: PCP was detected in samples collected from monitoring well MW-1 and MW-7 concentrations greater than the preliminary screening criteria.
- Total and dissolved chromium: Total and dissolved chromium: Total and dissolved chromium were detected at concentrations less than the MTCA preliminary screening criteria.

1.5.5.2.4 Quarter 4 – February 2003

- VOCs: TCE was detected in samples collected from monitoring well MW-5 at concentrations above the MTCA preliminary screening criteria. PCE was detected in samples collected from monitoring wells MW-5 and MW-6 at concentrations above the MTCA preliminary screening criteria.
- PCP/TCP: PCP and TCP were not detected at concentrations greater than the MTCA preliminary screening criteria.
- Total and dissolved chromium: Total chromium was detected in samples collected from monitoring well MW-1 at a concentration greater than the MTCA preliminary screening criteria.

1.5.6 Air

The non-volatile nature of PCP was used as a basis to eliminate PCP as an air contaminant concern. Organic vapor readings taken during the October 2001 water monitoring did not indicate the presence of volatile compounds above background levels.

1.6 RI Summary and Conclusions

Field investigation activities for the remedial investigation were conducted from April 2002 through February 2003. Three additional groundwater monitoring wells were installed at the site. There are a total of seven monitoring wells onsite.

Approximately 80 reconnaissance soil samples were collected at the site. Soil samples were screened in the field for the potential presence of PCP using the EnSys Soil Test System™ from Strategic Diagnostics, Inc and for VOCs using a flame ionization detector (FID). In those borings with positive detections of PCP, select samples with positive detections and the first underlying sample with a negative detection were submitted to the laboratory for analysis. Background soil samples were collected from depths of one and two feet bgs.

Sediment samples were collected using a hand auger from the catch basins, screened in the field for the potential presence of PCP and submitted to the laboratory for analysis.

The results of historical analytical testing of samples obtained during RI activities indicate the following for soil and groundwater at the site:

1.6.1 Soil

- PCP was detected at concentrations exceeding the MTCA preliminary screening criterion of 8330 μg/kg in soil samples collected from areas and/or depths as follows:
    - at shallow depths in the topographic low spot in the vicinity of the railroad spur and tank farm bank. Ecology reportedly obtained shallow samples that contained PCP from this area in 1985; the specific sample depths are not included in Ecology's report. PCP was not detected at concentrations that exceed the MTCA criterion in the borings advanced in this area during Kennedy/Jenks Consultants investigation activities.
    - at depths up to two feet bgs in the tank farm area during BHIPs 1985 study, prior to removal of the USTs. PCP was not detected at concentrations exceeding the MTCA preliminary screening criteria in soil samples obtained from this area during Kennedy/Jenks Consultants investigation activities.
    - to a minimum depth of approximately 16 feet immediately beneath the mixing room floor in the vicinity of the abandoned USTs. Soil data were collected from beneath the mixing room floor during previous investigations at the site. The laboratory reporting limits for PCP in all of these samples are greater than the MTCA preliminary screening criterion. Therefore, the vertical extent of PCP-contaminated soil in this area has not been defined with regard to the MTCA preliminary screening criterion. PCP was not detected at concentrations exceeding the screening criterion in any of the samples collected from boring RS-4 which was advanced immediately outside of the former mixing room. Samples collected at depths of 2, 10 and 15 feet bgs from this boring were analyzed for PCP.
- Dioxins (expressed as TEQ values in this report or as OCDD during Payne Reimer's 1987 study) were detected at concentrations greater than the MTCA preliminary screening criterion of 6.67 pg/g in soil samples collected from the following areas:
    - at a depth of 6.5 to 7 feet beneath the mixing room floor in the vicinity of the abandoned USTs (Payne Reimer boring B-7). The vertical extent of dioxin-contaminated soil in this boring was not determined during Payne Reimer's study; however, the analytical results for boring RS-4, advanced immediately outside of the former mixing room indicate that dioxin concentrations in soil that exceed the screening criterion do not appear to extend beyond a depth of 10 feet bgs.
    - near the eastern edge of the bank of the tank farm (boring RS-5) at a depth of approximately 5 and 10 feet bgs.
    - near the railroad spur, east of the tank farm (borings RS-6 and RS-7) at depths to two feet bgs.

- near the railroad spur, in the southeast corner of the former storage area (boring RS-1) at depths to two feet bgs.

- near the dry well and catch basin located in the north central portion of the site (borings DW-3A and DW-3B) at a depth of approximately 20 feet bgs.

1.6.2 Groundwater

- PCP was detected at a concentration slightly exceeding the MTCA preliminary screening criterion of 0.729 μg/l in the groundwater sample obtained from monitoring well MW-1 in August 2002.

- TCE, cis-1,2-DCE and/or PCE were detected at concentrations exceeding one or more of the MTCA preliminary screening criteria in groundwater samples obtained from all of the monitoring wells during one or more sampling events conducted between 1988 and 2002. Based on the results of studies conducted in this industrial area of Vancouver by Ecology and others, and the analytical results for soil samples obtained during this RI, the former Strebor facility is not considered a source of the area-wide chlorinated solvent-contaminated groundwater plume.

1.6.3 Catch Basin Sediments

- SVOCs were detected in all sediment samples obtained from the catch basins. Tetra Pak contracted with West Coast Marine Cleaning to remove and properly dispose of the sediment materials from each of the four catch basins in October 2002.

References for Remedial Investigation

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Shannon & Wilson 1989. *Environmental Site Assessment, Strebor Site, Vancouver, Washington*. Shannon & Wilson, Inc., July 1989.

Washington State Department of Ecology 2001. Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC. Ecology Publication No. 94-06, Amended 12 February 2001.

Washington State Publication #94-115. Natural Background Soil Metals Concentrations in Washington State. October 1994.

Tables

Table 1: Historical Soil Analytical Results

Sample Designation[a]	General Location[b]	Sample Depth[c]	Pentachlorophenol (µg/kg)[d]	Dioxin[e] (µg/kg)
Ecology - 1985				
#1	on Bank	Unk[f]	620	NA[g]
#2	Low Spot off bank	Unk	330000	NA
#2	Low Spot off bank(2)	Unk	314000	NA
Beecham Home Improvement Products - 1985				
1V	End of rail spur	Unk	<150	NA
2V	Low spot by tracks	surface	<150	NA
2V1	Low spot by tracks	9 in	7140	NA
2V2	Low spot by tracks	18 in	<500	NA
3V	Tank Farm - tank 2 vent pipe	12 in	3670	NA
3V1	Tank Farm - tank 2 vent pipe	24 in	<500	NA
4V	Tank Farm - tank 3 vent pipe	12 in	35300	NA
4V1	Tank Farm - tank 3 vent pipe	24 in	<500	NA
5V	on Bank	12 in	<150	NA
5V1	on Bank	24 in	3420	NA
5V2	on Bank	36 in	<500	NA
6V	Tank Farm - tank 8 vent pipe	12 in	20990	NA
6V1	Tank Farm - tank 8 vent pipe	24 in	11290	NA
6V2	Tank Farm - tank 8 vent pipe	36 in	<500	NA
7V	Tank Farm - tank 6 vent pipe	12 in	<500	NA
8V	Tank Farm - tank 9 vent pipe	12 in	<500	NA
Payne Reimer Group - 1987				
B1 No. 1	End of rail spur	0 to 1.5 ft	<4000	NA
B1 No. 8	End of rail spur	14.2 to 14.8 ft	<4000	NA
B2 No. 1	Immediately north of grassy area	0 to 1.5 ft	<4000	NA
B2 No. 8	Immediately north of grassy area	13.5 to 14.1	<4000	NA
B3 No. 1	Grassy area, west side of site	0 to 1.5 ft	<4000	NA
B3 No. 10	Grassy area, west side of site	14.3 to 14.8 ft	<4000	NA
B4 No. 1	Grassy area, northwest corner	0 to 1.5 ft	<4000	NA
B4 No. 7	Grassy area, northwest corner	12.7 to 13.5 ft	<4000	NA
B5 No. 1	Parking lot	0 to 1.5 ft	<4000	NA
B5 No. 10	Parking lot	13.5 to 15 ft	<4000	NA
B6 No. 1	Tank Farm	0 to 1.5 ft	<4000	<10
B6 No. 7	Tank Farm	9.0 to 9.7 ft	<4000	<10
B6 No. 11	Tank Farm	15.6 to 16.4 ft	<4000	<10
B7 No. 6	Mixing room - between tanks	6.5 to 7.0 ft	15200000	50
Q-1	NE corner of building	surface	<4000	NA
RR-1	Stain on railroad tracks	surface	<4000	NA
Bay West Environmental - 1988				
BW-1	Tank Farm	9 ft	<18000	NA
SB-4	Tank Farm	8.5 ft	<18000	NA
SB-4	Tank Farm	14 ft	<18000	NA
ISB-1	Mixing room	12.5 ft	890000	NA
ISB-1	Mixing room	16.5 ft	<18000	NA
ISB-2	Mixing room - between tanks	5.5 ft	690000	NA
ISB-2	Mixing room - between tanks	10.5 ft	490000	NA
ISB-2	Mixing room - between tanks	15.5 ft	720000	NA
ISB-2	Mixing room - between tanks	21 ft	<18000	NA
ISB-3	Mixing room	10.5 ft	400000	NA
ISB-3	Mixing room	15.5 ft	<18000	NA
ISB-4	Mixing room	NO data presented for ISB-4		
ISB-5	Mixing room	10.5 ft	<18000	NA

Notes:

(a) Soil sample ID as designated in past reports.

(b) General location of sample, if specified in report.

(c) Sample depth - as specified, in either inches (in) or feet (ft).

(d) Results are reported in micrograms per kilogram (µg/kg).

(e) Octachlorodibenzodioxin (OCDD).

(f) Unk - unknown.

(g) NA - not analyzed.

Table 2: Summary of Groundwater Analytical Results for Monitoring Wells

		Volatile Organic Compounds(a) (µg/l)(b)							Semivolatile Organic Compounds (µg/l)(c)		Metals (µg/l)(d)							
Monitoring Well Number	Date Sampled	cis-1,2- Dichloroethene	1,2- Dichloropropane	Trichloroethene	Tetrachloroethene	1,1- Dichloroethane	1,1,1- Trichloroethane	Toluene	Benzoic Acid	Pentachlorophenol	Arsenic		Chromium		Total Lead	Total Copper	Total Zinc	Total Thallium
											Total	Dissolved	Total	Dissolved				
MW-1	08/16/88(e)	NA(f)	**1.8**	<1(g)	<1	NA	<1		NA	<3.8	NA	NA	NA	NA	NA	NA	NA	NA
	04/19/02	**0.672 J(h)**	<1	**2.73**	**1.12**	<1	<1		**1.17 J**	<0.8	**1.65**	**1.58**	**1.89**	**1.83**	<0.5	NA	NA	<0.5
	08/21/02	<1	<1	<1	<1	<1	<1		NA	**1.48**	NA	NA	**14.7**	**8.81**	NA	NA	NA	NA
	11/19/02	<1	<1	**0.514 J**	<1	<1	<1		<4	**1.67**	NA	NA	**12.2**	**8.85**	NA	NA	NA	NA
	02/25/03	<1	<1	<1	<1	<	<1	**0.6 J**	NA	<0.19			**286**	**1.61**				
MW-2	08/16/88(e)	NA	<1	**3.2**	1.1	<1	**1.2**		NA	<4.1	NA	NA	NA	NA	NA	NA	NA	NA
	04/18/02	**1.46**	<1	**3.77**	**1.19**	<1	<1		<4	<0.8	**1.09**	**2.06**	**1.18**	**5.02**	<0.5	NA	NA	<0.5
	08/21/02	<1	<1	<1	<1	<1	<1		NA	<0.8	NA	NA	**6.36**	**5.02**	NA	NA	NA	NA
	11/19/02	<1	<1	<1	<1	<1	<1		<4	<0.8	NA	NA	**4.06**	**3.21**	NA	NA	NA	NA
	02/25/03	<1	<1	1.03	<1	<1	<1	**0.522 J**	NA	<0.19			**29.3**	**1.81**				
MW-3	08/16/88(e)	NA	<1	**6.8**	**2.1**	<1	<1.6		NA	<4.4	NA	NA	NA	NA	NA	NA	NA	NA
	04/16/90(i)	NA	<5	**6**	**2 J**	<5	<5		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	04/16/90(j)	**200**	<10	<10	**6**	NA	<10		<50	<50	**13**	NA	**84**	NA	**10**	**96**	**218**	**5**
	04/18/02	**5.24**	<1	**8.7**	**3.47**	**0.525 J**	<1		<4	<0.8	<0.5	**1.33**	**2.92**	**4.32**	**0.757**	NA	NA	<0.5
	08/20/02	<1	<1	<1	<1	<1	<1		NA	<0.8	NA	NA	**8.56**	**2.8**	NA	NA	NA	NA
	11/18/02	**0.831 J**	<1	**2.89**	**1.37**	<1	<1		<4	<0.8	NA	NA	<3	**1.85**	NA	NA	NA	NA
	02/24/03	<1	<1	<1	<1	<1	<1	<1	NA	**0.254**	NA	NA	**1.16**	**1.42**	NA	NA	NA	NA
MW-5	08/25/87(k)	**11**	<5	**26**	**11**	<5	<5		NA	<10	NA	NA	NA	NA	NA	NA	NA	NA
	08/16/88(e)	NA	<1	**16**	**4.1**	<1	**5**		NA	<3.6	NA	NA	NA	NA	NA	NA	NA	NA
	04/19/02	**3.44**	<1	**6.87**	**3.61**	<1	<1		<4	<0.8	**1.64**	**1.73**	**1.66**	**1.77**	<0.5	NA	NA	<0.5
	08/21/02	<1	<1	**2.32**	**1.23**	<1	<1		NA	<0.8	NA	NA	**6.32**	**4.59**	NA	NA	NA	NA
	11/19/02	**1.34**	<1	**3.77**	**2**	<1	<1		<4	<0.8	NA	NA	<3	**3.1**	NA	NA	NA	NA
	02/25/03	**0.937 J**	<1	**3.52**	**1.75**	<1	<1	<1	NA	<0.189	NA	NA	**41.9**	**1.54**	NA	NA	NA	NA
MW-6	04/18/02	**5.35**	<1	**9.69**	**3.68**	**0.601 J**	**0.634 J**		<4	<0.8	<0.5	**1.12**	**3.21**	**4.02**	<0.5	NA	NA	<0.5
	08/20/02	<1	<1	**2.46**	**1.08**	<1	<1		NA	<0.813	NA	NA	**8.21**	**4.41**	NA	NA	NA	NA
	11/18/02	**0.983 J**	<1	**3.53**	**1.47**	<1	<1		<4	<0.8	NA	NA	<3	**2.94**	NA	NA	NA	NA
	02/24/03	**1.02**	<1	**3.08**	**1.42**	<1	<1	<1	NA	<0.19	NA	NA	**1.16**	**4.18**	NA	NA	NA	NA
MW-7	08/07/02	NA	NA	NA	NA	NA	NA		**5.62**	**0.412 J**	NA	NA	NA	NA	NA	NA	NA	NA
	08/20/02	<1	<1	**2.18**	**1.25**	<1	<1		NA	**0.347 J**	NA	NA	**6.31**	**4.39**	NA	NA	NA	NA
	11/19/02	<1	<1	**0.759 J**	<1	<1	<1		<4	**7.58**	NA	NA	<3	**2.96**	NA	NA	NA	NA
	02/25/03	<1	<1	**0.703 J**	<1	<1	<1	**0.635 J**	NA	<0.191	NA	NA	**13.6**	**0.86**	NA	NA	NA	NA
MW-8	02/25/03	<1	<1	**1.26**	<1	<1	<1	**0.589 J**	NA	<0.189	NA	NA	**9.91**	**1.47**	NA	NA	NA	NA
Screening Values																		
Maximum Contaminant Level (MCL)(l)		70	5	5	5	NL(m)	200		NL	1	50		100		NL	NL	NL	NL
MTCA Method A(n)		NL	NL	5	5	NL	200		NL	NL	5		50		15	NL	NL	NL
MTCA Method B(o)		8	NL	3.98	0.858	800	7200		6.40E+04	0.729	0.058		NL		NL	592	4800	NL

Notes:

(a) Samples were analyzed for VOCs by EPA Method 8260. Only detected analytes are summarized in this table. Refer to the laboratory reports in Appendix G for a complete list of analytes and laboratory reporting limits.

(b) Results are reported in micrograms per liter (µg/l).

(c) Samples were analyzed for SVOCs by EPA Method 8270. Only detected analytes are summarized in this table. Refer to the laboratory reports in Appendix G for a complete list of analytes and laboratory reporting limits.

(d) Samples were analyzed for arsenic, chromium, chromium VI, lead, thallium using EPA Method 6020 (chromium VI by Method 7195). Only detected analytes are summarized in this table. Refer to the laboratory reports in Appendix G for a complete list of analytes and laboratory reporting limits.

(e) Samples collected by Bay West, Inc. Some analytes were detected in travel and equipment blanks.

(f) NA = not analyzed.

(g) "<" denotes analyte was not detected at the indicated detection limit.

(h) J denotes positively identified, but numerical value is an estimated quantity.

(i) Samples obtained by CH2M Hill.

(j) Sample obtained by Ecology.

(k) Sample obtained by Payne Reimer Group.

(l) USEPA Maximum Contaminant Level (MCL). CLARC Version 3.1.

(m) NL - not listed.

(n) MTCA Method A Groundwater CLARC Version 3.1.

(o) MTCA Method B Groundwater CLARC Version 3.1. Carcinogenic values used if available.

Bold values indicate positive laboratory detection.

Highlighted values indicate detection above one or more screening value.

Table 3: Water Level Measurements

Well	Date	TOC elevation (ft msl)[(a)]	Est. Total Depth (ft)	Depth to Water (ft)[(b)]	Water Elevation (msl)
MW-1	02/19/02	54.40	50.05	48.62	5.78
	02/27/02			47.73	6.67
	03/25/02			48.78	5.62
	04/18/02		49.94	43.55	10.85
	05/28/02			45.70	8.70
	08/19/02			49.45	4.95
	11/18/02		50.18	49.64	4.76
	02/25/03		50.18	48.23	6.17
MW-2	10/08/01	51.44	50.05	48.10	3.34
	02/19/02			45.73	5.71
	02/27/02			44.72	6.72
	03/25/02			45.80	5.64
	04/18/02		49.91	40.55	10.89
	05/28/02			42.78	8.66
	08/19/02			46.55	4.89
	11/18/02		50.12	46.73	4.71
	02/25/03		50.11	45.32	6.12
MW-3	10/08/01	53.38	54.88	50.28	3.10
	02/19/02			47.53	5.85
	02/27/02			46.70	6.68
	03/25/02			47.79	5.59
	04/18/02		54.72	42.78	10.60
	05/28/02			44.68	8.70
	08/19/02			48.43	4.95
	11/18/02		54.90	48.63	4.75
	02/24/03		54.99	47.23	6.15
MW-5	10/08/01	51.17	50.18	48.05	3.12
	02/19/02			45.52	5.65
	02/27/02			44.42	6.75
	03/25/02			45.50	5.67
	04/18/02		50.05	40.24	10.93
	05/28/02			42.46	8.71
	08/19/02			46.25	4.92
	11/18/02		50.28	46.42	4.75
	02/25/03		50.29	45.02	6.15
MW-6	04/18/02	49.94	53.71	38.92	11.02
	05/28/02			41.45	8.49
	08/19/02			44.92	5.02
	11/18/02		52.88	45.10	4.84
	02/24/03		53.89	43.73	6.21
MW-7	08/07/02	49.76	54.55	44.39	5.37
	08/19/02		54.55	44.80	4.96
	11/18/02		54.22	44.97	4.79
	02/25/03		54.53	43.55	6.21
MW-8	02/25/03	48.42	54.45	42.18	6.24

Notes:

(a) Top of casing elevations reported in feet above mean sea level (msl).

(b) Depth to water measured in feet below ground surface.

Table 4: Summary of Soil Analytical Results - Volatile Organic Compounds

			Volatile Organic Compounds[a] (µg/kg)[b]								
Sample Designation[c]	**Sample Depth (ft)[d]**	**Sample Date**	**Dichloro difluoromethane**	**Trichloro fluoromethane**	**Methylene chloride**	**Benzene**	**Toluene**	**Ethylbenzene**	**m,p-Xylene**	**o-Xylene**	**1,2,4-Trimethyl benzene**
Rail Spur											
RS1-2	2	04/08/02	<1.16[e]	<1.16	<1.16	<1.16	**0.671 J[f]**	<1.16	<1.16	<1.16	<1.16
RS2-10	10	04/08/02	**1.09 J**	**3.03**	**1.28 B[g]**	**1.41**	**14.7**	**1.2 J**	**4.53**	**1.34**	<1.27
RS3-10	10	04/08/02	**1.03 J**	**2.59**	**0.804 J B**	**1.04 J**	**12.2**	**0.99 J**	**3.41**	**1.12 J**	<1.27
RS4-2	2	04/08/02	<1.13	**0.755 J**	**0.586 J B**	<1.13	**3.24**	<1.13	<1.13	<1.13	<1.13
RS4-10	10	04/08/02	<1.86	<1.86	**0.981 J**	<1.86	<1.86	<1.86	<1.86	<1.86	<1.86
RS5-2	2	04/08/02	**0.582 J**	**1.37**	**0.63 J B**	<1.13	**6.01**	<1.13	**1.75 J**	<1.13	<1.13
RS5-5	5	04/08/02	**0.719 J**	**1.86**	<1.2	**0.685 J**	**9.94**	**0.898 J**	**2.37 J**	**0.643 J**	<1.2
RS6-0-1	0-1	04/08/02	<1.03	<1.03	**0.587 J B**	<1.03	**0.774 J**	<1.03	<1.03	<1.03	<1.03
RS6-2	2	04/08/02	<1.16	<1.16	**0.796 J B**	<1.16	<1.16	<1.16	<1.16	<1.16	<1.16
RS7-0-1	0-1	04/10/02	<1.61	<1.61	<1.61	<1.61	<1.61	<1.61	<1.61	**0.881 J**	<1.61
RS8-10	10	04/10/02	<2.05	<2.05	**3.07**	<2.05	<2.05	<2.05	<2.05	**1.25 J**	<2.05
Tank Farm											
TF1-20	20	04/08/02	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	**2.19**
TF6-15	15	04/09/02	<2.07	<2.07	**1.06 J**	<2.07	<2.07	<2.07	<2.07	<2.07	<2.07
TF7-15	15	04/10/02	<1.57	<1.57	**1.69**	<1.57	<1.57	<1.57	<1.57	<1.57	<1.57
Screening Criteria											
MTCA Method A - Unrestricted Land Use[h]			NL[i]	NL	20	30	7000	6000	9000	9000	NL
MTCA Method B - Unrestricted Land Use[h]			1.60E+07	2.40E+07	1.33E+05	1.82E+04	1.60E+07	8.00E+06	1.60E+08	1.60E+08	none

Notes:

(a) Soil samples were analyzed for volatile organic compounds by EPA Method 8260. Only detected analytes are summarized in this table. Values in **bold** were above the detection limit or qualified by the laboratory. Refer to the laboratory reports in Appendix G for a complete list of analytes and laboratory reporting limits.

(b) Results are reported in micrograms per kilogram (µg/kg).

(c) The first portion of the sample identification is the boring number; the second portion is the sample depth. For example, sample RS-6-2 was obtained from boring RS-6 at a depth of 2 feet bgs.

(d) Sample depths recorded at feet below ground surface.

(e) "<" denotes analyte was not detected above the indicated laboratory method reporting limit.

(f) J denotes positively identified, but numerical value is an estimated quantity.

(g) B denotes analyte detected in the associated method blank.

(h) MTCA Method A Unrestricted Land Use. CLARC Version 3.1.

(I) NL - not listed.

(j) MTCA Method B Direct Contact Pathway. CLARC Version 3.1. Carcinogenic values used if available.

Table 5: Summary of Soil Analytical Results - Semivolatile Organic Compounds

Sample Designation(c)	Sample Depth (ft)(d)	Sample Date	Semivolatile Organic Compounds(a) (µg/kg)(b)															
			Phenol	Pentachlorophenol	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo (a) anthracene	Chrysene	Benzo fluoranthenes	Benzo(a) pyrene	Indeno(1,2,3-cd) pyrene	Benzo(g,h,i) perylene	Benzoic Acid	Butylbenzyl phthalate	Naphthalene	4-Chloroaniline
Rail Spur																		
RS-1-2	2	04/08/02	**316**	**109 J**(e)	**15.8**	<13.8	<13.8(f)	<13.8	<27.7	<27.7	<27.7	<13.8	<13.8	<13.8	<691	<138	<13.8	<138
RS-1-5	5	04/08/02	**434**	<153	<15.3	<15.3	<15.3	<15.3	<30.6	<30.6	<30.6	<15.3	<15.3	<15.3	<766	<153	<15.3	<153
RS-2-10	10	04/08/02	**603**	<173	**4.74 J**	**6.2 J**	<17.3	<17.3	<34.6	<34.6	<34.6	<17.3	<17.3	<17.3	<865	<173	<17.3	<173
RS-3-10	10	04/08/02	**3830**	<171	**13.7 J**	<17.1	<17.1	<17.1	<34.1	<34.1	<34.1	<17.1	<17.1	<17.1	<853	<171	<17.1	<171
RS-4-2	2	04/08/02	**678**	**609**	**44.7**	**9.11 J**	**45.9**	**38.2**	**10.8 J**	**8.89 J**	**9.05 J**	<14.5	<14.5	<14.5	<725	<145	<14.5	<145
RS-4-10	10	04/08/02	**270**	**472**	<15.8	<15.8	<15.8	<15.8	<31.7	<31.7	<31.7	<15.8	<15.8	<15.8	<792	<158	<15.8	<158
RS-4-15	15	04/10/02	**1830**	<183	<18.3	<18.3	<18.3	<18.3	<36.3	<36.3	<36.3	<18.3	<18.3	<18.3	<915	<183	<18.3	<183
RS-5-0-1	0-1	04/08/02	**165**	**2960 D**(g)	**16.7**	**7.41 J**	**22.2**	**24.2**	**16.4 J**	**13.5 J**	**24.6 J**	**20**	**8.98 J**	**9.36 J**	<722	<144	<14.4	<144
RS-5-2	2	04/08/02	**107 J**	**3180 D**	**6.62 J**	**4.41 J**	**6.87 J**	**7.24 J**	<28.7	**11.4 J**	<28.7	<14.4	<14.4	<14.4	**244 J**	<144	<14.4	<144
RS-5-5	5	04/08/02	**143 J**	**3440 D**	**9.62 J**	**5.58 J**	<15.5	<15.5	<31	<31	<31	<15.5	<15.5	<15.5	<775	<155	<15.5	<155
RS-5-10	10	04/08/02	**419**	**192**	**5.35 J**	<17.4	<17.4	<17.4	<34.8	<34.8	<34.8	<17.4	<17.4	<17.4	<871	<174	<17.4	<174
RS-6-0-1	0-1	04/08/02	<145	**177**	**5.29 J**	**5.15 J**	<14.5	<14.5	<29.1	**10.5 J**	<29.1	<14.5	<14.5	<14.5	<727	<145	<14.5	<145
RS-6-2	2	04/08/02	**271**	<159	**4.1 J**	<15.9	<15.9	<15.9	<31.8	<31.8	<31.8	<15.9	<15.9	<15.9	<795	<159	<15.9	<159
RS-7-0-1	0-1	04/10/02	<140	**5810 D**	<14	<14	<14	**17.1**	<27.9	<27.9	<27.9	<14	<14	<14	<699	<140	<14	<140
RS-7-2	2	04/10/02	**819**	<151	**24**	<15.1	<15.1	<15.1	<30.3	<30.3	<30.3	<15.1	<15.1	<15.1	<757	<151	<15.1	<151
RS-7-5	5	04/10/02	**2350**	<152	**6.23 J**	<15.2	<15.2	<15.2	<30.3	<30.3	<30.3	<15.2	<15.2	<15.2	<758	<152	<15.2	<152
RS-8-10	10	04/10/02	**1720**	<168	<16.8	<16.8	<16.8	<16.8	<33.6	<33.6	<33.6	<16.8	<16.8	<16.8	<841	<168	<16.8	<168
Tank Farm																		
TF-1-15	15	04/08/02	**2210**	<171	**14 J**	<17.1	<17.1	<17.1	<34.2	<34.2	<34.2	<17.1	<17.1	<17.1	<856	<171	<17.1	<171
TF-1-20	20	04/08/02	**879**	**41.4 J**	**23.5**	<14.8	<14.8	**11.9 J**	**9.49 J**	**22.2 J**	<29.6	<14.8	<14.8	<14.8	<739	<148	<14.8	<148
TF-2-15	15	04/08/02	**2270**	<161	<16.1	<16.1	<16.1	<16.1	<32.1	<32.1	<32.1	<16.1	<16.1	<16.1	**308 J**	<161	<16.1	<161
TF-3-15	15	04/09/02	**405**	<160	<16	<16	<16	<16	<32	<32	<32	<16	<16	<16	<801	<160	<16	<160
TF-5-5	5	04/10/02	**204**	<165	**5.53 J**	<16.5	<16.5	<16.5	<33	<33	<33	<16.5	<16.5	<16.5	<825	<165	<16.5	<165
TF-5-22	22	04/10/02	**1700**	**156 J**	**8.23 J**	<15.8	<15.8	<15.8	<31.7	<31.7	<31.7	<15.8	<15.8	<15.8	<792	<158	<15.8	<158
TF-6-10	10	04/09/02	**312**	<167	<16.7	<16.7	<16.7	<16.7	<33.5	<33.5	<33.5	<16.7	<16.7	<16.7	<837	**69.7 J**	<16.7	<167
TF-6-15	15	04/09/02	**1080**	<180	<18	<18	<18	<18	<35.9	<35.9	<35.9	<18	<18	<18	<899	<180	<18	<180
TF-7-15	15	04/10/02	**455**	<146	<14.6	<14.6	<14.6	<14.6	<29.2	<29.2	<29.2	<14.6	<14.6	<14.6	<729	<146	<14.6	<146
TF-8-25	25	04/09/02	**414**	<135	**4.05 J**	<13.5	<13.5	<13.5	<26.9	<26.9	<26.9	<13.5	<13.5	<13.5	<673	<135	<13.5	<135
TF-9-23	23	04/10/02	**1890**	<129	**8.4 J**	<12.9	<12.9	<12.9	<25.8	<25.8	<25.8	<12.9	<12.9	<12.9	<644	**33.9 J**	<12.9	<129
Dry Wells																		
DW-1-23	23	04/10/02	**4380 D**	<128	**50.1**	**7.12 J**	<12.8	**14.2**	<25.6	<25.6	<25.6	<12.8	<12.8	<12.8	**322 J**	<128	**327**	**86.6 J**
DW-2-23	23	04/09/02	**439**	<128	<12.8	<12.8	<12.8	**29**	<25.7	<25.7	<25.7	<12.8	<12.8	<12.8	<642	**34.6 J**	<12.8	<128
DW-3A-23	23	04/09/02	**1020**	<143	**10.9 J**	**3.74 J**	<14.3	<14.3	<28.6	<28.6	<28.6	<14.3	<14.3	<14.3	**248 J**	<143	<14.3	<143
DW-3B-23	23	04/09/02	**211**	<145	<14.5	<14.5	<14.5	<14.5	<145	<145	<145	<14.5	<14.5	<14.5	<725	<145	<14.5	<145
DW-4-23	23	04/09/02	**282**	<137	<13.7	<13.7	<13.7	<13.7	<137	<137	<137	<13.7	<13.7	<13.7	<688	**65.7 J**	<13.7	<137
Screening Criteria																		
MTCA Method A - Unrestricted Land Use(h)			NL(I)	NL	NL	NL	NL	NL	NL	NL	NL	100	NL	NL	NL	NL	5000	NL
MTCA Method B - Unrestricted Land Use(j)			1.11E+09	8.33E+03	NL	2.40E+07	3.20E+06	2.40E+06	137	NL	137	137	137	NL	3.20E+08	1.60E+07	1.60E+06	3.20E+05

Notes:

(a) Soil samples were analyzed for semivolatile organic compounds by EPA Method 8270. Only detected analytes are summarized in this table. Only detected analytes are summarized in this table. Values in **bold** were above the detection limit or qualified by the laboratory. Refer to the laboratory reports in Appendix G for a complete list of analytes and laboratory reporting limits.

(b) Results are reported in micrograms per kilogram (µg/kg).

(c) The first portion of the sample identification is the boring number; the second portion is the sample depth. For example, sample RS-6-2 was obtained from boring RS-6 at a depth of 2 feet bgs.

(d) Sample depths recorded at feet below ground surface.

(e) J denotes positively identified, but numerical value is an estimated quantity.

(f) "<" denotes analyte was not detected at the indicated detection limit.

(g) D denotes sample calculated on a 10 times dilution factor.

(h) MTCA Method A Unrestricted Land Use. CLARC Version 3.1.

(I) NL - not listed.

(j) MTCA Method B Direct Contact Pathway. CLARC Version 3.1. Carcinogenic values used if available.

Table 6: Summary of Soil Analytical Results - Metals

Sample Designation[c]	Sample Depth (ft)[d]	Sample Date	Metals[a] (mg/kg)[b]			
			Chromium VI	Chromium	Arsenic	Lead
Rail Spur						
RS-1-2	2	04/08/02	0.245	17.9	5.62	11.3
RS-1-5	5	04/08/02	<0.109[e]	22.9	10.4	12.4
RS-2-10	10	04/08/02	<0.132	12.2	10.4	17.4
RS-3-10	10	04/08/02	<0.126	11.9	7.87	13.5
RS-4-2	2	04/08/02	0.267	9.67	1.34	3.99
RS-4-10	10	04/08/02	0.112	12.8	3.87	9.56
RS-4-15	15	04/10/02	<0.135	13.3	6.28	9.8
RS-5-0-1	0-1	04/08/02	0.263	10.1	3.17	7.44
RS-5-2	2	04/08/02	0.553	14	4.43	13.5
RS-5-5	5	04/08/02	<0.115	12.7	4.69	8.41
RS-5-10	10	04/08/02	<0.128	12.2	8.62	12.9
RS-6-0-1	0-1	04/08/02	0.282	10.4	2.68	7.33
RS-6-2	2	04/08/02	<0.190	21.4	11.8	16.9
RS-7-0-1	0-1	04/10/02	0.127	12.5	5.21	7.13
RS-7-2	2	04/10/02	<0.115	25	9	13
RS-7-5	5	04/10/02	<0.118	21.1	8.07	11.3
RS-8-10	10	04/10/02	<0.121	15.5	7.75	10.9
Tank Farm						
TF-1-15	15	04/08/02	<0.119	10.1	7.44	13.3
TF-1-20	20	04/08/02	<0.107	11.6	3.18	6.09
TF-2-15	15	04/08/02	<0.126	13.8	8.01	13.1
TF-3-15	15	04/09/02	<0.127	12.7	8.14	12.9
TF-5-5	5	04/10/02	<0.121	24.9	10	12.9
TF-5-22	22	04/10/02	<0.119	18.8	1.66	3.78
TF-6-10	10	04/09/02	<0.12	14	7.26	11.9
TF-6-15	15	04/09/02	<0.136	14	4.16	8.85
TF-7-15	15	04/10/02	0.121	11.5	6.23	10.6
TF-8-25	25	04/09/02	0.106	4.18	1.21	2.35
TF-9-23	23	04/10/02	<0.108	8.01	1.38	3.03
Dry Wells						
DW-1-20	20	04/10/02	0.0952	7.93	1.46	2.44
DW-1-23	23	04/10/02	<0.0999	7.73	1.17	1.91
DW-2-23	23	04/09/02	<0.0972	5.56	1.29	2.83
DW-3A-20	20	04/09/02	0.282	14.4	1.78	3.23
DW-3A-23	23	04/09/02	<0.102	7.99	1.45	2.97
DW-3B-23	23	04/09/02	<0.101	3.8	1.13	2.67
DW-4-23	23	04/09/02	<0.105	4.05	<0.106	3.28
Background Samples						
Background	1	04/11/02	NA[f]	18.7	7.5	14.3
Background-2	2	04/12/02	NA	24.6	11.2	14.6
Screening Criteria						
Natural Background Concentrations[g]			NL[h]	27	6	17
MTCA Method A - Unrestricted Land Use[i]			19	2000	20	250
MTCA Method B - Unrestricted Land Use[j]			240	1.20E+05	0.67	NL

Notes:

(a) Soil samples were analyzed for semivolatile organic compounds by EPA Method 6020. Only detected analytes are summarized in this table. Refer to the laboratory reports in Appendix G for a complete list of analytes and laboratory reporting limits.

(b) Results are reported in milligrams per kilogram (mg/kg).

(c) The first portion of the sample identification is the boring number; the second portion is the sample depth. For example, sample RS-6-2 was obtained from boring RS-6 at a depth of 2 feet bgs.

(d) Sample depths recorded at feet below ground surface.

(e) "<" denotes analyte was not detected at the indicated detection limit.

(f) Not analyzed.

(g) Natural Background Soil Metals Concentrations in Washington State Publication #94-115.

(h) NL - Not listed.

(i) MTCA Method A Unrestricted Land Use. CLARK Version 3.1.

(j) MTCA Method B Direct Contact Pathway. CLARK Version 3.1. Carcinogenic values used if given.

Table 7: Summary of Soil Analytical Results Dioxin - Toxic Equivalency Factors

Sample Designation[(a)]	Sample Depth (ft)[(b)]	Sample Date	TEQ[(c)] (pg/g)[(d)]
Rail Spur			
RS-1-2	2	04/08/02	90.3
RS-4-2	2	04/08/02	122.2
RS-4-10	10	04/08/02	5.8
RS-5-0-1	0-1	04/08/02	413.8
RS-5-2	2	04/08/02	76.9
RS-5-5	5	04/08/02	1398.2
RS-6-0-1	0-1	04/08/02	223.8
RS-7-0-1	0-1	04/10/02	1971.3
RS-7-2	2	04/10/02	7.5
Tank Farm			
TF-1-15	15	04/08/02	0.1
TF-5-5	5	04/10/02	0.1
TF-5-22	22	04/10/02	0.0
TF-6-10	10	04/09/02	7.3
TF-8-25	25	04/09/02	3.3
Dry Wells			
DW-3A-20	20	04/09/02	64.8
DW-3A-23	23	04/09/02	5.5
Screening Criteria			
MTCA Method B - Unrestricted Land Use[(e)]			6.7

Notes:

(a) Sample designations indicate exploration location and sampling depth. For example, sample TF-1-15 was obtained from exploration TF-1 at a depth of 15 feet bgs.

(b) Sample depths recorded at feet below ground surface.

(c) Soil samples were analyzed for dioxin compounds by EPA Method 1613. Concentrations are given as toxicity equivalents (TEQ), in accordance with Ecology guidance.

(d) Results reported in picograms per gram (pg/g)

(e) MTCA Method B Direct Contact Pathway. CLARC Version 3.1. Carcinogenic values used if available.

Table 8: Comparison of PCP Test Kit and Analytical Results

Sample[a]	Photometer Reading[b]	Laboratory result[c] (µg/kg)[d]
RS-1-2	-0.54	109 J
RS-4-2	-0.19	609
RS-4-10	-0.80	472
RS-5-0	-0.82	2960 D[e]
RS-5-2	-0.76	3180 D
RS-5-5	-0.85	3440 D
RS-5-10	0.05	192
RS-6-0	-0.52	177
RS-7-0	-0.70	5810 D
RS-7-2	-0.28	<151
TF-1-15	-0.02	<171
TF-1-20	0.15	41.4 J
TF-5-5	-0.49	<165
TF-5-22	-0.77	156 J
TF-6-10	-0.14	<167
TF-8-25	-0.56	<135
DW-3A-20	-0.07	<142
DW-3A-23	-0.01	<143
SED-1	-0.69	371000 D
SED-2	-0.29	6650
SED-3	-0.43	34400
SED-4	-0.13	<1910

Notes:

(a) Sample designations indicate exploration location and/or sampling depth. For example, sample TF-1-5 was obtained from exploration TF-1 at a depth of 5 feet bgs.

(b) Photometer reading obtained using Penta EnSys(r) Soil Test Kit. A negative value indicates that PCP was detected at a value greater than 0.5 ppm.

(c) Samples were analyzed for SVOCs by EPA Method 8270.

(d) Results are reported in micrograms per kilogram (µg/kg).

(e) D10 denotes sample calculated at a 10 times dilution factor.

Table 9: Summary of Sediment Analytical Results - Semivolatiles

		Semivolatile Organic Compounds[a] (µg/kg)[b]																
Sample Designation[c]	**Sample Date**	**Isophorone**	**Naphthalene**	**4-Chloroaniline**	**2-Methyl naphthalene**	**2,6-Dinitrotoluene**	**Dibenzofuran**	**Fluorene**	**4,6-Dinitro-2-methylphenol**	**Benzo (a) anthracene**	**Pentachlorophenol**	**Phenanthrene**	**Anthracene**	**Fluoranthene**	**Pyrene**	**Crysene**	**bis(2-Ethylhexyl) phthalate**	**Di-n-octylphthalate**
Sed-1	04/12/02	9450	5700	17200	2850	20100	333 J[d]	1410	12500	<413[e]	371000 D[f]	2460	3100	3080	3440	4530	1300000 D100[g]	<2070
Sed-2	04/12/02	<1890	<189	<1890	<189	<1890	<1890	<189	<4720	1630	6650	1290	1500	4250	2610	2520	174000 D	3200 B[h]
Sed-3	04/12/02	<1680	799	<1680	481	<1680	<1680	243	<4190	<335	34400	289	1080	<168	780	1020	291000 D	2160

Notes:

(a) Soil samples were analyzed for semivolatile organic compounds by EPA Method 8270. Only detected analytes are summarized in this table. Refer to the laboratory reports in Appendix C for a complete list of analytes and laboratory reporting limits.
(b) Results are reported in micrograms per kilogram (µg/kg).
(c) Sample locations are shown on Figure 3.
(d) J denotes positively identified, but numerical value is an estimated quantity.
(e) "<" denotes analyte was not detected at the indicated detection limit.
(f) D denotes sample calculated on a 10 times dilution factor.
(g) "D 100" denotes sample calculated on a 100 times dilution factor.
(h) B denotes analytes detected in the associated method blank.

Table 10: Summary of Reconnaissance Groundwater Analytical Results

		Semivolatile Organic Compounds[a] (μg/l)[b]										Volatile Organic Compounds[c] (μg/l)		Metals[d] (μg/l)					Petroleum Hydrocarbons
														Chromium					
Sample Designation[e]	Sample Date	Phenol	Pentachlorophenol	Phenanthrene	Anthracene	Di-n-octylphthalate	Benzoic Acid	Dimethyl phthalate	2,6-Dinitrotoluene	Diethylphthalate	Naphthalene	Trichloroethene	Tetrachloroethene	Total	Dissolved	Arsenic	Lead	Thallium	Diesel-range[f]
RGW1	04/12/02	0.394 J[g]	0.431 J	0.0676 J	0.0798 J	0.867 J	<4.76[h]	<0.952	<0.952	<0.952	<0.0952	2.51	1.34 J	876	1.68	92.2	231	4.78	129 J
RGW2	04/11/02	0.75 J	8.73	<0.111	<0.111	3.31 B	10.8	0.231 J	0.79 J	0.977 J B	<0.111	1.15 J	<2	1860	3.32	170	465	11.7	216 J
RGW3	04/11/02	0.891 J	1.03	<0.102	<0.102	5.02	<5.1	<1.02	<1.02	0.615 J B	0.106	<2	<2	2640	3.89	315	711	17.7	149 J

Notes:

(a) Samples were analyzed for SVOC by EPA Method 8270. Only detected analytes are summarized in this table.

(b) Samples reported in micrograms per liter (μg/l).

(c) Samples were analyzed for VOC by EPA Method 8260. Only detected analytes are summarized in this table.

(d) Samples were analyzed for arsenic, chromium, chromium VI, lead, thallium using EPA Method 6020 (chromium VI by Method 7195). Only detected analytes are summarized in this table. Refer to the laboratory reports in Appendix C for a complete list of analytes and laboratory reporting limits.

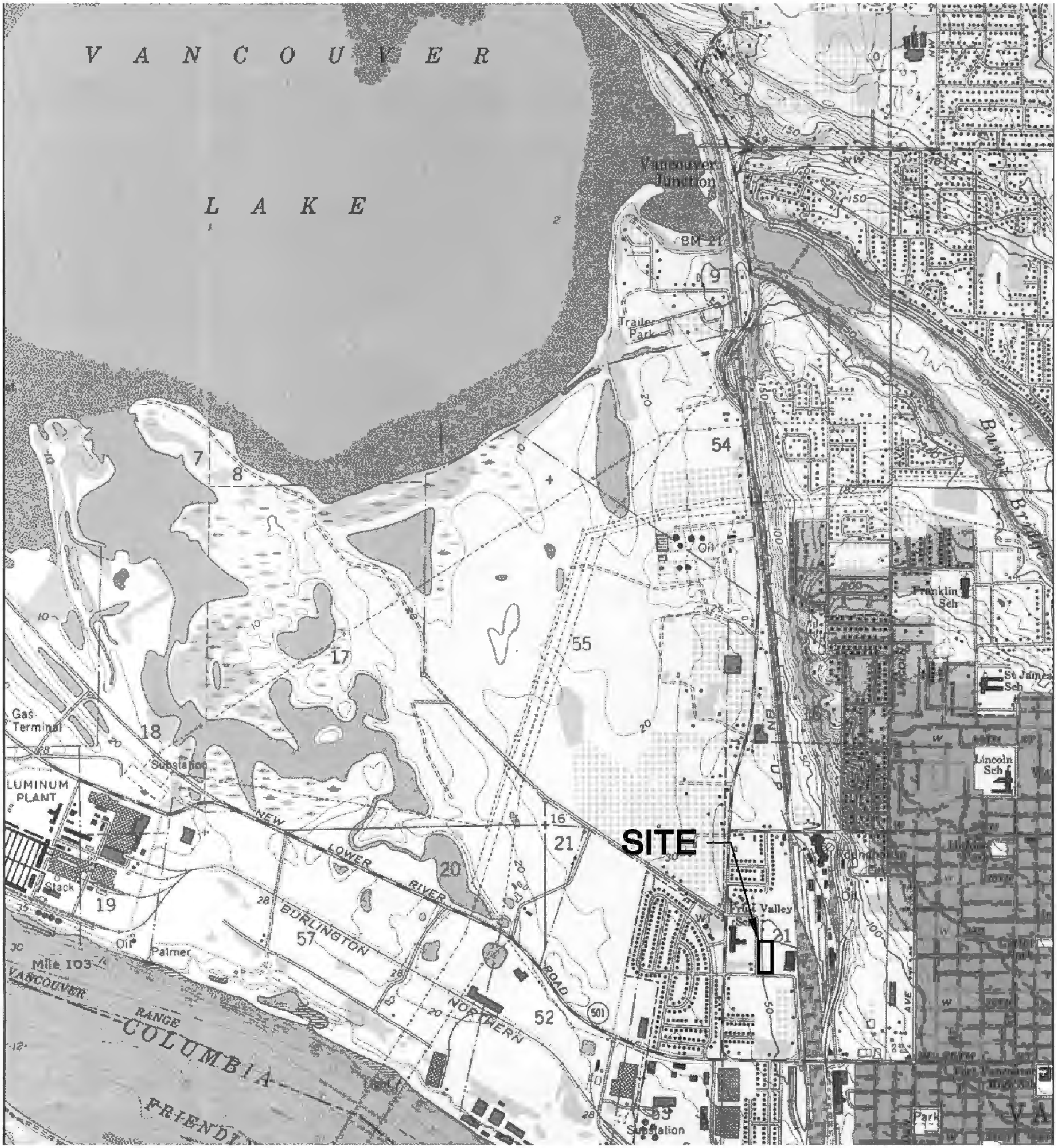
(e) Sample designation reflects the reconnaissance exploration number. For example, groundwater sample RGW1 was collected from exploration location RGW1.

(f) Samples were analyzed for diesel-range hydrocarbons by Northwest Method NWTPH-Dx.

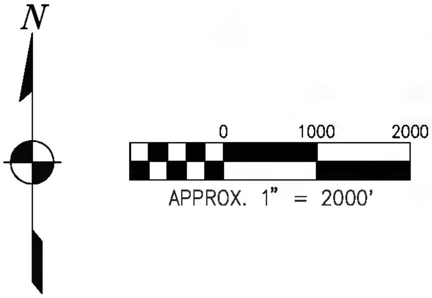
(g) J denotes positively identified, but numerical value is an estimated quantity.

(h) "<" denotes analyte was not detected at the indicated detection limit.

Figures



QUADRANGLE LOCATION



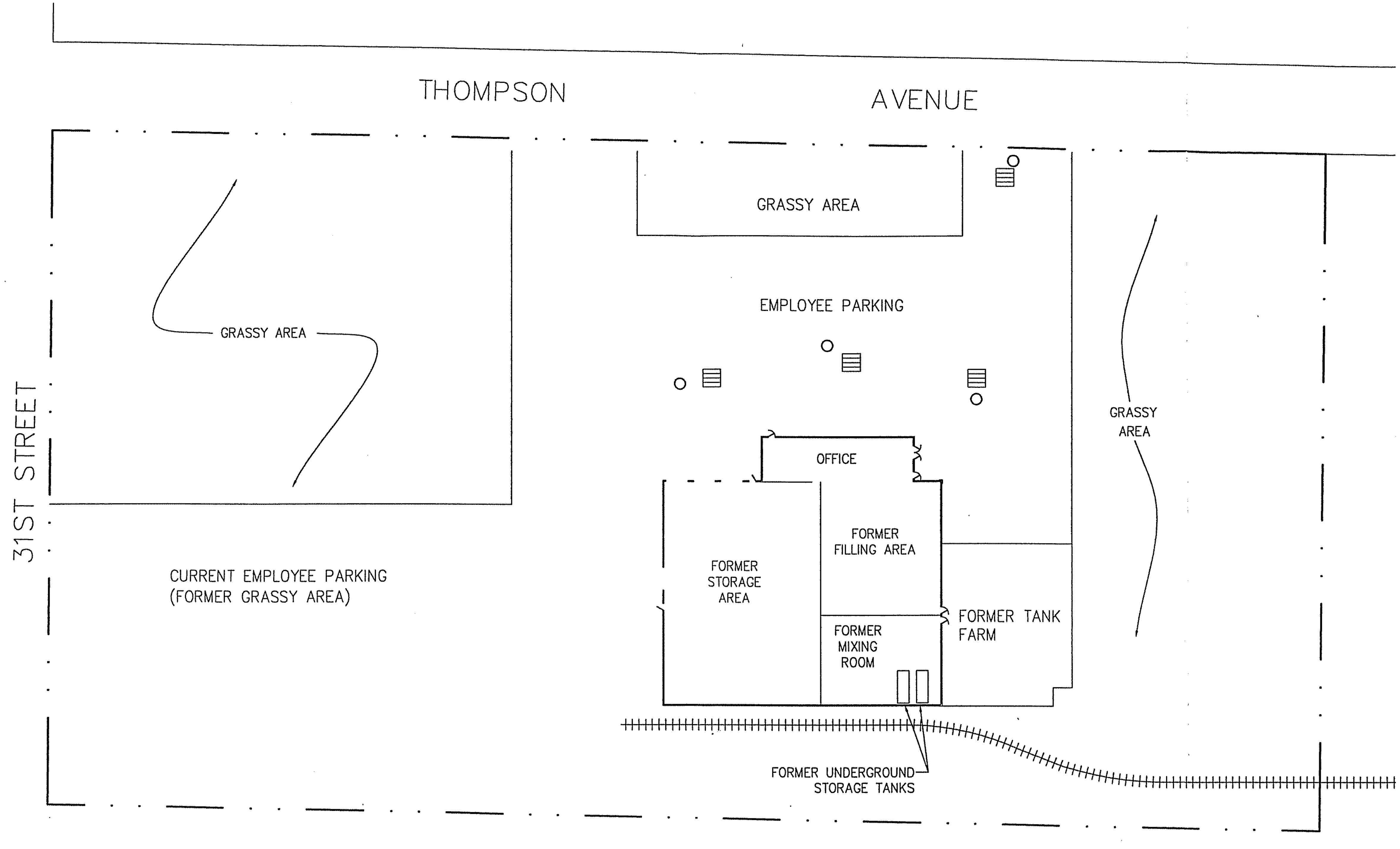
Kennedy/Jenks Consultants

TETRA PAK
FORMER STREBOR SITE

VICINITY MAP

K/J 016066.11/P01SK001

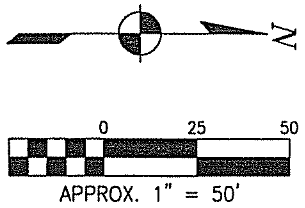
FIGURE 1



LEGEND

○	STORMWATER DRYWELLS
▤	STORMWATER CATCH BASIN
— · · —	APPROXIMATE SITE BOUNDARY
┼┼┼┼┼┼┼┼	RAILROAD SPUR

NOTE:
ALL LOCATIONS APPROXIMATE.



REFERENCE: SITE PLAN PROVIDED BY TETRA PAK

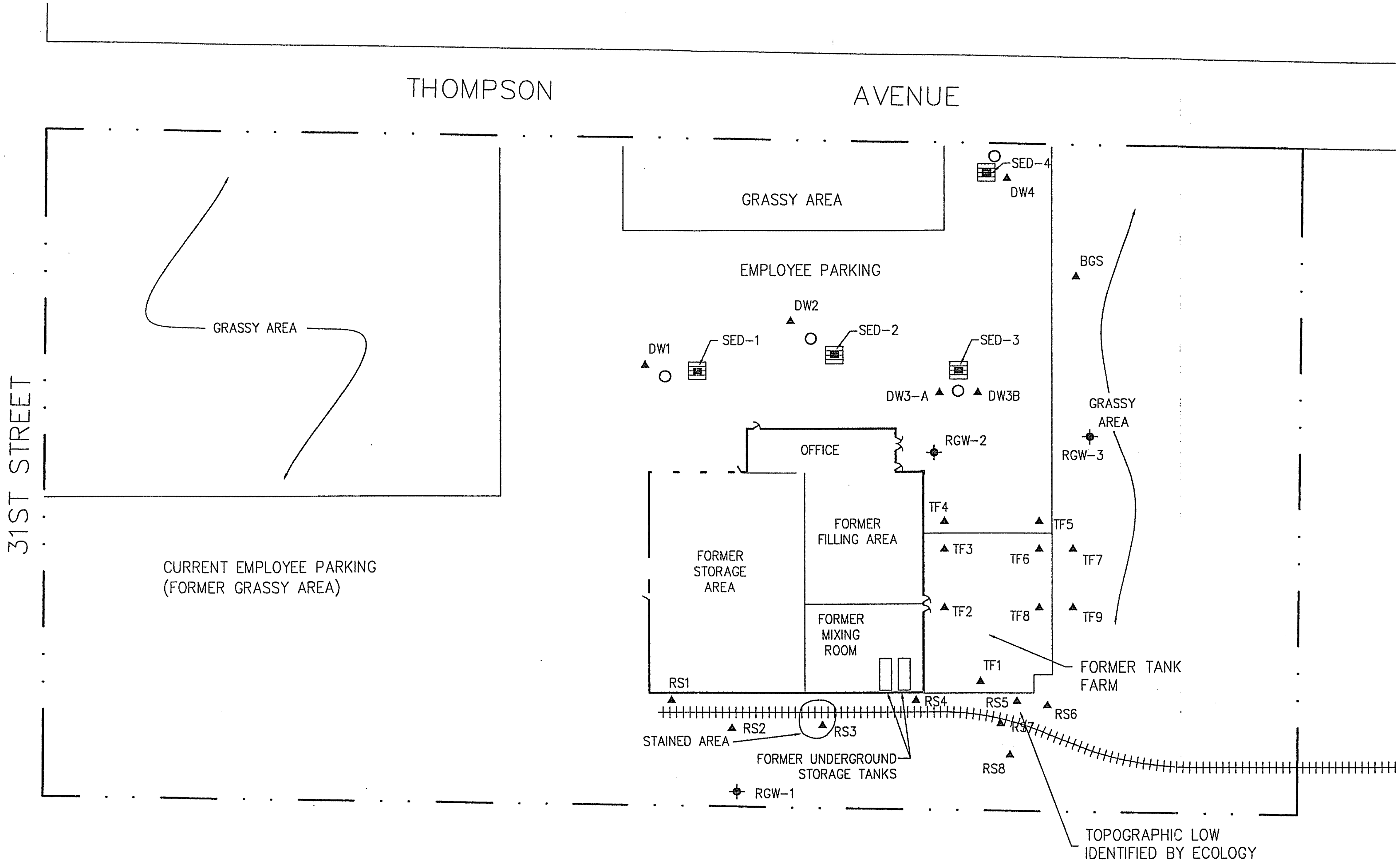
Kennedy/Jenks Consultants

TETRA PAK
FORMER STREBOR SITE

SITE PLAN

K/J 016066.11/P02SK002

FIGURE 2



LEGEND

▲ RECONNAISSANCE SOIL EXPLORATION LOCATION

■ SEDIMENT SAMPLE LOCATION

⊕ RECONNAISSANCE GROUNDWATER EXPLORATION LOCATION

○ STORMWATER DRYWELLS

▤ STORMWATER CATCH BASIN

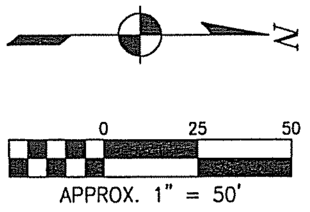
—·· — APPROXIMATE SITE BOUNDARY

┼┼┼┼┼┼┼┼ RAILROAD SPUR

BGS BACKGROUND SAMPLE

REFERENCE: SITE PLAN PROVIDED BY TETRA PAK

NOTE:
ALL LOCATIONS APPROXIMATE.



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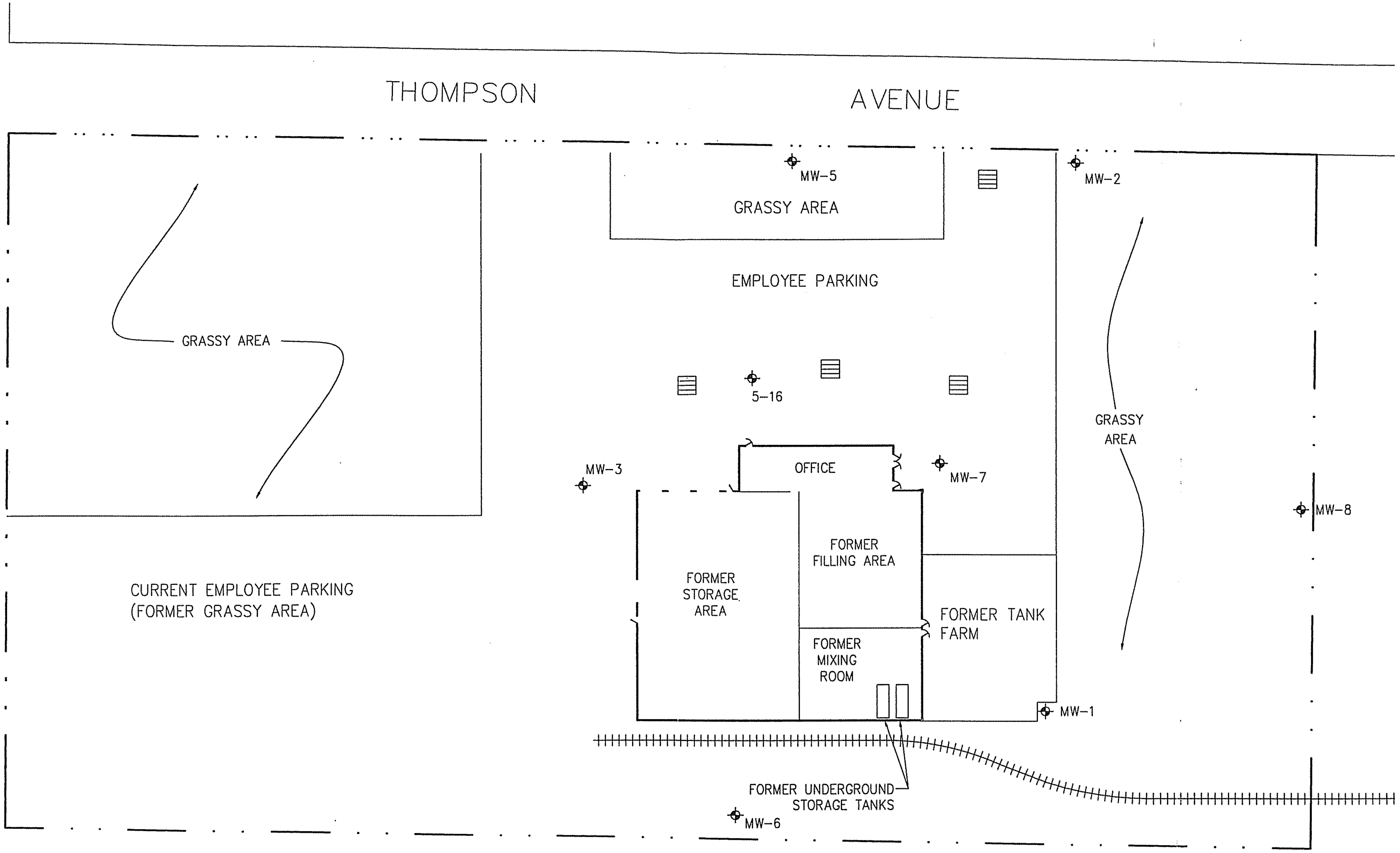
TETRA PAK
FORMER STREBOR SITE

RECONNAISSANCE EXPLORATION BORINGS

K/J 016066.11/P02SK003

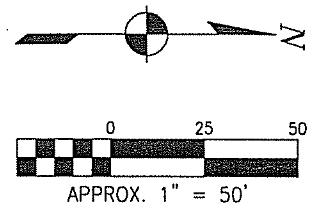
FIGURE 3



LEGEND

⌖ MW-1 MONITORING WELL LOCATION
▤ STORMWATER CATCH BASIN
—·— APPROXIMATE SITE BOUNDARY
┼┼┼┼ RAILROAD SPUR

NOTE:
ALL LOCATIONS APPROXIMATE.



REFERENCE: SITE PLAN PROVIDED BY TETRA PAK

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TETRA PAK
FORMER STREBOR SITE

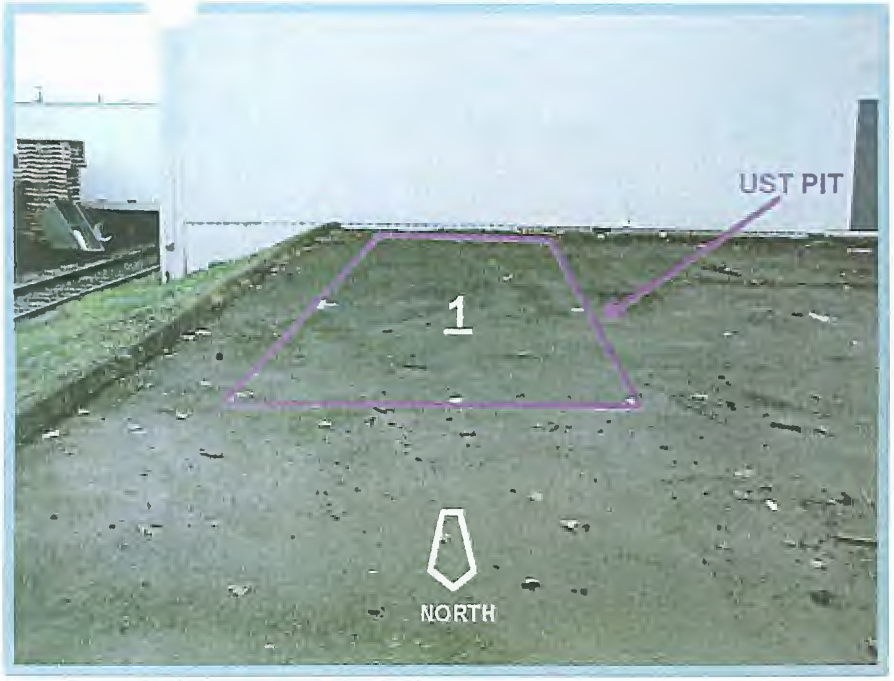
MONITORING WELL LOCATIONS

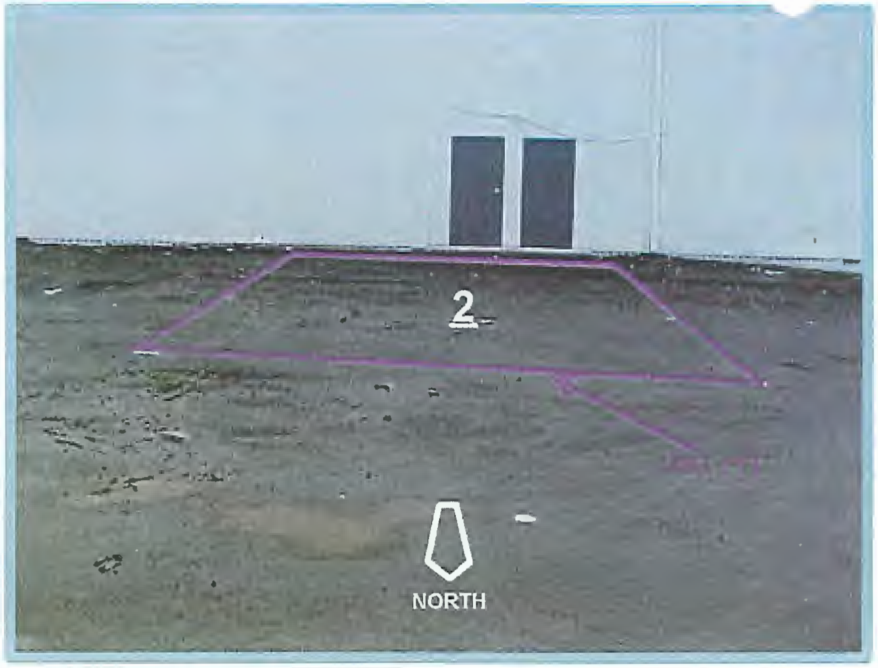
K/J 016066.11/P02SK003

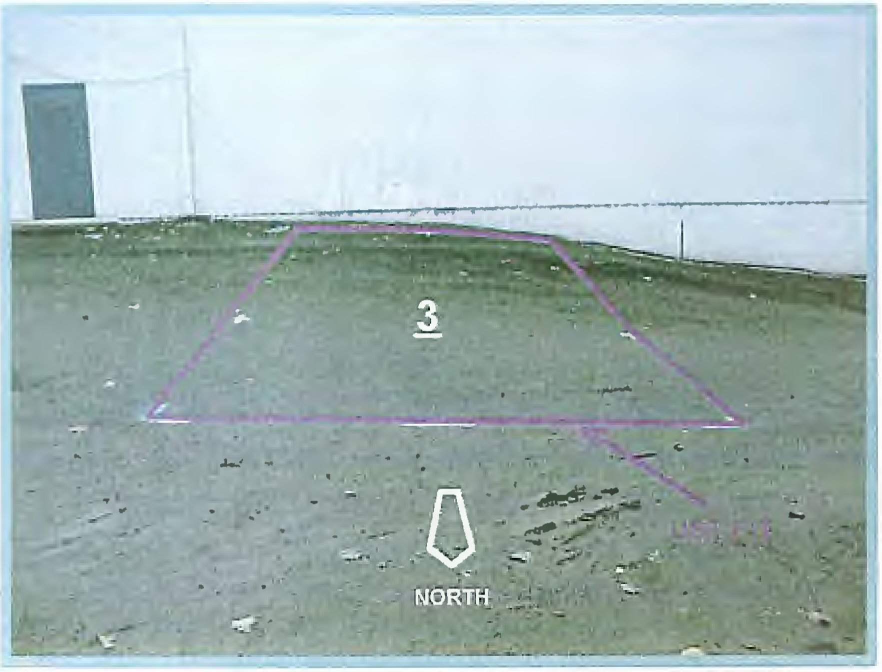
FIGURE 4

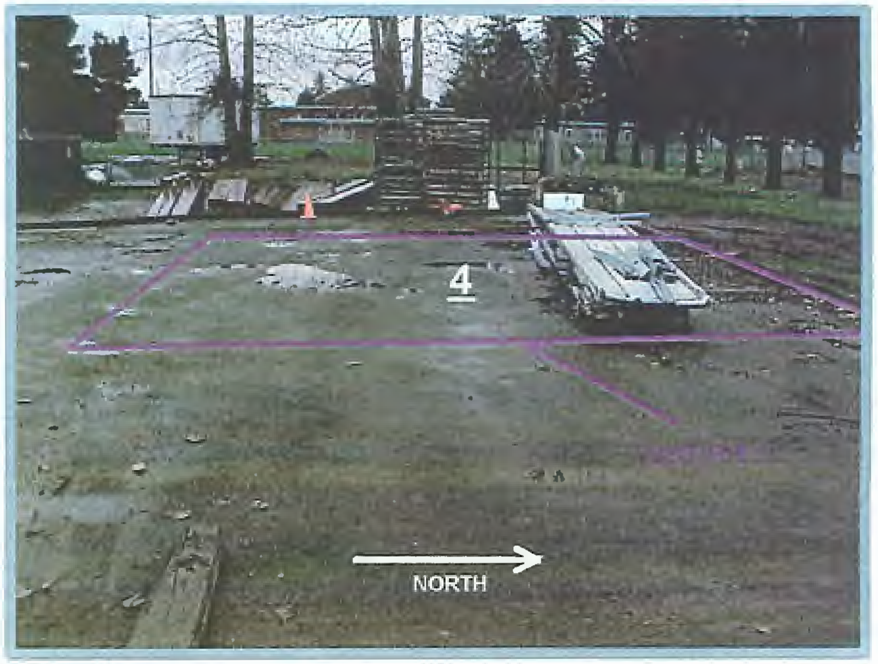
Appendix A

Ground Penetrating Radar Survey









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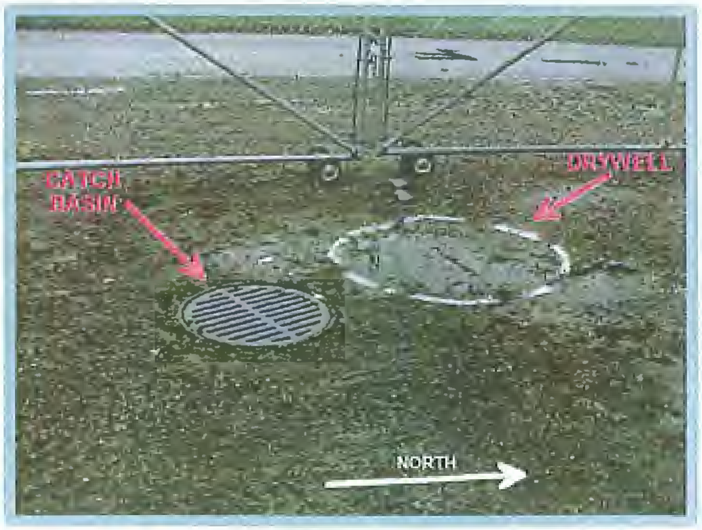
DATE: January 30, 2002 *SUBSURFACE MAPPING SURVEY* PROJECT No. 3984	CLIENT: KENNEDY/JENKS CONSULTANTS	

DRY WELL 1

DRY WELL 2

DRY WELL 3



DRY WELL 4

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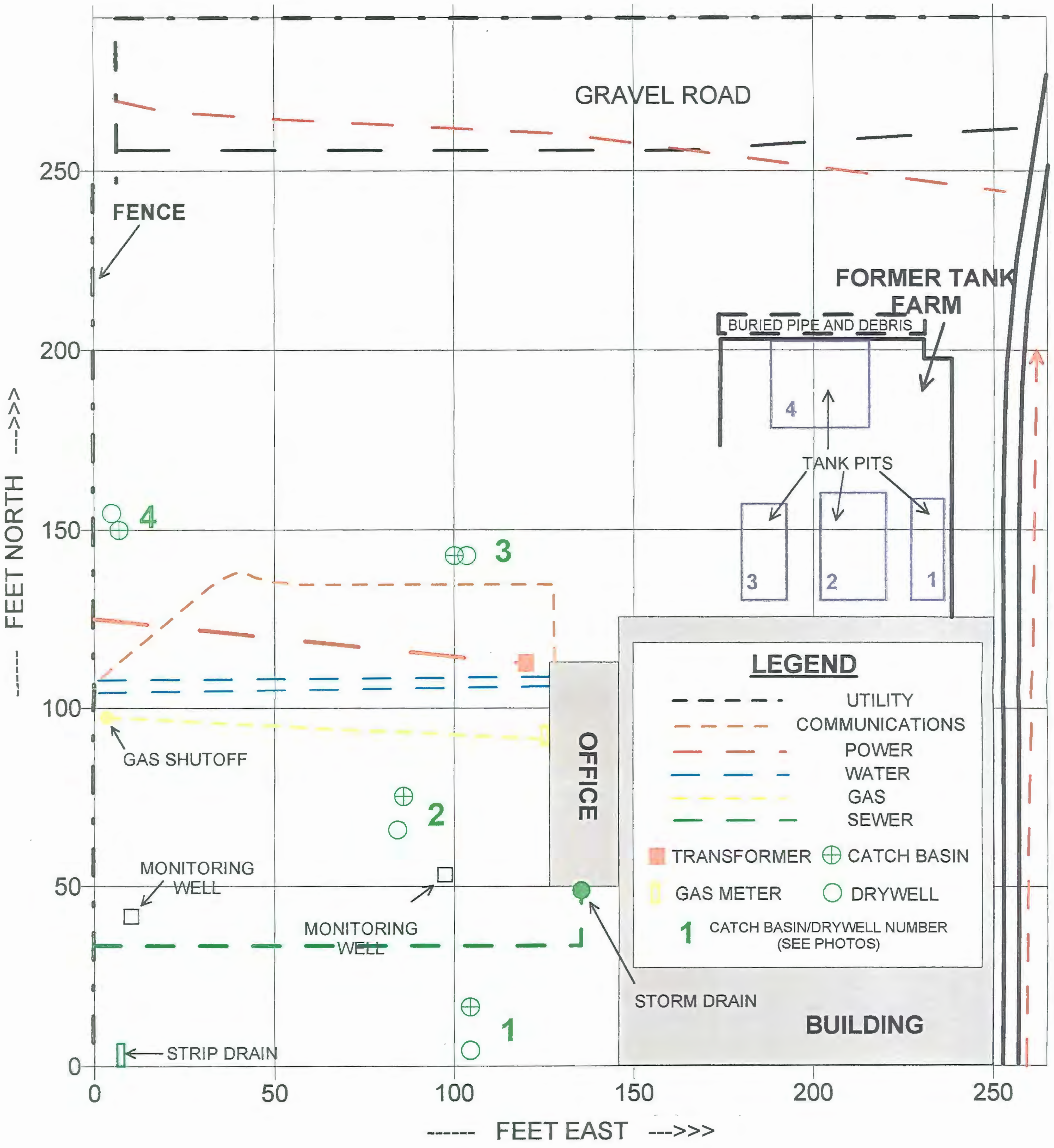
PROJECT No. 3984

LOCATION:
TETRA PAK SITE
3125 THOMPSON AVE
VANCOUVER, WASHINGTON

CLIENT: KENNEDY/JENKS CONSULTANTS

DRY WELLS



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SUBSURFACE MAPPING SURVEY
PROJECT No. 3984

LOCATION:
TETRA PAK SITE
3125 THOMPSON AVE
VANCOUVER, WASHINGTON

CLIENT: KENNEDY/JENKS CONSULTANTS

SITE MAP

Appendix B

Boring Logs and Monitoring Well Construction Diagrams

Boring & Well Construction Log

Kennedy/Jenks Consultants

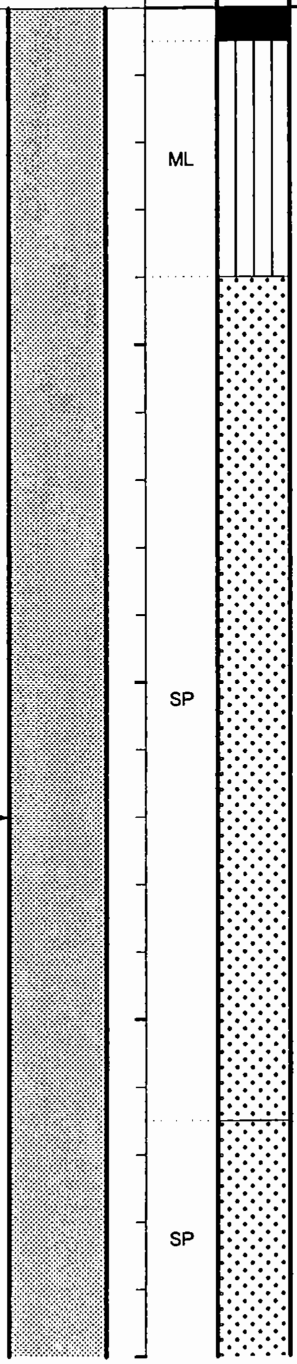
BORING LOCATION West side of dry well #2				
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Bill			
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch			
ISOLATION CASING NA	FROM NA	TO NA	FT.	
BLANK CASING NA	FROM NA	TO NA	FT.	
PERFORATED CASING NA	FROM NA	TO NA	FT.	
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA	FT.	
SEAL 3/8-inch Bentonite chips	FROM 0	TO 24	FT.	
GROUT NA	FROM NA	TO NA	FT.	

Boring/Well Name DW-2

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 24.0 ft. bgs
DATE STARTED 4/9/02	DATE COMPLETED 4/9/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.



SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
								Asphalt and baserock
	4				ML		0	Sandy Silt: brown, fine grained, nonplastic, very stiff, dry, no odor
								Sand: brown, fine grained, medium dense, dry, no odor
			5					
	4						0	
DW2-10	4		10		SP			
								becomes slightly plastic, wet
				Backfilled with bentonite chips				looses plasticity
	4							
DW2-15			15					
								Sand and Gravel: greyish brown, coarse grained, subangular gravel up to 2-inches, loose, dry, no odor
	4				SP			
DW2-20			20					

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 2

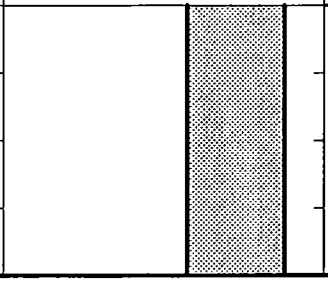
Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak

Project Number 016066.11

Boring/Well Name DW-2

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
DW2-23	4				SP	⁘		Sand and Gravel: same as above
								Refusal at 24 feet below ground surface

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	South side of dry well #3				
DRILLING COMPANY	Cascade Drilling, Inc.	DRILLER	Bill		
DRILLING METHOD(S)	GeoProbe	DRILL BIT(S) SIZE	2.5-inch		
ISOLATION CASING	NA	FROM	NA	TO	NA FT.
BLANK CASING	NA	FROM	NA	TO	NA FT.
PERFORATED CASING	NA	FROM	NA	TO	NA FT.
SIZE AND TYPE OF FILTER PACK	NA	FROM	NA	TO	NA FT.
SEAL	3/8-inch Bentonite chips	FROM	0	TO	24 FT.
GROUT	NA	FROM	NA	TO	NA FT.

Boring/Well Name DW-3A

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 24.0 ft. bgs
DATE STARTED 4/9/02	DATE COMPLETED 4/9/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.

SAMPLES Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
								Asphalt and baserock
	4				ML		0	Sandy Silt: black, fine grained, some clay, slightly plastic, stiff, dry, no odor, some organic material
			5					
	4				SP		0	Sand: brown, fine grained, dense, dry, no odor
DW3-10	4		10		SP			Sand: brown, fine grained, some silt, nonplastic, medium dense, dry, no odor
				Backfilled with bentonite chips				
	4				ML			Sandy Silt: brown, fine grained, some clay, slightly plastic, stiff, wet, no odor
DW3-15			15					
	4				SP			Sand and Gravel: greyish brown, coarse, loose, dry, no odor
DW3-20			20					

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 2

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak

Project Number 016066.11

Boring/Well Name DW-3A

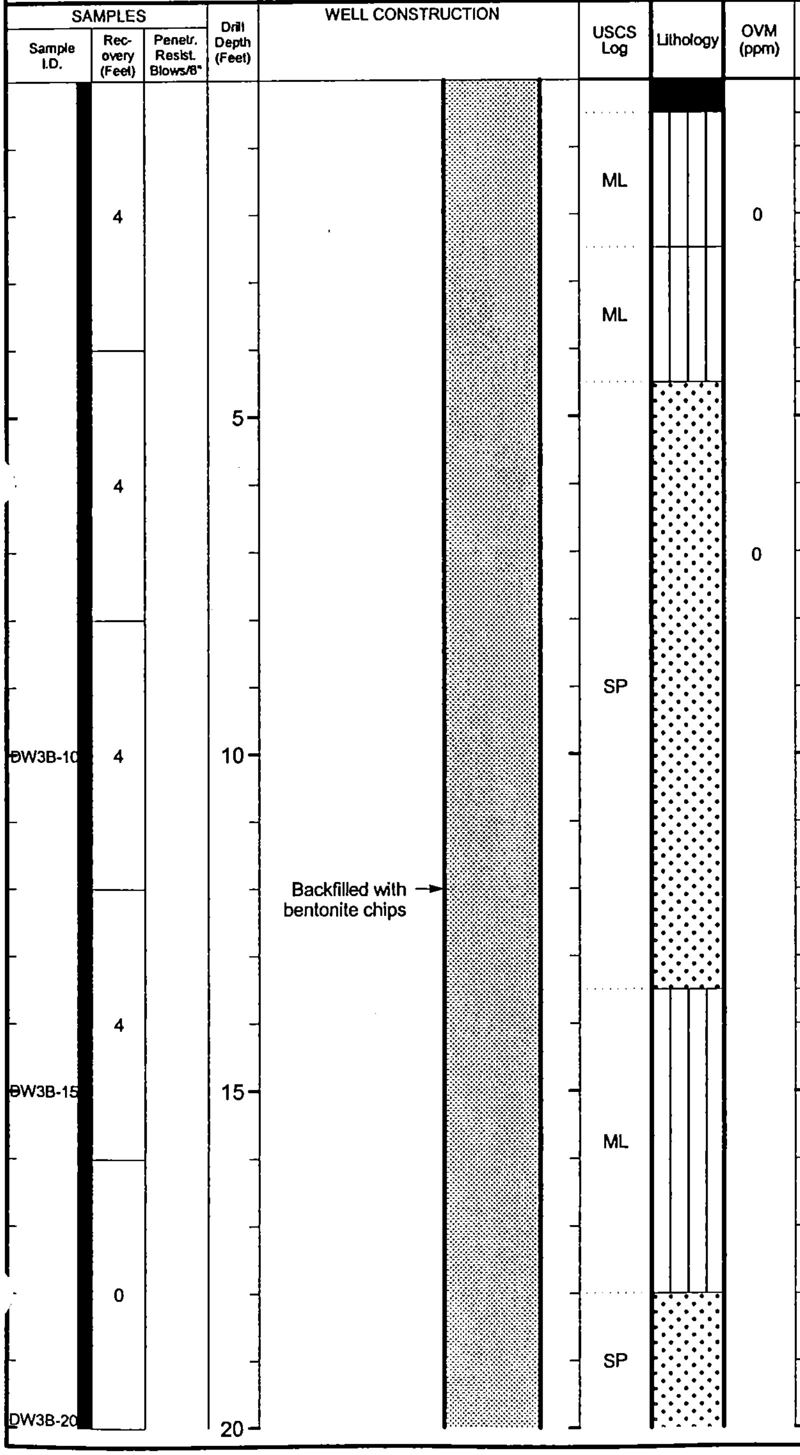
SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
DW3-23	4			▒	SP	⁙		Sand and Gravel: same as above

Refusal at 24 feet below ground surface

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION North side of drywell #3		Boring/Well Name DW-3B Project Name Tetra Pak Project Number 016066.11
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Bill	
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch	
ISOLATION CASING NA	FROM NA TO NA FT.	LOGGED BY S. Pasek TOTAL DEPTH 24.0 ft. bgs
BLANK CASING NA	FROM NA TO NA FT.	DATE STARTED 4/9/02 DATE COMPLETED 4/9/02
PERFORATED CASING NA	FROM NA TO NA FT.	ELEVATION GROUND NA ELEVATION CASING NA
SIZE AND TYPE OF FILTER PACK NA	FROM NA TO NA FT.	DEPTH TO GW BGS NA STATIC GW ELEVATION NA
SEAL 3/8-inch Bentonite chips	FROM 0 TO 24 FT.	SAMPLING METHODS Macro Core
GROUT NA	FROM NA TO NA FT.	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.



SAMPLE DESCRIPTION and DRILLING REMARKS

Asphalt and baserock

Sandy Silt: very dark brown to black, fine grained, very hard, some organic material, dry, no odor

Sandy Silt: brown, fine grained, nonplastic, hard, no organic material, dry, no odor

Sand: brown, fine grained, dense, dry, no odor

grades to fine to medium grained sand

Sandy Silt: brown, fine grained, some clay, slightly plastic, wet, no odor

No recovery from 16 to 20 feet below ground surface

According to driller, material is hard. Recovered some very coarse sand and gravel (up to 2-inches) in shoe

F-40.1
(6-87) (3-88) (8-90) (4-98)

Project Name Tetra Pak Project Number 016066.11 Boring/Well Name DW-3B

SAMPLES								
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
DW3B-23	4				SP			Sand and Gravel: greyish brown, coarse, subangular gravel up to 2-inches, loose, dry, no odor

Refusal at 24 feet below ground surface

Boring & Well Construction Log

Kennedy/Jenks Consultants

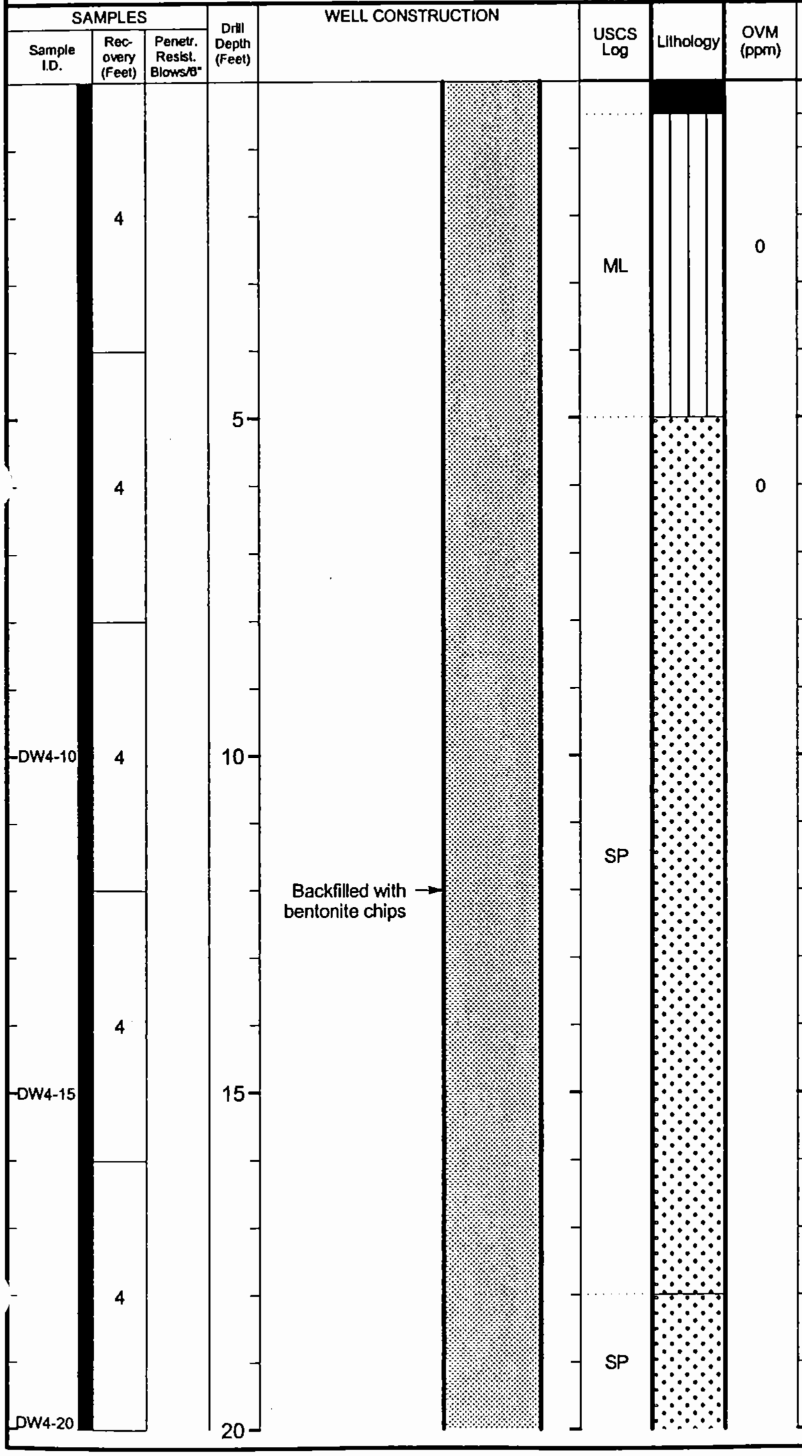
BORING LOCATION	East side of dry well #4		
DRILLING COMPANY	Cascade Drilling, Inc.	DRILLER	Bill
DRILLING METHOD(S)	GeoProbe	DRILL BIT(S) SIZE	2.5-inch
ISOLATION CASING	NA	FROM NA TO NA FT.	
BLANK CASING	NA	FROM NA TO NA FT.	
PERFORATED CASING	NA	FROM NA TO NA FT.	
SIZE AND TYPE OF FILTER PACK	NA	FROM NA TO NA FT.	
SEAL	3/8-inch Bentonite chips	FROM 0 TO 24 FT.	
GROUT	NA	FROM NA TO NA FT.	

Boring/Well Name: DW-4

Project Name: Tetra Pak

Project Number: 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 24.0 ft. bgs
DATE STARTED 4/9/02	DATE COMPLETED 4/9/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ____ FT.



SAMPLE DESCRIPTION and DRILLING REMARKS

Asphalt and baserock

Sandy Silt: brown, fine grained, very stiff to hard, dry, no odor

Sand: brown, medium to fine grained, medium dense, dry, no odor

Sand and Gravel: greyish brown, coarse, loose, dry, no odor

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 2

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak Project Number 016066.11 Boring/Well Name DW-4

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
DW4-23	4				SP			Sand and Gravel: same as above

Refusal at 24 feet below ground surface

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 2 OF 2

Boring & Well Construction Log

Kennedy/Jenks Consultants

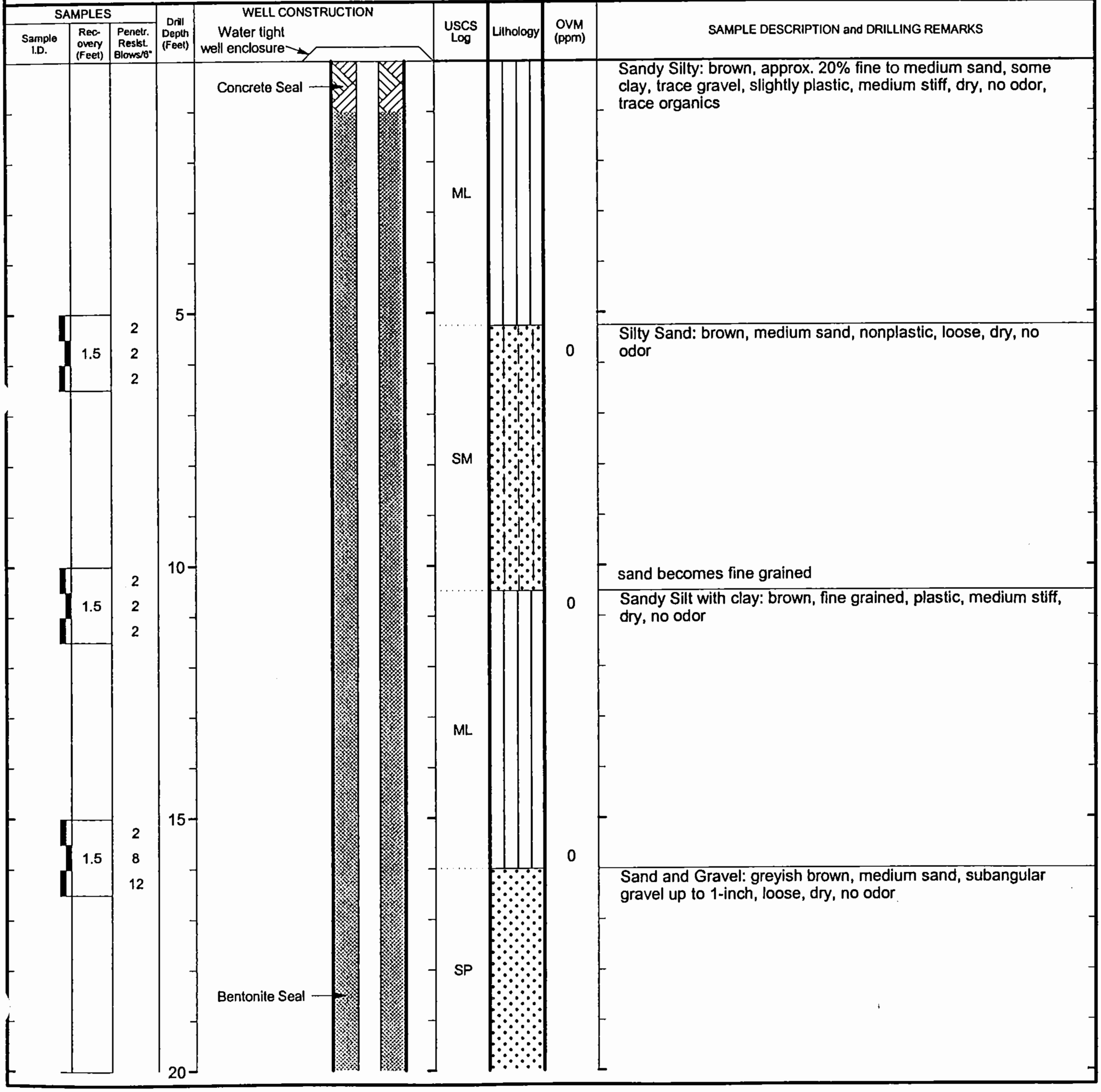
BORING LOCATION	Parking lot southeast of Former Strebor building			
DRILLING COMPANY	Cascade Drilling, Inc.	DRILLER	Rodney	
DRILLING METHOD(S)	Hollow Stem Auger	DRILL BIT(S) SIZE	6-inch	
ISOLATION CASING	NA	FROM NA	TO NA	FT.
BLANK CASING	2-inch Schedule 40 PVC	FROM 0	TO 39	FT.
PERFORATED CASING	2-inch Schedule 40 PVC with 0.020-inch slots	FROM 39	TO 54	FT.
SIZE AND TYPE OF FILTER PACK	2/12 kiln dried sand	FROM 36	TO 54	FT.
SEAL	3/8-inch Bentonite chips	FROM 1	TO 36	FT.
GROUT	Concrete	FROM 0	TO 1	FT.

Boring/Well Name: RGW1/MW-6

Project Name: Tetra Pak

Project Number: 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 55.0 ft. bgs
DATE STARTED 4/12/02	DATE COMPLETED 4/12/02
ELEVATION GROUND	ELEVATION CASING
DEPTH TO GW BGS 45	STATIC GW ELEVATION
SAMPLING METHODS Split-Spoon	WELL COMPLETION ☒ SURFACE HOUSING ☐ STAND PIPE ______ FT.



SAMPLES Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	USCS Log	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
			0	ML		Sandy Silty: brown, approx. 20% fine to medium sand, some clay, trace gravel, slightly plastic, medium stiff, dry, no odor, trace organics
	1.5	2 2 2	5	SM	0	Silty Sand: brown, medium sand, nonplastic, loose, dry, no odor
						sand becomes fine grained
	1.5	2 2 2	10	ML	0	Sandy Silt with clay: brown, fine grained, plastic, medium stiff, dry, no odor
	1.5	2 8 12	15	SP	0	Sand and Gravel: greyish brown, medium sand, subangular gravel up to 1-inch, loose, dry, no odor

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 3

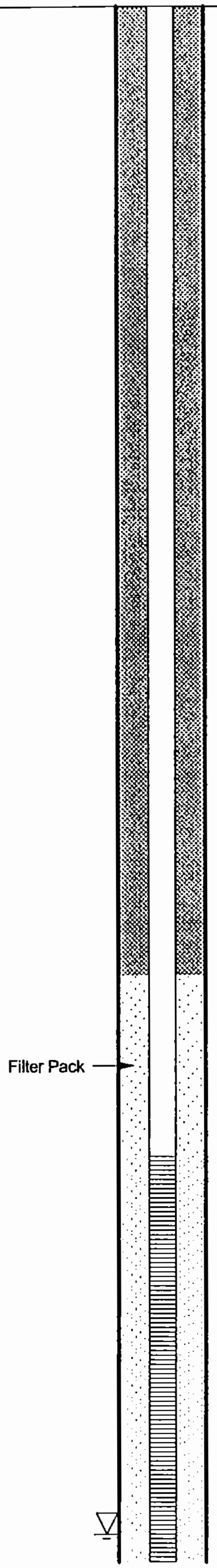
Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak

Project Number 016066.11

Boring/Well Name RGW1/MW-6



SAMPLES			Drill Depth (Feet)	USCS Log	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"				
	1.5	5 6 6			0	Sand and Gravel as above. Sand becomes coarse grained at approx. 20.25, there is a 2-inch lense of medium sand, no gravel, medium dense, dry, no odor At aprrox. 20.5, trace gravel up to 1/4-inch
						At aprrox. 25, approx. 40% gravel up to 1-inch
	1.5	6 7 10	25		0	At approx. 25.5, trace gravel
	1.5	7 7 9	30		0	
				SP		
	1.5	7 7 9	35		0	
	1.5	8 11 12	40		0	gravel content increases to approx. 20%
			45			very coarse sand and gravel, saturated

F-40.1
(6-87) (3-88) (8-90) (4-98)

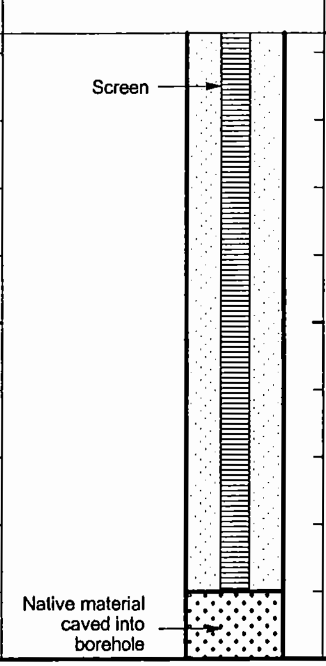
Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name **Tetra Pak** Project Number **016066.11** Boring/Well Name **RGW1/MW-6**

SAMPLES			Drill Depth (Feet)	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"					
	1.5						Sand and Gravel: same as above
	1.5	10 12 15	50	SP			gravel size increases to up to 1.5-inch
			55				

WELL CONSTRUCTION

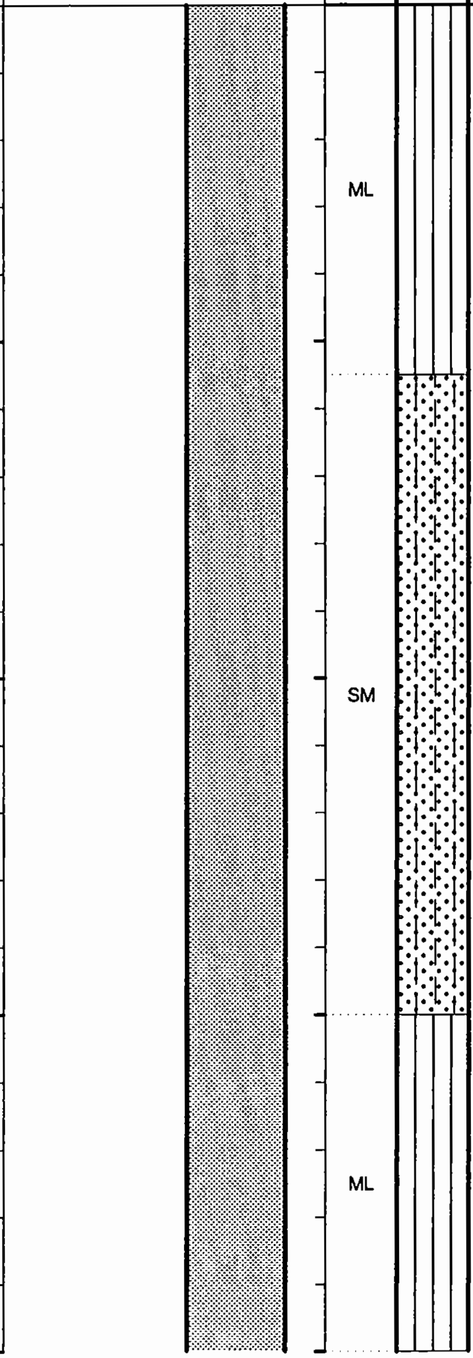


Groundwater sample collected from borehole prior to monitoring well construction and development

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION North of office at Former Strebor building		Boring/Well Name RGW2
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Rodney	Project Name Tetra Pak
DRILLING METHOD(S) Hollow Stem Auger	DRILL BIT(S) SIZE 6'-inch	Project Number 016066.11
ISOLATION CASING NA	FROM NA TO NA FT.	LOGGED BY S. Pasek / TOTAL DEPTH 50.0 ft. bgs
BLANK CASING NA	FROM NA TO NA FT.	DATE STARTED 4/11/02 / DATE COMPLETED 4/11/02
PERFORATED CASING NA	FROM NA TO NA FT.	ELEVATION GROUND NA / ELEVATION CASING NA
SIZE AND TYPE OF FILTER PACK NA	FROM NA TO NA FT.	DEPTH TO GW BGS 45.0 / STATIC GW ELEVATION NA
SEAL 3/8-inch Bentonite chips	FROM 0 TO 50 FT.	SAMPLING METHODS Split-Spoon
GROUT NA	FROM NA TO NA FT.	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.



SAMPLES: Sample I.D.	SAMPLES: Recovery (Feet)	SAMPLES: Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
			0		ML			Sandy Silty: brown, some clay, approx. 20% fine to medium grained sand, slightly plastic, stiff, dry, no odor
	1.5	2 2 3	5				0	
			5.5		SM			Silty Sand: brown, fine grained, nonplastic, medium dense, dry, no odor
	1.5	2 2 3	10				0	some clay, slightly plastic
	1.5	2 3 4	15		ML		0	Sandy Silt: brown, approx. 10% medium grained sand, nonplastic, stiff, dry, no odor
			20					

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 3

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak

Project Number 016066.11

Boring/Well Name RGW2

SAMPLES Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
	1.5	3 5 5			SP		0	Sand and Gravel: greyish brown, coarse grained, subangular gravel up to 2-inchs, loose, moist, no odor
	1.5	7 31 15	25	Backfilled with bentonite chips			0	
	1.5	7 8 12	30				0	
					SP			
	1	13 50/6	35				0	
	0.5	50/5	40				0	
		25	45	▽				Saturated

F-40.1
(6-87) (3-88) (8-90) (4-98)

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak

Project Number 016066.11

Boring/Well Name RGW2

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
	1	20 17			SP		0	Sand and Gravel: greyish brown, coarse grained, subangular gravel up to 2-inchs, loose, moist, no odor
			50					Groundwater sample collected from borehole

Boring & Well Construction Log

Kennedy/Jenks Consultants

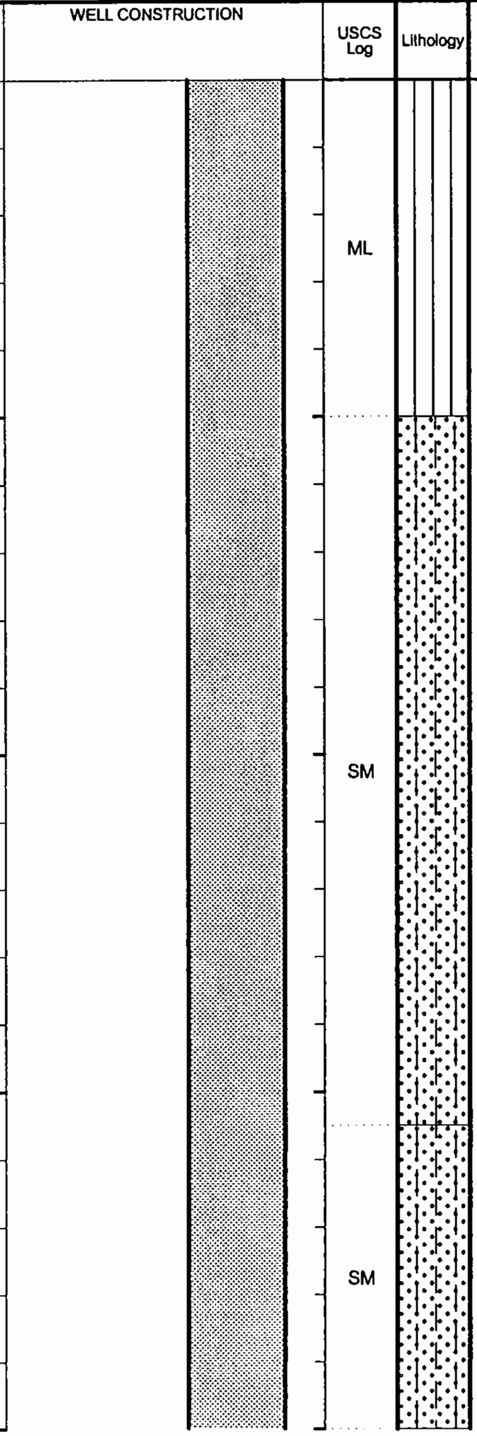
BORING LOCATION	In grassy area northwest of former tank farm area			
DRILLING COMPANY	Cascade Drilling, Inc.	DRILLER	Rodney	
DRILLING METHOD(S)	Hollow Stem Auger	DRILL BIT(S) SIZE	6-inch	
ISOLATION CASING	NA	FROM NA	TO NA	FT.
BLANK CASING	NA	FROM NA	TO NA	FT.
PERFORATED CASING	NA	FROM NA	TO NA	FT.
SIZE AND TYPE OF FILTER PACK	NA	FROM NA	TO NA	FT.
SEAL	3/8-inch Bentonite chips	FROM 0	TO 50	FT.
GROUT	NA	FROM NA	TO NA	FT.

Boring/Well Name RGW3

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 50.0 ft. bgs
DATE STARTED 4/11/02	DATE COMPLETED 4/11/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS 45.0	STATIC GW ELEVATION NA
SAMPLING METHODS Split-Spoon	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.



Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	USCS Log	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
				ML		Sandy Silty: brown, approx. 20% fine to medium sand, some clay, slightly plastic, stiff, dry, no odor
	1.5	3 7 8	5	SM	0	Silty Sand: brown, fine sand, nonplastic, medium dense, dry, no odor
	1.5	2 2 3	10	SM	0	slightly plastic, trace clay
	1.5		15	SM	0	Silty Sand: brown, coarse grained, medium dense, nonplastic, dry, no odor
			20			

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 3

Boring & Well Construction Log **Kennedy/Jenks Consultants**

Project Name Tetra Pak

Project Number 016066.11

Boring/Well Name RGW3

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"						
	1.5	9 7 10			SP		0	Sand and Gravel: greyish brown, coarse grained, loose, dry, no odor
	1.5	11 13 10	25	Backfilled with bentonite chips			0	subangular gravel up to 2-inches
	1.5	5 7 10	30				0	
					SP			
	1.5	7 9 10	35				0	
	1.5	12 10 11	40				0	
			45	∇				Saturated

F-40.1
(6-87) (3-88) (8-90) (4-98)

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak Project Number 016066.11 Boring/Well Name RGW3

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"						
RGW3 - 45.0/46.5	1.5			▨	SP	⁘	0	Sand and Gravel: greyish brown, coarse grained, subangular gravel up to 1-inch, loose, saturated, no odor
			50					

Groundwater sample collected from borehole

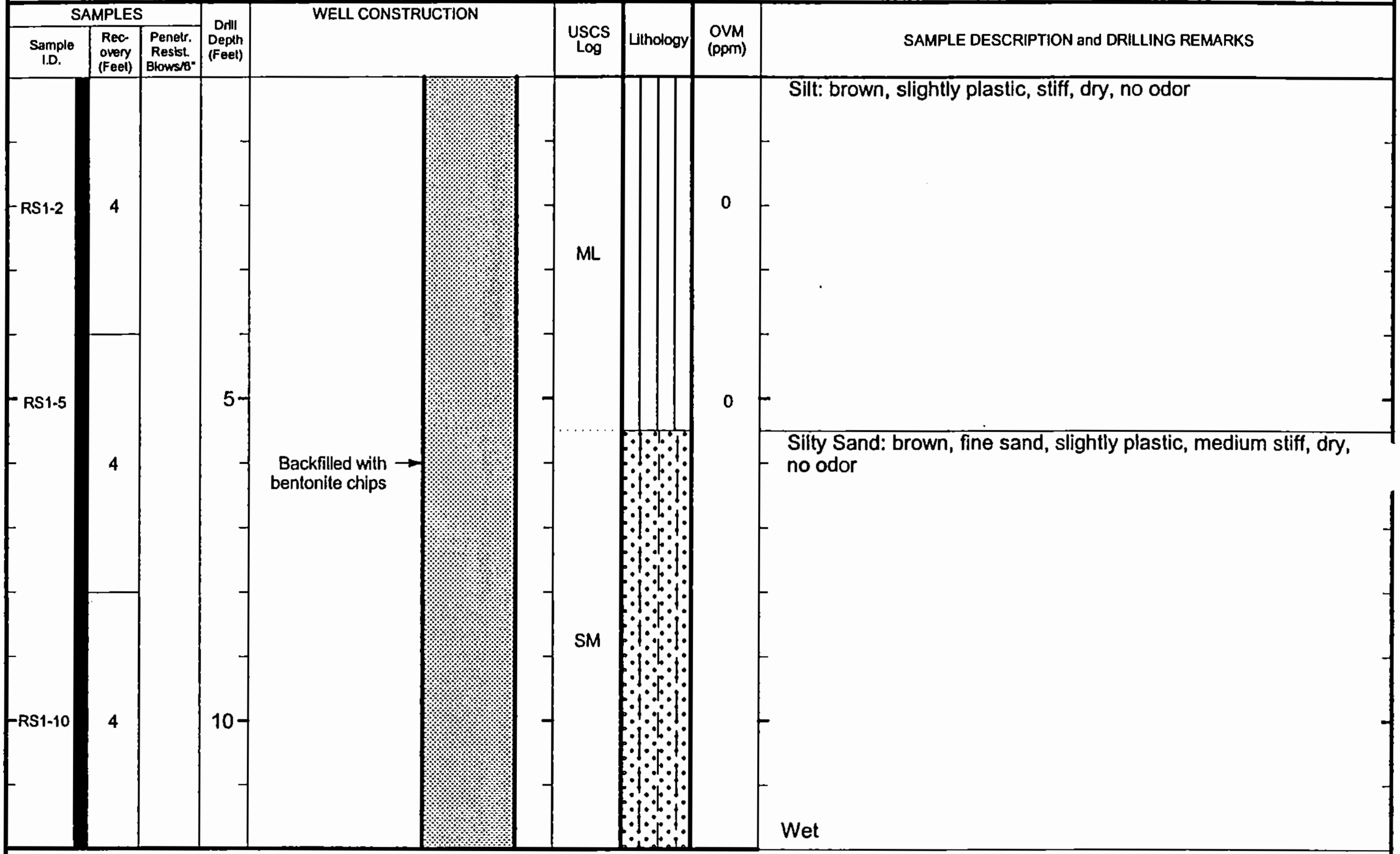
Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION Near SE corner of Former Strebor building		Boring/Well Name RS-1
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Caleb	Project Name Tetra Pak
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch	Project Number 016066.11

	FROM	TO	FT.
ISOLATION CASING NA	NA	NA	
BLANK CASING NA	NA	NA	
PERFORATED CASING NA	NA	NA	
SIZE AND TYPE OF FILTER PACK NA	NA	NA	
SEAL 3/8-inch Bentonite chips	0	12	
GROUT NA	NA	NA	

LOGGED BY S. Pasek	TOTAL DEPTH 12.0 ft. bgs
DATE STARTED 4/8/02	DATE COMPLETED 4/8/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.



SAMPLES Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
								Silt: brown, slightly plastic, stiff, dry, no odor
RS1-2	4				ML		0	
RS1-5			5				0	
	4			Backfilled with bentonite chips				Silty Sand: brown, fine sand, slightly plastic, medium stiff, dry, no odor
					SM			
RS1-10	4		10					
								Wet

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 1

Boring & Well Construction Log

Kennedy/Jenks Consultants

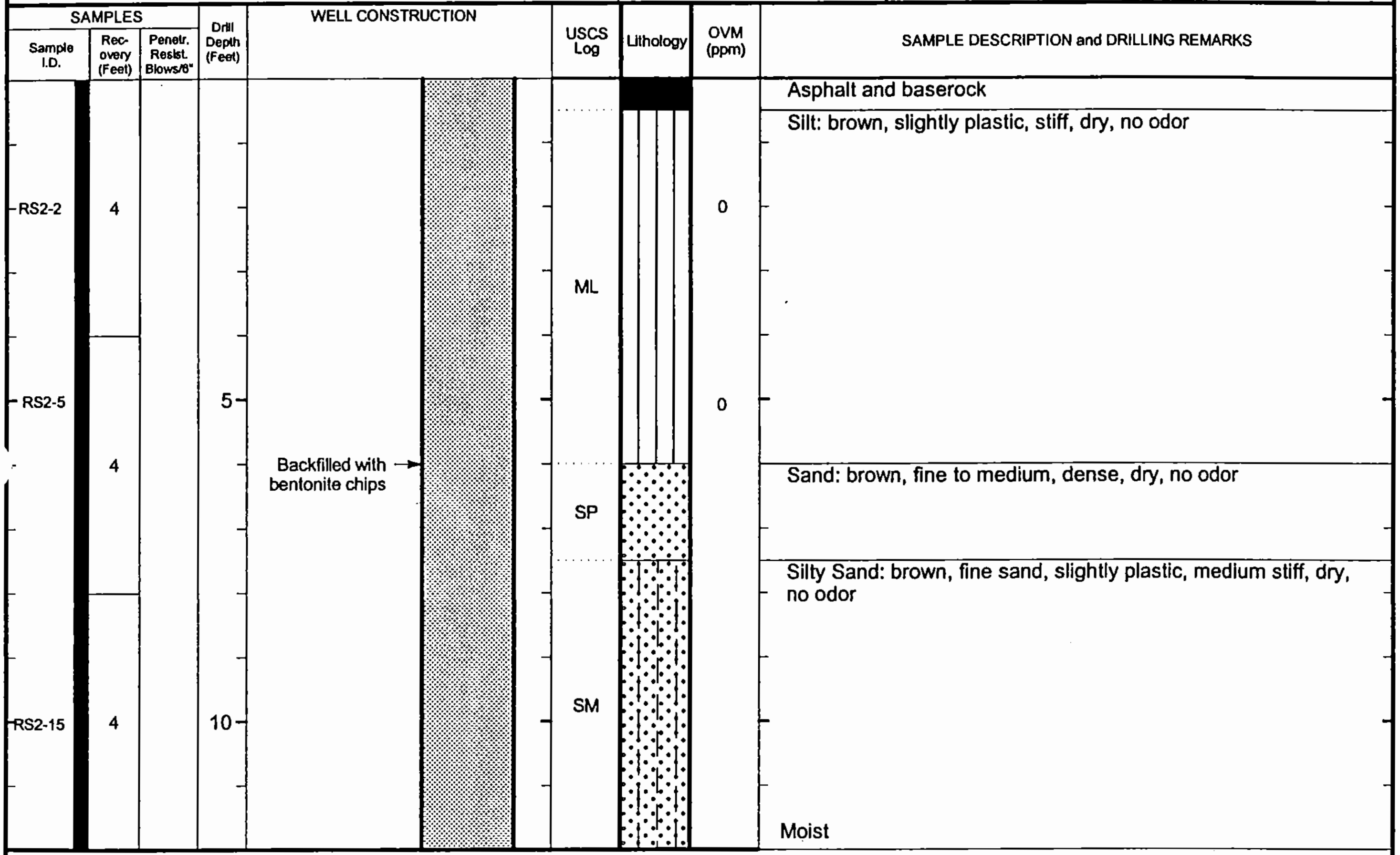
BORING LOCATION Along railroad tracks on east side of Former Strebor building		
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Caleb	
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch	
ISOLATION CASING NA	FROM NA	TO NA FT.
BLANK CASING NA	FROM NA	TO NA FT.
PERFORATED CASING NA	FROM NA	TO NA FT.
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA FT.
SEAL 3/8-inch Bentonite chips	FROM 0	TO 12 FT.
GROUT NA	FROM NA	TO NA FT.

Boring/Well Name RS-2

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 12.0 ft. bgs
DATE STARTED 4/8/02	DATE COMPLETED 4/8/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE _____ FT.



SAMPLES: Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
							Asphalt and baserock
RS2-2	4				ML	0	Silt: brown, slightly plastic, stiff, dry, no odor
RS2-5			5			0	
	4			Backfilled with bentonite chips	SP		Sand: brown, fine to medium, dense, dry, no odor
RS2-15	4		10		SM		Silty Sand: brown, fine sand, slightly plastic, medium stiff, dry, no odor Moist

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 1

Boring & Well Construction Log

Kennedy/Jenks Consultants

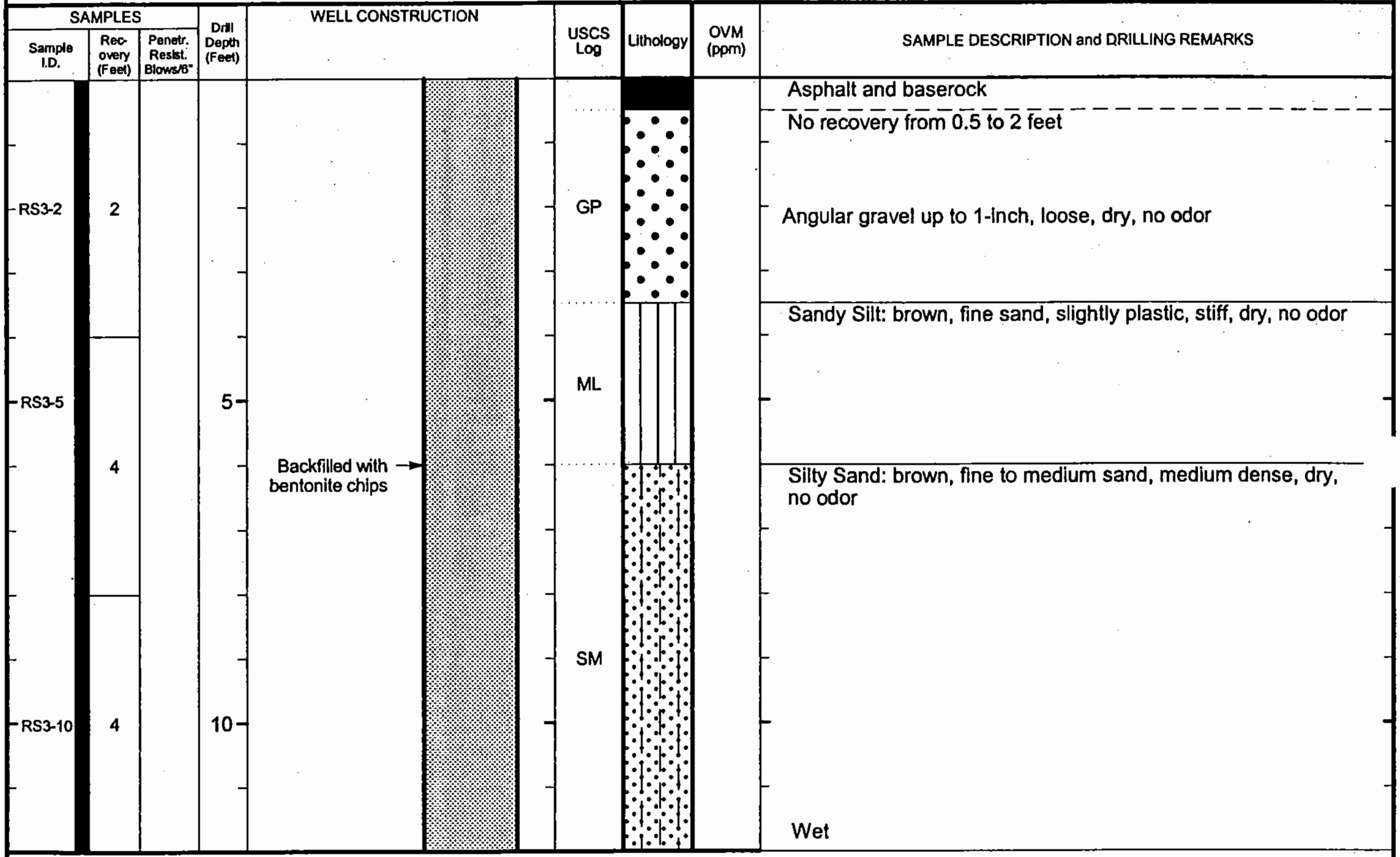
BORING LOCATION Along railroad tracks on east side of Former Strebor building, north of RS-2				
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Caleb			
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch			
ISOLATION CASING NA	FROM NA	TO NA	FT.	
BLANK CASING NA	FROM NA	TO NA	FT.	
PERFORATED CASING NA	FROM NA	TO NA	FT.	
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA	FT.	
SEAL 3/8-inch Bentonite chips	FROM 0	TO 12	FT.	
GROUT NA	FROM NA	TO NA	FT.	

Boring/Well Name RS-3

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 12.0 ft. bgs
DATE STARTED 4/8/02	DATE COMPLETED 4/8/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ____ FT.



Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	Well Construction	USCS Log	Lithology	OVM (ppm)	Sample Description and Drilling Remarks
								Asphalt and baserock
								No recovery from 0.5 to 2 feet
RS3-2	2				GP			Angular gravel up to 1-inch, loose, dry, no odor
					ML			Sandy Silt: brown, fine sand, slightly plastic, stiff, dry, no odor
RS3-5			5					
	4			Backfilled with bentonite chips	SM			Silty Sand: brown, fine to medium sand, medium dense, dry, no odor
RS3-10	4		10					
								Wet

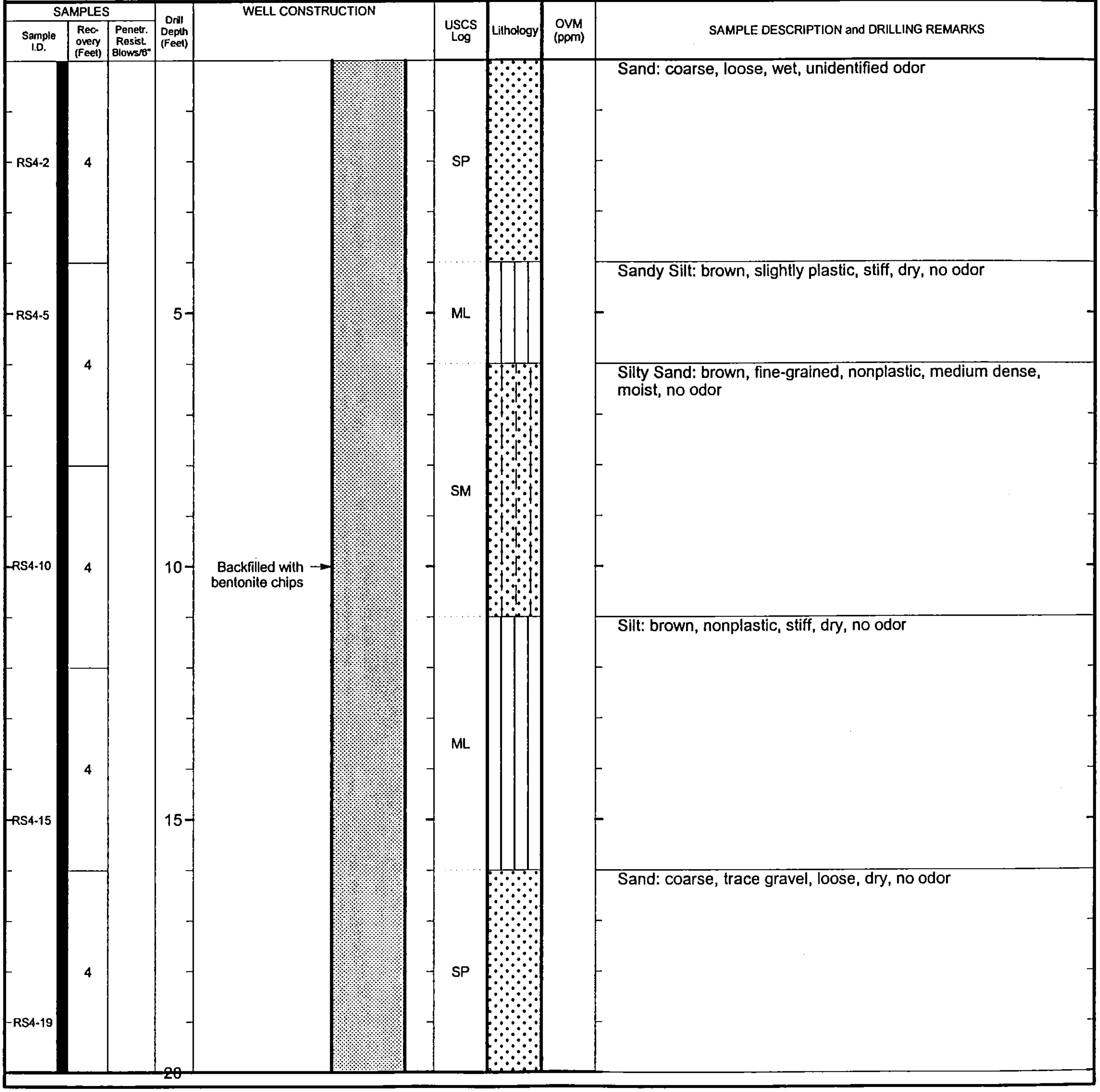
F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 1

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION Near northeast corner of Former Strebor building		Boring/Well Name: RS-4
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Caleb	Project Name: Tetra Pak
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch	Project Number: 016066.11
ISOLATION CASING NA	FROM NA TO NA FT.	LOGGED BY: S. Pasek TOTAL DEPTH: 20.0 ft. bgs
BLANK CASING NA	FROM NA TO NA FT.	DATE STARTED: 4/8/02 DATE COMPLETED: 4/10/02
PERFORATED CASING NA	FROM NA TO NA FT.	ELEVATION GROUND: NA ELEVATION CASING: NA
SIZE AND TYPE OF FILTER PACK NA	FROM NA TO NA FT.	DEPTH TO GW BGS: NA STATIC GW ELEVATION: NA
SEAL 3/8-inch Bentonite chips	FROM 0 TO 20 FT.	SAMPLING METHODS: Macro Core WELL COMPLETION: ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.
GROUT NA	FROM NA TO NA FT.	



SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
RS4-2	4				SP			Sand: coarse, loose, wet, unidentified odor
RS4-5			5		ML			Sandy Silt: brown, slightly plastic, stiff, dry, no odor
	4				SM			Silty Sand: brown, fine-grained, nonplastic, medium dense, moist, no odor
RS4-10	4		10	Backfilled with bentonite chips				
	4				ML			Silt: brown, nonplastic, stiff, dry, no odor
RS4-15			15					
	4				SP			Sand: coarse, trace gravel, loose, dry, no odor
RS4-19			20					

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 1

Boring & Well Construction Log **Kennedy/Jenks Consultants**

BORING LOCATION Southeast of northeast corner of paved former tank farm area				Boring/Well Name RS-5 Project Name Tetra Pak Project Number 016066.11
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Caleb			
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch			
ISOLATION CASING NA	FROM NA	TO NA	FT.	LOGGED BY S. Pasek — TOTAL DEPTH 12.0 ft. bgs
BLANK CASING NA	FROM NA	TO NA	FT.	DATE STARTED 4/8/02 — DATE COMPLETED 4/8/02
PERFORATED CASING NA	FROM NA	TO NA	FT.	ELEVATION GROUND NA — ELEVATION CASING NA
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA	FT.	DEPTH TO GW BGS NA — STATIC GW ELEVATION NA
SEAL 3/8-inch Bentonite chips	FROM 0	TO 12	FT.	SAMPLING METHODS Macro Core — WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ____ FT.
GROUT NA	FROM NA	TO NA	FT.	

SAMPLES								
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
RS5-0-1								Sand and gravel: coarse sand, loose, dry, no odor
RS5-2	4				SP			
								Silty Sand: brown, fine grained, medium dense, moist, no odor
RS5-5			5					
	4			Backfilled with bentonite chips				
					SM			
RS5-10	4		10					

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 1

Boring & Well Construction Log

Kennedy/Jenks Consultants

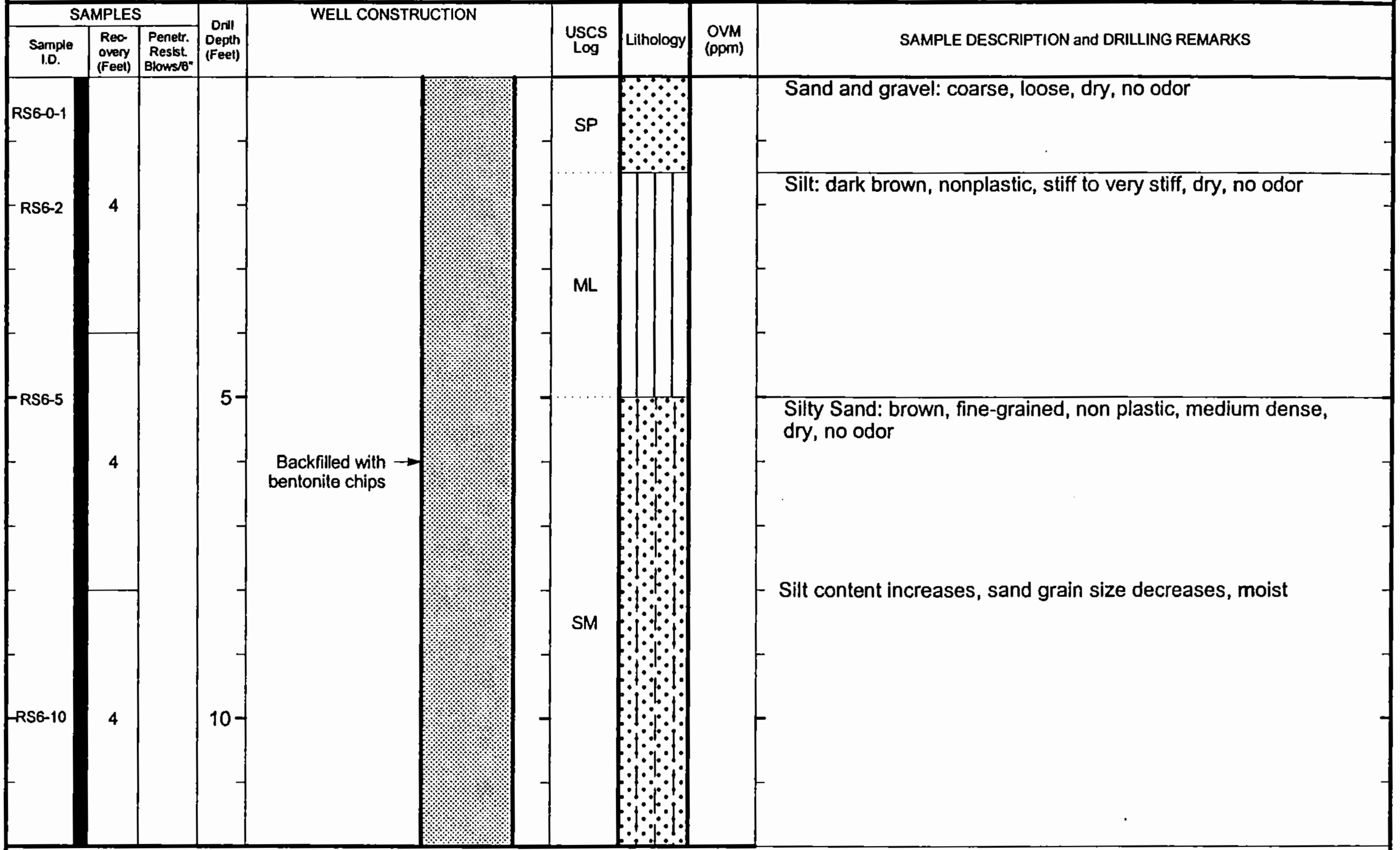
BORING LOCATION: Northeast of RS-5			
DRILLING COMPANY: Cascade Drilling, Inc.	DRILLER: Caleb		
DRILLING METHOD(S): GeoProbe	DRILL BIT(S) SIZE: 2.5-inch		
ISOLATION CASING: NA	FROM NA	TO NA	FT.
BLANK CASING: NA	FROM NA	TO NA	FT.
PERFORATED CASING: NA	FROM NA	TO NA	FT.
SIZE AND TYPE OF FILTER PACK: NA	FROM NA	TO NA	FT.
SEAL: 3/8-inch Bentonite chips	FROM 0	TO 12	FT.
GROUT: NA	FROM NA	TO NA	FT.

Boring/Well Name: RS-6

Project Name: Tetra Pak

Project Number: 016066.11

LOGGED BY: S. Pasek	TOTAL DEPTH: 12.0 ft. bgs
DATE STARTED: 4/8/02	DATE COMPLETED: 4/8/02
ELEVATION GROUND: NA	ELEVATION CASING: NA
DEPTH TO GW BGS: NA	STATIC GW ELEVATION: NA
SAMPLING METHODS: Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.



SAMPLES: Sample I.D.	SAMPLES: Recovery (Feet)	SAMPLES: Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
RS6-0-1					SP			Sand and gravel: coarse, loose, dry, no odor
RS6-2	4				ML			Silt: dark brown, nonplastic, stiff to very stiff, dry, no odor
RS6-5			5		SM			Silty Sand: brown, fine-grained, non plastic, medium dense, dry, no odor
	4			Backfilled with bentonite chips				
								Silt content increases, sand grain size decreases, moist
RS6-10	4		10					

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 1

Boring & Well Construction Log

Kennedy/Jenks Consultants

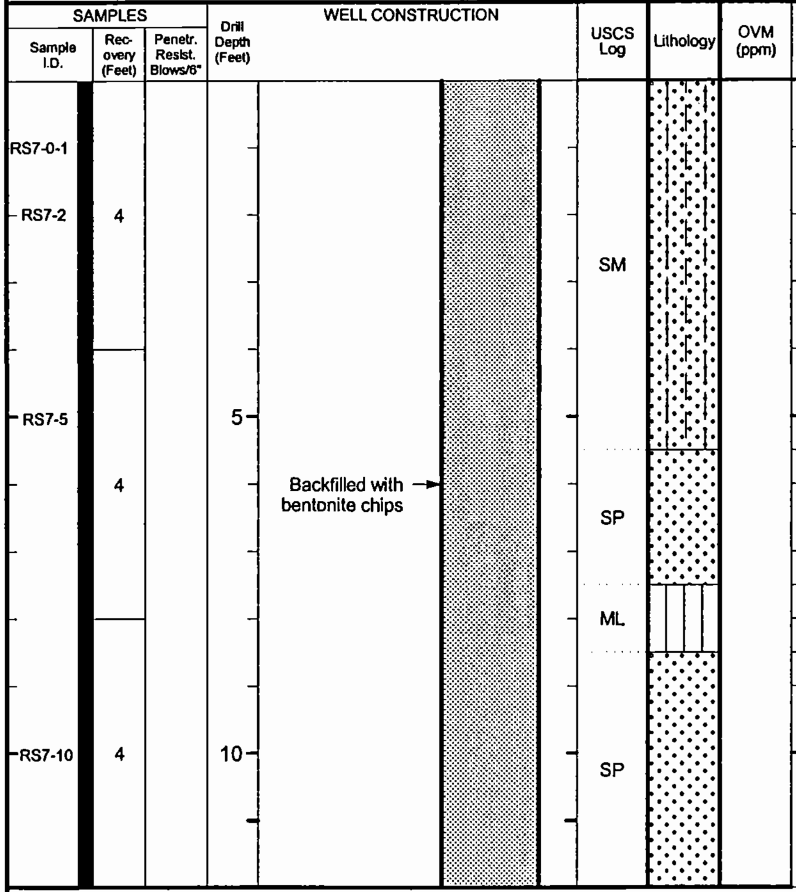
BORING LOCATION East of TF1		
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Bill	
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch	
ISOLATION CASING NA	FROM NA	TO NA FT.
BLANK CASING NA	FROM NA	TO NA FT.
PERFORATED CASING NA	FROM NA	TO NA FT.
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA FT.
SEAL 3/8-inch Bentonite chips	FROM 0	TO 24 FT.
GROUT NA	FROM NA	TO NA FT.

Boring/Well Name RS-7

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 12.0
DATE STARTED 4/10/02	DATE COMPLETED 4/10/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.



SAMPLE DESCRIPTION and DRILLING REMARKS

Silty Sand with clay: brown, fine to medium grained, plastic, stiff, dry, no odor, some organic material

At 2.5 ft, lose organic material

Sand: brown, fine grained, medium dense, dry, no odor

Silt: brown, nonplastic, stiff, moist, no odor

Sand: brown, fine grained, medium dense, dry, no odor

F-40.1
(6-87) (3-88) (6-90) (4-98)

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION East of RS-7 along east side of railroad tracks				Boring/Well Name RS-8 Project Name Tetra Pak Project Number 016066.11
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Bill			
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch			
ISOLATION CASING NA	FROM NA	TO NA	FT.	LOGGED BY S. Pasek
BLANK CASING NA	FROM NA	TO NA	FT.	TOTAL DEPTH 12.0 ft. bgs
PERFORATED CASING NA	FROM NA	TO NA	FT.	DATE STARTED 4/10/02
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA	FT.	DATE COMPLETED 4/10/02
SEAL 3/8-inch Bentonite chips	FROM 0	TO 12	FT.	ELEVATION GROUND NA
GROUT NA	FROM NA	TO NA	FT.	ELEVATION CASING NA
				DEPTH TO GW BGS NA
				STATIC GW ELEVATION NA
				SAMPLING METHODS Macro Core
				WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
						■		Asphalt and baserock
RS8-0-1								Silty Sand with clay: brown, fine grained, plastic, stiff, dry, no odor, some organic material
RS8-2	4							no organic material
					SM			
RS8-5			5					
	4			Backfilled with bentonite chips →				Sand: brown, fine grained, medium dense, dry, no odor
					SP			
					ML			Silt: brown, nonplastic, medium stiff, moist, no odor
								Sand: brown, fine grained, medium dense, dry, no odor
RS8-10	4		10		SP			

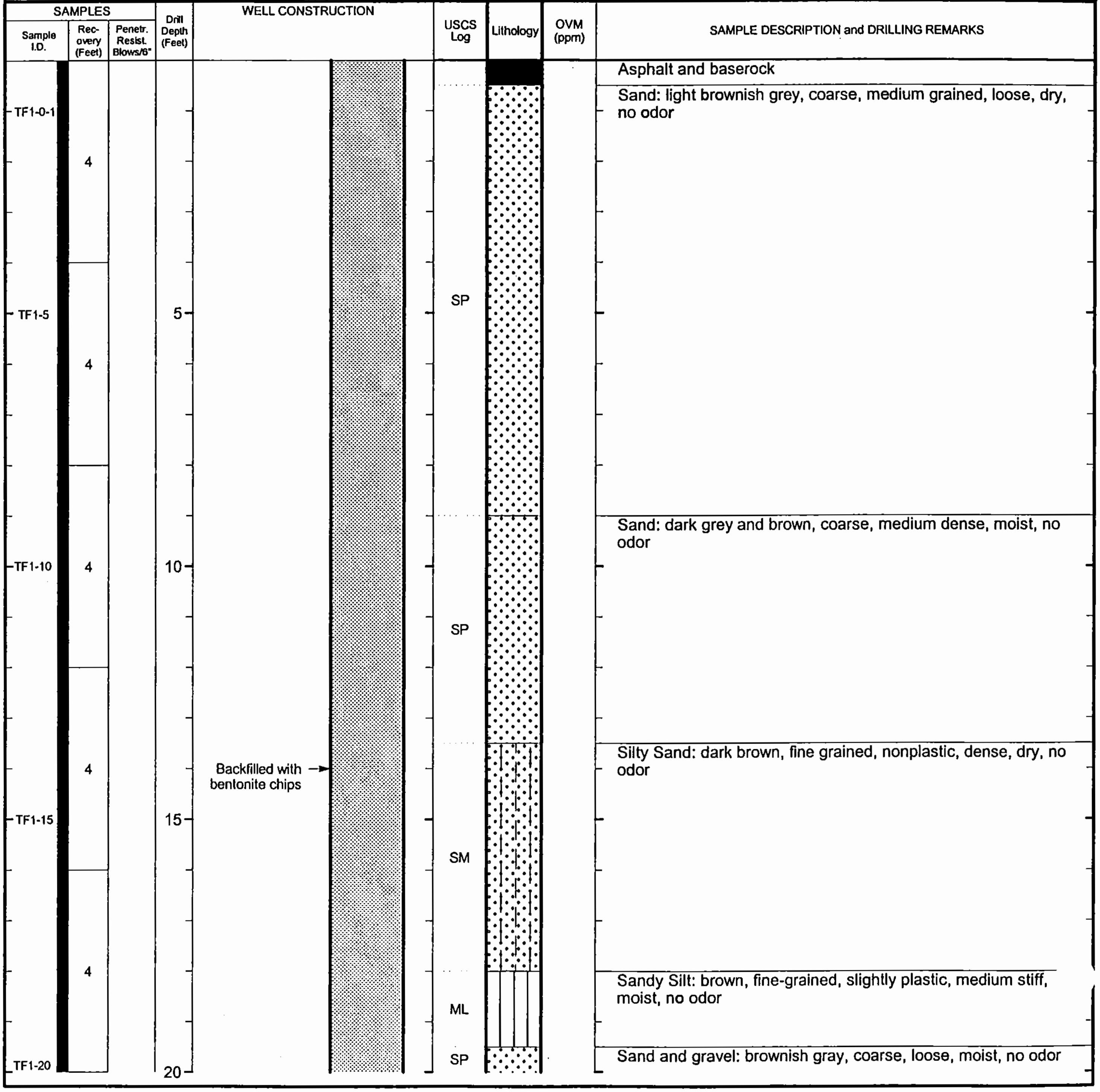
F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 1

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION East side of the former tank farm area				Boring/Well Name: TF-1 Project Name: Tetra Pak Project Number: 016066.11
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Caleb			
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch			
ISOLATION CASING NA	FROM NA	TO NA	FT.	LOGGED BY: S. Pasek TOTAL DEPTH: 28.0 ft. bgs
BLANK CASING NA	FROM NA	TO NA	FT.	DATE STARTED: 4/8/02 DATE COMPLETED: 4/8/02
PERFORATED CASING NA	FROM NA	TO NA	FT.	ELEVATION GROUND: NA ELEVATION CASING: NA
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA	FT.	DEPTH TO GW BGS: NA STATIC GW ELEVATION: NA
SEAL 3/8-inch Bentonite chips	FROM 0	TO 28	FT.	SAMPLING METHODS: Macro Core WELL COMPLETION: ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.
GROUT NA	FROM NA	TO NA	FT.	



Asphalt and baserock

Sand: light brownish grey, coarse, medium grained, loose, dry, no odor

Sand: dark grey and brown, coarse, medium dense, moist, no odor

Silty Sand: dark brown, fine grained, nonplastic, dense, dry, no odor

Sandy Silt: brown, fine-grained, slightly plastic, medium stiff, moist, no odor

Sand and gravel: brownish gray, coarse, loose, moist, no odor

F-40.1
(6-87) (3-88) (8-90) (4-98)

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak **Project Number** 016066.11 **Boring/Well Name** TF-1

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
								Sand and Gravel: same as above
	4							
					SP			
TF1-25			25					
	4							

F-40.1
(6-87) (3-88) (8-90) (4-98)

Boring & Well Construction Log

Kennedy/Jenks Consultants

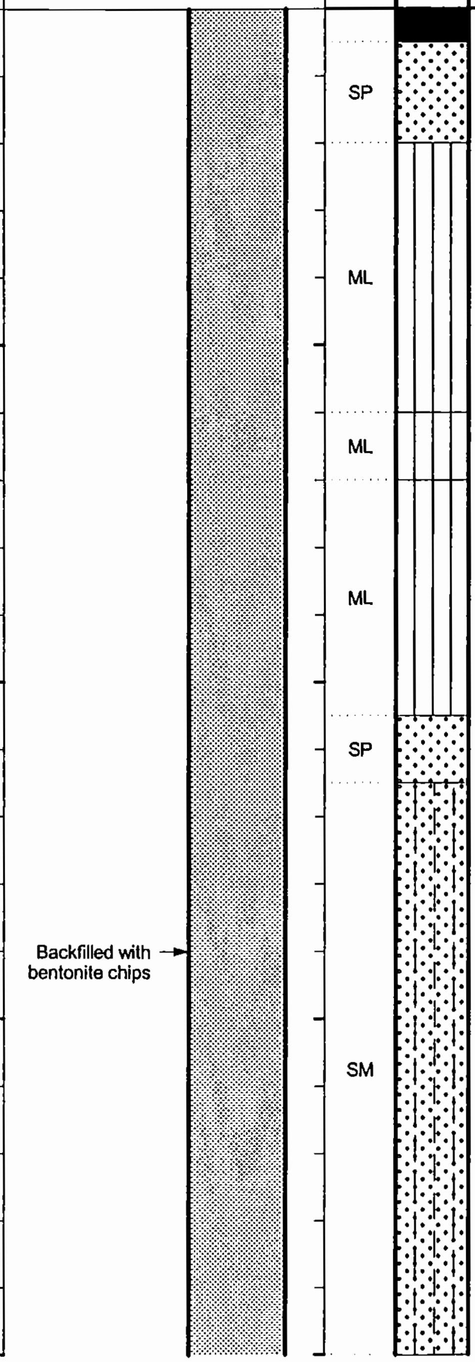
BORING LOCATION In front of doors on north side of former Strebor building				
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Caleb			
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch			
ISOLATION CASING NA	FROM NA	TO NA	FT.	
BLANK CASING NA	FROM NA	TO NA	FT.	
PERFORATED CASING NA	FROM NA	TO NA	FT.	
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA	FT.	
SEAL 3/8-inch Bentonite chips	FROM 0	TO 28	FT.	
GROUT NA	FROM NA	TO NA	FT.	

Boring/Well Name TF-2

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 28.0 ft. bgs
DATE STARTED 4/8/02	DATE COMPLETED 4/8/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ____ FT.



SAMPLES Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	USCS Log	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
						Asphalt and baserock
				SP		Sand and gravel: greyish brown, coarse, loose, dry, no odor
	4					
				ML		Sandy Silt: brown, fine to medium grained, slightly plastic, stiff, dry, no odor
TF2-5			5			
	4			ML		Silt: dark brown, nonplastic, very stiff, dry, no odor, some organic material
				ML		Sandy Silt: brown, fine grained, slightly plastic, stiff, moist, no odor, no organic material
TF2-10	4		10			
				SP		Sand and gravel: greyish brown, coarse, subangular gravel up to 1-inch, loose, moist, no odor
				SM		Silty Sand: brown, fine grained, medium dense, dry, no odor
	4					
TF2-15			15			
	4					
TF2-20			20			

F-40.1
(6-87) (3-88) (8-90) (4-98)

Project Name Tetra Pak Project Number 016066.11 Boring/Well Name TF-2

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"						
								Sand and Gravel: greyish brown, coarse, loose, dry, no odor
	4							
TF2-24					SP			
			25					
	4							

Boring & Well Construction Log

Kennedy/Jenks Consultants

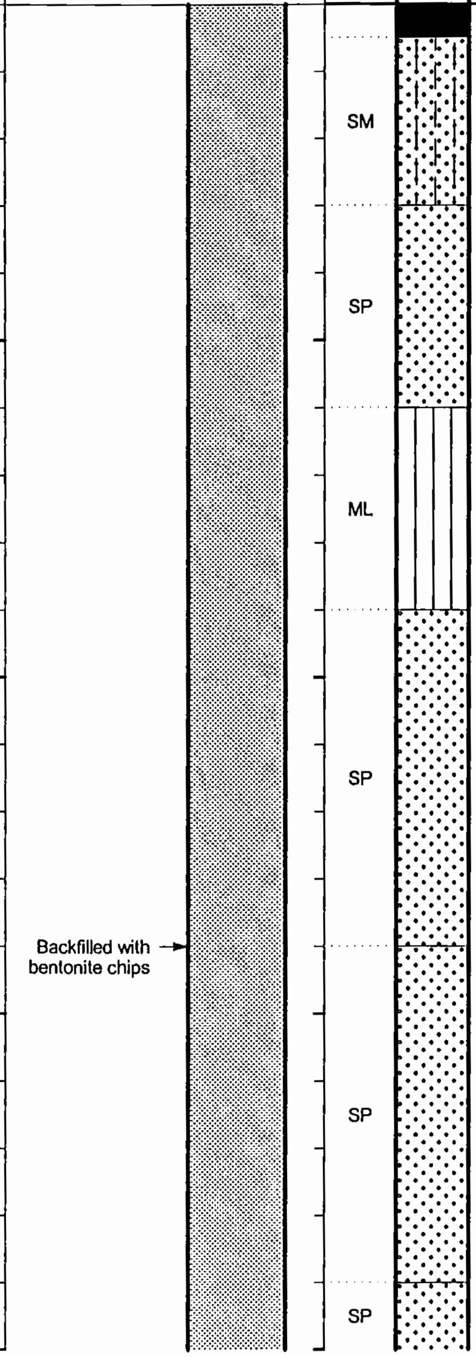
BORING LOCATION: Southwest corner of former tank farm		
DRILLING COMPANY: Cascade Drilling, Inc.	DRILLER: Bill	
DRILLING METHOD(S): GeoProbe	DRILL BIT(S) SIZE: 2.5-inch	
ISOLATION CASING: NA	FROM NA TO NA FT.	
BLANK CASING: NA	FROM NA TO NA FT.	
PERFORATED CASING: NA	FROM NA TO NA FT.	
SIZE AND TYPE OF FILTER PACK: NA	FROM NA TO NA FT.	
SEAL: 3/8-inch Bentonite chips	FROM 0 TO 28 FT.	
GROUT: NA	FROM NA TO NA FT.	

Boring/Well Name: TF-3

Project Name: Tetra Pak

Project Number: 016066.11

LOGGED BY: S. Pasek	TOTAL DEPTH: 28.0 ft. bgs
DATE STARTED: 4/9/02	DATE COMPLETED: 4/9/02
ELEVATION GROUND: NA	ELEVATION CASING: NA
DEPTH TO GW BGS: NA	STATIC GW ELEVATION: NA
SAMPLING METHODS: Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ____ FT.



Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	USCS Log	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
			0–0.5			Asphalt and baserock
	4		0.5–3	SM	0	Silty Sand with gravel: brown, fine to medium grained, slightly plastic, stiff, dry, no odor
TF3-5			3–6	SP	0	Sand: greyish brown, coarse, medium dense, dry, no odor
	4		6–9	ML		Sandy Silt: brown, fine grained, slightly plastic, stiff, dry, no odor
TF3-10	4		9–14	SP		Sand: brown, fine grained, medium dense, dry, no odor
TF3-15	4		14–19	SP		Sand: brown, some silt, fine grained, slightly plastic, soft, wet, no odor
TF3-20	4		19–20	SP		Sand and Gravel: greyish brown, coarse, subangular gravel up to 1-inch, loose, dry, no odor

F-40.1
(6-87) (3-88) (8-90) (4-98)

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak　Project Number 016066.11　Boring/Well Name TF-3

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
	4				SP			Sand and Gravel: same as above
TF3-25	4		25					

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	West of TF3			
DRILLING COMPANY	Cascade Drilling, Inc.	DRILLER	Bill	
DRILLING METHOD(S)	GeoProbe	DRILL BIT(S) SIZE	2.5-inch	
ISOLATION CASING	NA	FROM NA	TO NA	FT.
BLANK CASING	NA	FROM NA	TO NA	FT.
PERFORATED CASING	NA	FROM NA	TO NA	FT.
SIZE AND TYPE OF FILTER PACK	NA	FROM NA	TO NA	FT.
SEAL	3/8-inch Bentonite chips	FROM 0	TO 24	FT.
GROUT	NA	FROM NA	TO NA	FT.

Boring/Well Name TF-4

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 24.0 ft. bgs
DATE STARTED 4/10/02	DATE COMPLETED 4/10/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"						
								Asphalt and baserock
					SP			Sand: brown, mediume grained, some subangular gravel up to 2-inch, medium dense, dry, no odor
	4						0	Sandy Silt: brown, fine grained, nonplastic, stiff, dry, no odor
								Trace clay, slightly plastic
					ML			
TF4-5			5					
	4						0	
								Sand: brown, fine to medium grained, medium dense, dry, no odor
					SP			
TF4-10	4		10					
				Backfilled with bentonite chips				Sandy Silt: brown, trace clay, slightly plastic, stiff, moist, no odor
	4				ML			becomes soft, wet
TF4-15			15					
								Sand and Gravel: greyish brown, coarse grained, subangular gravel up to 2-inch, loose, dry, no odor
	2				SP			
TF4-20			20					

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 2

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak Project Number 016066.11 Boring/Well Name TF-4

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"						
				▨		⁘		Sand and Gravel: same as above
	4			▨	SP	⁘		
TF4-23				▨		⁘		

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 2 OF 2

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION West of TF6		Boring/Well Name TF-5
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Bill	Project Name Tetra Pak
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch	Project Number 016066.11
ISOLATION CASING NA	FROM NA TO NA FT.	LOGGED BY S. Pasek TOTAL DEPTH 24.0 ft. bgs
BLANK CASING NA	FROM NA TO NA FT.	DATE STARTED 4/10/02 DATE COMPLETED 4/10/02
PERFORATED CASING NA	FROM NA TO NA FT.	ELEVATION GROUND NA ELEVATION CASING NA
SIZE AND TYPE OF FILTER PACK NA	FROM NA TO NA FT.	DEPTH TO GW BGS NA STATIC GW ELEVATION NA
SEAL 3/8-inch Bentonite chips	FROM 0 TO 24 FT.	SAMPLING METHODS Macro Core WELL COMPLETION
GROUT NA	FROM NA TO NA FT.	☐ SURFACE HOUSING ☐ STAND PIPE ____ FT.

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"						
								Asphalt and baserock
								Silt: brown, stiff, nonplastic, dry, no odor
	4						0	
								some clay, slightly plastic
					ML		0	some sand, nonplastic
TF5-5			5					
	4							
								Sand: brown, fine grained, nonplastic, medium dense, dry, no odor
TF5-10	4		10		SP			
				Backfilled with bentonite chips				
								Clayey Sand: brown, fine grained, plastic, wet, no odor
	4				SC			
TF5-15			15					
								Sand and Gravel: greyish brown, coarse grained, subangulat gravel up to 2-inch, loose, dry, no odor
	4				SP			
TF5-20			20					

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak   Project Number 016066.11   Boring/Well Name TF-5

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
								Sand and Gravel: same as above
TF5-22	3				SP			
								No recovery

Boring & Well Construction Log

Kennedy/Jenks Consultants

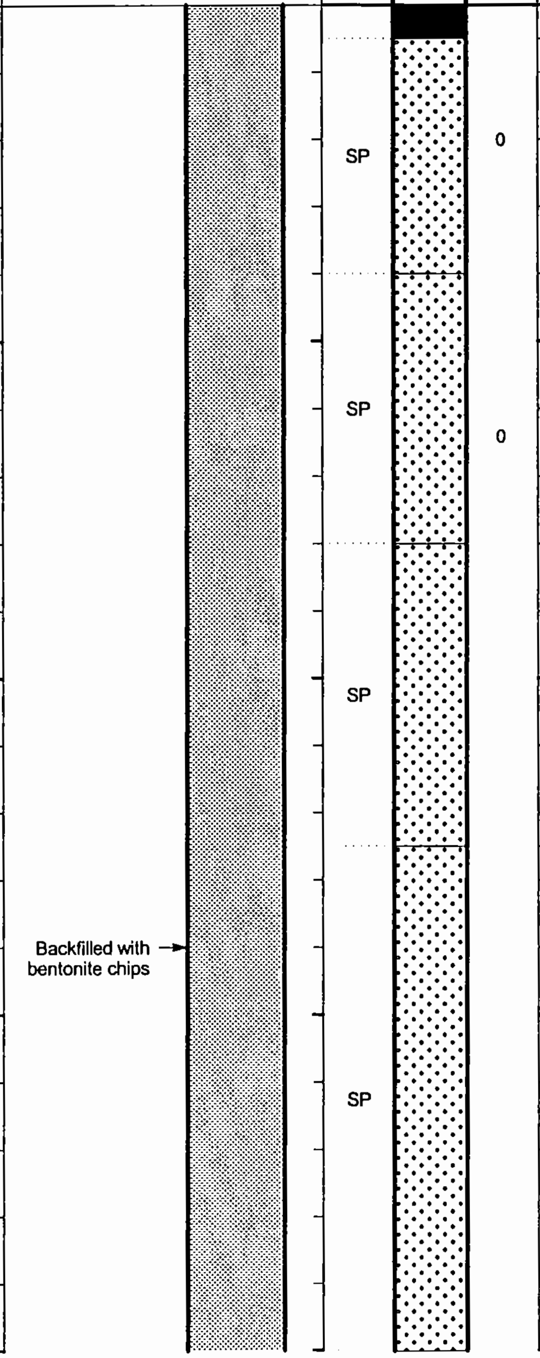
BORING LOCATION	Northwest corner of the paved former tank farm area			
DRILLING COMPANY	Cascade Drilling, Inc.	DRILLER	Bill	
DRILLING METHOD(S)	GeoProbe	DRILL BIT(S) SIZE	2.5-inch	
ISOLATION CASING	NA	FROM NA	TO NA	FT.
BLANK CASING	NA	FROM NA	TO NA	FT.
PERFORATED CASING	NA	FROM NA	TO NA	FT.
SIZE AND TYPE OF FILTER PACK	NA	FROM NA	TO NA	FT.
SEAL	3/8-inch Bentonite chips	FROM 0	TO 28	FT.
GROUT	NA	FROM NA	TO NA	FT.

Boring/Well Name: TF-6

Project Name: Tetra Pak

Project Number: 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 28.0 ft. bgs
DATE STARTED 4/9/02	DATE COMPLETED 4/9/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE _____ FT.



SAMPLES Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	USCS Log	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
						Asphalt and baserock
	4			SP	0	Silty Sand and Gravel: mottled greyish brown, nonplastic, stiff, dry, no odor
TF6-5	4		5	SP	0	Sand and Gravel: greyish brown, fine to coarse grained, dense, dry, no odor
TF6-10	4		10	SP		Sand: greyish brown, medium grained, loose, dry, no odor
TF6-15	4		15	SP		Sand with silt: brown, fine grained, slightly plastic soft, wet, no odor
	3					No recovery from 16 to 17 feet below ground surface
TF6-20			20			

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 2

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak

Project Number 016066.11

Boring/Well Name TF-6

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
	4							Sand and Gravel: greyish brown, medium to coarse grained, subangular gravel up to 2-inches, loose, dry, no odor
					SP			
TF6-25			25					
	4							

Boring & Well Construction Log

Kennedy/Jenks Consultants

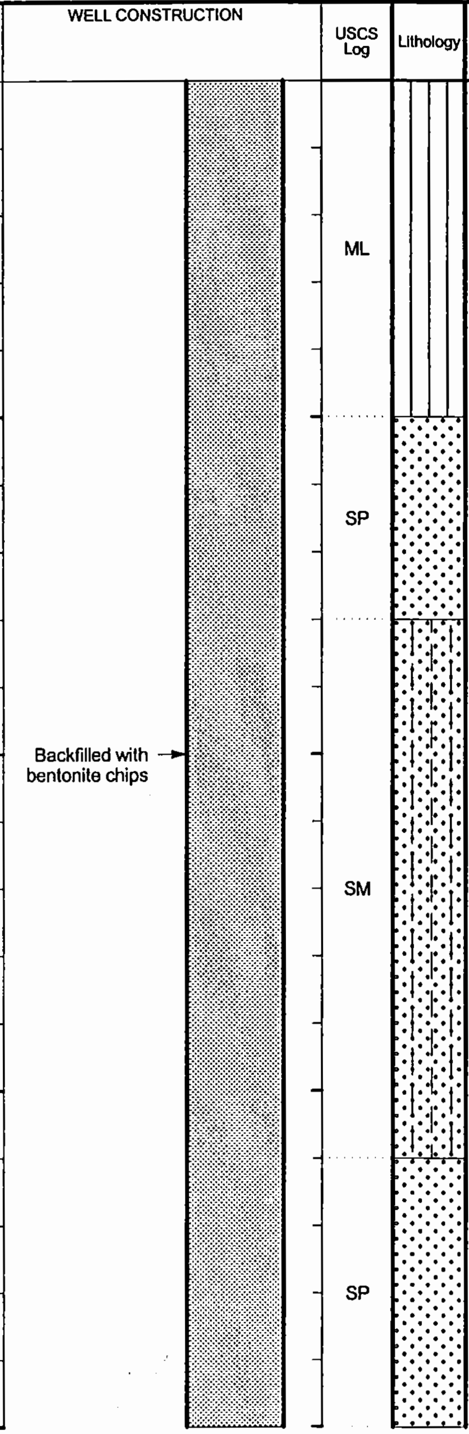
BORING LOCATION	North of TF6	
DRILLING COMPANY	Cascade Drilling, Inc.	DRILLER: Bill
DRILLING METHOD(S)	GeoProbe	DRILL BIT(S) SIZE: 2.5-inch
ISOLATION CASING	NA	FROM NA TO NA FT.
BLANK CASING	NA	FROM NA TO NA FT.
PERFORATED CASING	NA	FROM NA TO NA FT.
SIZE AND TYPE OF FILTER PACK	NA	FROM NA TO NA FT.
SEAL	3/8-inch Bentonite chips	FROM 0 TO 20 FT.
GROUT	NA	FROM NA TO NA FT.

Boring/Well Name: TF-7

Project Name: Tetra Pak

Project Number: 016066.11

LOGGED BY: S. Pasek	TOTAL DEPTH: 20.0 ft. bgs
DATE STARTED: 4/10/02	DATE COMPLETED: 4/10/02
ELEVATION GROUND: NA	ELEVATION CASING: NA
DEPTH TO GW BGS: NA	STATIC GW ELEVATION: NA
SAMPLING METHODS: Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ____ FT.



SAMPLES Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
	4				ML	0 0	Sandy Silt: brown, fine to medium grain, nonplastic, stiff, dry, no odor, some organic material
TF7-5			5				
	4				SP		Sand: brown, fine grained, medium dense, dry, no odor, no organic material
							Silty Sand: brown, fine grained, nonplastic, medium dense, dry, no odor
TF7-10	4		10	Backfilled with bentonite chips	SM		
	4						Some clay, plastic, soft
TF7-15			15				
	4				SP		Sand and Gravel: greyish brown, coarse sand, subangular gravel up to 2-inch, loose, dry, no odor
			20				Refusal at 20 feet below ground surface

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION North central portion of the paved former tank farm area		
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Bill	
DRILLING METHOD(S) GeoProbe	DRILL BIT(S) SIZE 2.5-inch	
ISOLATION CASING NA	FROM NA	TO NA FT.
BLANK CASING NA	FROM NA	TO NA FT.
PERFORATED CASING NA	FROM NA	TO NA FT.
SIZE AND TYPE OF FILTER PACK NA	FROM NA	TO NA FT.
SEAL 3/8-inch Bentonite chips	FROM 0	TO 28 FT.
GROUT NA	FROM NA	TO NA FT.

Boring/Well Name TF-8

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY S. Pasek	TOTAL DEPTH 28.0 ft. bgs
DATE STARTED 4/9/02	DATE COMPLETED 4/9/02
ELEVATION GROUND NA	ELEVATION CASING NA
DEPTH TO GW BGS NA	STATIC GW ELEVATION NA
SAMPLING METHODS Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.

SAMPLES: Sample I.D.	SAMPLES: Recovery (Feet)	SAMPLES: Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
								Asphalt and baserock
	4				SM		0	Sandy Silt: brown, nonplastic, stiff, dry, no odor
								Sand: brown, medium grained, dense, dry, no odor
TF8-5			5					
	4				SP		0	
TF8-10	4		10					
								Sand with silt: brown, fine grained, nonplastic, dense, dry, no odor
	4			Backfilled with bentonite chips				
TF8-15			15		SP			
	4							
TF8-20			20					

F-40.1
(6-87) (3-88) (8-90) (4-98)

SHEET 1 OF 2

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak
Project Number 016066.11
Boring/Well Name TF-8

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
	4							Sand and Gravel: greyish brown, medium to coarse grained, loose, dry, no odor
					SP			
TF8-25			25					
	4							

F-40.1
(6-87) (3-88) (6-90) (4-98)

SHEET 2 OF 2

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: North of TF8			
DRILLING COMPANY: Cascade Drilling, Inc.	DRILLER: Bill		
DRILLING METHOD(S): GeoProbe	DRILL BIT(S) SIZE: 2.5-inch		
ISOLATION CASING: NA	FROM NA	TO NA	FT.
BLANK CASING: NA	FROM NA	TO NA	FT.
PERFORATED CASING: NA	FROM NA	TO NA	FT.
SIZE AND TYPE OF FILTER PACK: NA	FROM NA	TO NA	FT.
SEAL: 3/8-inch Bentonite chips	FROM 0	TO 24	FT.
GROUT: NA	FROM NA	TO NA	FT.

Boring/Well Name: TF-9

Project Name: Tetra Pak

Project Number: 016066.11

LOGGED BY: S. Pasek	TOTAL DEPTH: 24.0 ft. bgs
DATE STARTED: 4/10/02	DATE COMPLETED: 4/10/02
ELEVATION GROUND: NA	ELEVATION CASING: NA
DEPTH TO GW BGS: NA	STATIC GW ELEVATION: NA
SAMPLING METHODS: Macro Core	WELL COMPLETION ☐ SURFACE HOUSING ☐ STAND PIPE ______ FT.

SAMPLES Sample I.D.	Rec-overy (Feet)	Penetr. Resist. Blows/6"	Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
	4				SP			Sand: brown, medium grained, some gravel, medium dense, dry, no odor
TF9-5			5		ML		0	Sandy Silt: brown, approx. 40% fine to medium sand, nonplastic, dry, no odor
	4				SP			Sand: brown, fine grained, medium dense, dry, no odor
TF9-10	4		10		ML			Silt: brown, nonplastic, stiff, dry, no odor
				Backfilled with bentonite chips	SM			Sand with silt: brown, fine-grained, nonplastic, dense, dry, no odor
TF9-15	4		15		ML			Sandy Silt with clay: brown, fine grained, plastic, moist, no odor becomes wet
TF9-20	4		20		SP			Sand and Gravel: greyish brown, coarse grained, subangular gravel up to 2-inch, loose, dry, no odor gravel content decreases with depth

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak **Project Number** 016066.11 **Boring/Well Name** TF-9

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
TF9-23	4			▒	SP	░		Sand and Gravel: same as above

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION Adjacent to RGW2				
DRILLING COMPANY Cascade Drilling, Inc.	DRILLER Darryl			
DRILLING METHOD(S) Hollow Stem Auger	DRILL BIT(S) SIZE 6-inch			
ISOLATION CASING NA	FROM	TO	FT.	
BLANK CASING 2-inch diameter Schedule 40 PVC	FROM 0	TO 40	FT.	
PERFORATED CASING 2-inch diameter Schedule 40 PVC with 0.010-inch slots	FROM 40	TO 55	FT.	
SIZE AND TYPE OF FILTER PACK Colorado Sand	FROM 38	TO 55	FT.	
SEAL 3/8-inch Bentonite Hole Plug	FROM 1	TO 38	FT.	
GROUT NA	FROM	TO	FT.	

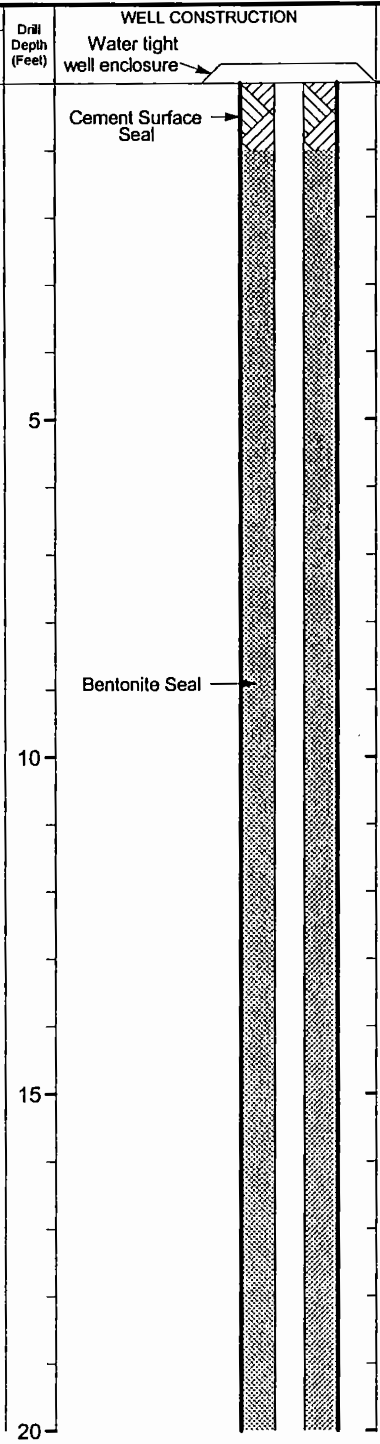
Boring/Well Name MW-7

Project Name Tetra Pak

Project Number 016066.11

LOGGED BY NA	TOTAL DEPTH 55.0 ft. bgs
DATE STARTED 7/29/02	DATE COMPLETED 7/29/02
ELEVATION GROUND	ELEVATION CASING
DEPTH TO GW BGS 45.0	STATIC GW ELEVATION
SAMPLING METHODS NA	WELL COMPLETION ☒ SURFACE HOUSING ☐ STAND PIPE ____ FT.

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
								Soil was not logged. Well is located immediately adjacent to reconnaissance groundwater sample borehole RGW2.

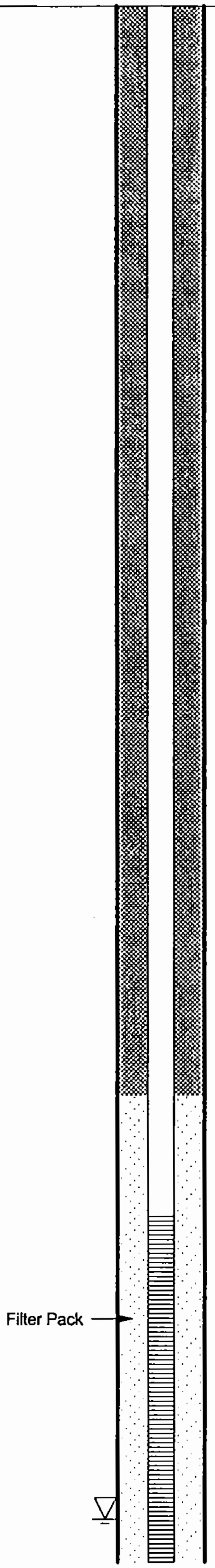


Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak Project Number 016066.11 Boring/Well Name MW-7

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
			25					
			30					
			35					
			40					
			45					



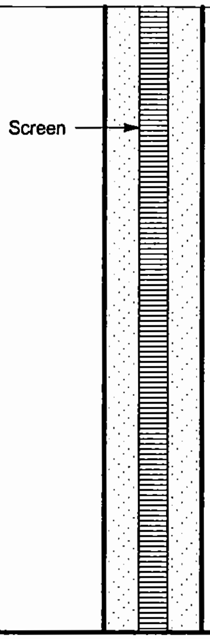
Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name Tetra Pak

Project Number 016066.11

Boring/Well Name MW-7

SAMPLES			Drill Depth (Feet)	WELL CONSTRUCTION	USCS Log	Lithology	OVM (ppm)	SAMPLE DESCRIPTION and DRILLING REMARKS
Sample I.D.	Recovery (Feet)	Penetr. Resist. Blows/6"						
			50					
			55					

F-40.1
(6-87) (3-88) (8-90) (4-98)

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: Along north property boundary			
DRILLING COMPANY: Cascade Drilling Company, Inc.	DRILLER: Darryl		
DRILLING METHOD(S): Hollow Stem Auger	DRILL BIT(S) SIZE: 6.25-inch		
ISOLATION CASING: NA	FROM n/a	TO n/a	FT.
BLANK CASING: 2-inch diameter Schedule 40 PVC	FROM 0	TO 40	FT.
SLOTTED CASING: 2-inch diameter Schedule 40 PVC with 0.010-inch slot	FROM 40	TO 55	FT.
SIZE AND TYPE OF FILTER PACK: 10/20 Colorado Sand	FROM 38	TO 55	FT.
SEAL: 3/8-inch Bentonite Hole Plug	FROM 0	TO 38	FT.
GROUT: NA	FROM n/a	TO n/a	FT.

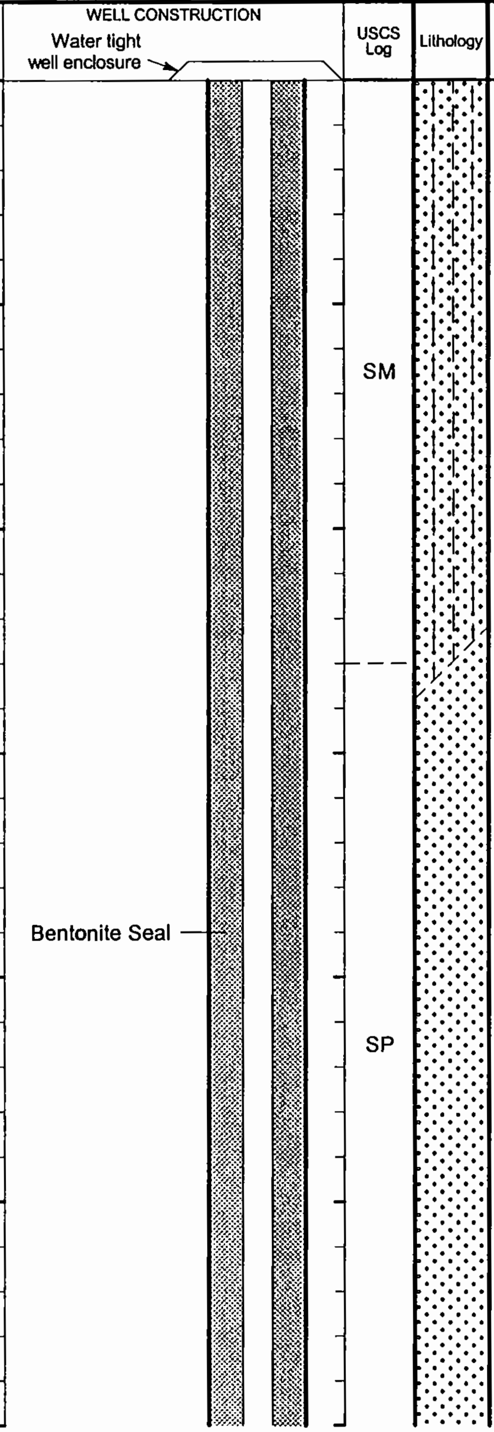
Well Name: MW-8

Project Name: Tetra Pak

Project Number: 016066.09

ELEVATION AND DATUM	TOTAL DEPTH: 56.5 ft. bgs
DATE STARTED: 2/14/03	DATE COMPLETED: 2/14/03
STATIC WATER ELEVATION: n/a	
LOGGED BY: S. Pasek	
SAMPLING METHODS: SPT	WELL COMPLETION: ☒ SURFACE HOUSING ☐ STAND PIPE n/a FT.

SAMPLES			Drill Depth (Feet)
Type & No.	Recovery (Feet)	Penetr. Resist. Blows/6"	
⋈	1.5	4 7 9	5
⋈	1.5	7 12 13	10
⋈	.25	50/6	15
⋈	.5	24 50/6	20
⋈	.5	37 50/6	25
			30



Color

SAMPLE DESCRIPTION and DRILLING REMARKS

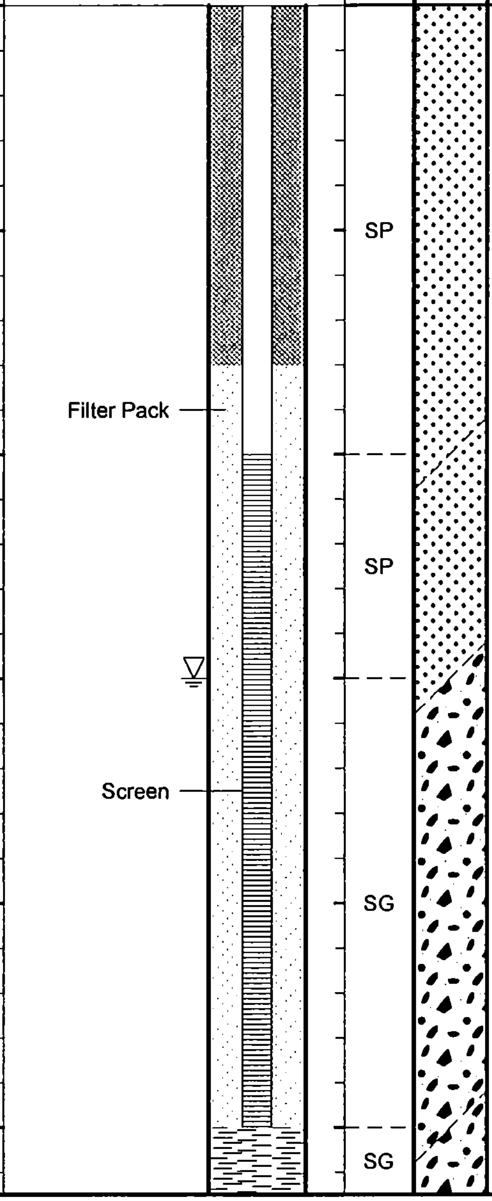
SILTY SAND (SM) BROWN, FINE TO MEDIUM GRAINED, MODERATELY DENSE, NONPLASTIC, DRY, NO ODOR

SAND (SP) DARK GRAY, MEDIUM TO COARSE GRAINED, MODERATELY DENSE TO LOOSE, DRY, NO ODOR, ANGULAR TO SUBANGULAR

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name **Tetra Pak** Project Number **016066.09** Well Name **MW-8**



SAMPLES Type & No.	SAMPLES Recovery (Feet)	SAMPLES Penetr. Resist. Blows/6"	Drill Depth (Feet)	USCS Log	Color	SAMPLE DESCRIPTION and DRILLING REMARKS
	1	30 40 50/4				**SAND (SP)** DARK GRAY, MEDIUM TO COARSE GRAINED, MODERATELY DENSE TO LOOSE, DRY, NO ODOR, ANGULAR TO SUBANGULAR, continued
	1.5	30 22 33	35	SP		
	.5	32 50/5	40	SP		**SAND (SP)** DARK GRAY, MEDIUM TO COARSE GRAINED, MODERATELY DENSE TO LOOSE, DRY, NO ODOR, TRACE GRAVEL UP TO .25-INCH DIAMETER
	.5	20 50/3	45			**GRAVELLY SAND (SG)** DARK GRAY, COARSE GRAINED, MODERATELY DENSE TO LOOSE, SATURATED, NO ODOR, APPROXIMATELY 20% SUBROUNDED TO ROUNDED GRAVEL UP TO 1-INCH DIAMETER
	1	7 24 50/4	50	SG		
	1.5	18 35 27	55	SG		**GRAVELLY SAND (SG)** DARK GRAY, MEDIUM TO COARSE GRAINED, MODERATELY DENSE TO LOOSE, SATURATED, NO ODOR, APPROXIMATELY 15% SUBROUNDED TO ROUNDED GRAVEL UP TO 0.25-INCH DIAMETER

Appendix C

Groundwater Purge and Sample Forms

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Teka Pak - Vancouver, WA.
\# 016066.11
WELL # MW-1
FIELD PERSONNEL: Chris Hyatt & Deanne Knill
DATE: 4-19-02
PAGE: 1 OF 1
SAMPLING METHOD: Solinst - Dedicated Bladder Pump
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Hach - pH, Temp. & EC

WATER LEVEL DATA*

Initial SWL @ TOC	43.55	4/18
Bottom of Well/ Total Length of Casing	49.94	4/18
Final SWL @ TOC	0	
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)	-2.5'	

WELL DATA

Casing Diameter (in.)	2 inch
Borehole Diameter (in.)	0
Well Volume Factor (V_1)**	0.163
Annular Volume Factor (V_2)**	0
Length of Water Column (ft.) = L_1	6.39
Length of Filter Pack (ft.) = L_2	0
Porosity of Filter Pack (%)	40%

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is L_1>L_2? Yes_____ No ✓
Yes: BV = L_1 ______ x V_1 _____ + L_2 _____ x V_2 _____ = ______ gals.
No: BV = L_1 ________ x (V_1 _______ + V_2 ________) = _______ gals.
Total Purge Volume = BV 1.04 x No. of bore volumes 3 = 3.12 gals.

Actual Gals. Purged	3.5 gals
No. of BV's Purged	3+

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	µS/cm Conductivity ~~mmhos/cm~~ x100	Temperature C [✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
1020	0.5	6.55	2.40	54.1			H_2O clear, no turbidity or odor
1030	1.5	6.55	2.33	54.2			Clear, no turbidity or odor
1050	2.5	6.62	2.31	54.4			Clear, no odor
1100	3.0	6.62	2.33	54.4			H_2O clear, no odor or turbidity

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS
MW-1	1105	glass/plastic		HCL HNO3	11		

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Well Volume Factor (V_1) gal./ft

Nominal Casing Dia. (in.)	Well Volume Factor (V_1)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Annular Volume Factor (V_2) gal./ft

Nominal Casing Dia. (in.)	Borehole Dia. (in.)	V_2		
		Porosity=30%	Porosity = 40%	Porosity = 50%
2	6	0.372	0.496	0.620
	7.25	0.573	0.764	0.955
	7.75	0.666	0.888	1.110
	8.25	0.765	1.020	1.275
	10.25	1.218	1.624	2.03
4	8.25	0.585	0.78	0.975
	10.25	1.038	1.384	1.73
	12.25	1.59	2.12	2.65
6	12.25	1.299	1.732	2.165

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	# 016066.11	WELL # MW-2
FIELD PERSONNEL: Chris Hyatt & Deanna Keill	DATE: 4-18-02	PAGE: 1 OF 1
SAMPLING METHOD: Dedicated Bladder Pump		SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Hach - pH, Temp & EC		

WATER LEVEL DATA*

Initial SWL @ TOC	40.55	
Bottom of Well/ Total Length of Casing	49.91	
Final SWL @ TOC	0	
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)	-2.5'	

WELL DATA

Casing Diameter (in.)	2"
Borehole Diameter (in.)	0
Well Volume Factor (V_1)**	0.163
Annular Volume Factor (V_2)**	0
Length of Water Column (ft.) = L_1	9.36'
Length of Filter Pack (ft.) = L_2	0
Porosity of Filter Pack (%)	40%

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is $L_1>L_2$? Yes______ No ✓

Yes: BV = L_1 ______ x V_1 ______ + L_2 ______ x V_2 ______ = ______ gals.

No: BV = L_1 ______ x (V_1 ______ + V_2 ______) = ______ gals.

Total Purge Volume = BV 1.5 x No. of bore volumes 3 = 4.5 gals.

Actual Gals. Purged	5 gals
No. of BV's Purged	3+

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	µS/cm Conductivity ~~mmhos/cm~~ x100	Temperature C / [✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
11:15	1 gal	6.48	3.46	56.8			no odor, clear.
11:20	1.2 gal	6.42	3.06	58.9			no odor, clear
11:40	2 gal	6.45	2.93	59.7			no odor clear
1205	3 gal	6.56	2.83	58.5			no odor, clear
1225	5 gal	6.51	2.82	57.5			no odor, clear

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Well Volume Factor (V_1) gal./ft

Nominal Casing Dia. (in.)	Well Volume Factor (V_1)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Annular Volume Factor (V_2) gal./ft

Nominal Casing Dia. (in.)	Borehole Dia. (in.)	V_2		
		Porosity=30%	Porosity = 40%	Porosity = 50%
2	6	0.372	0.496	0.620
	7.25	0.573	0.764	0.955
	7.75	0.666	0.888	1.110
	8.25	0.765	1.020	1.275
	10.25	1.218	1.624	2.03
4	8.25	0.585	0.78	0.975
	10.25	1.038	1.384	1.73
	12.25	1.59	2.12	2.65
6	12.25	1.299	1.732	2.165

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GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak
\# 016006.11
WELL # MW-~~X~~3
FIELD PERSONNEL: Chris Hyatt, Deonne Knill
DATE: 4-18-02
PAGE: 1 OF 1
SAMPLING METHOD: Bladder Pump
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Hach - pH, Temp. & Conductivity

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC	42.48 ~~40.24~~		Casing Diameter (in.)	2 inch	Calculated Borehole Volume (BV) = ____ Is $L_1>L_2$? Yes____ No ✓	
Bottom of Well/ Total Length of Casing	54.72 ~~50.05~~		Borehole Diameter (in.)	0	Yes: BV = L_1 ____ x V_1 ____ + L_2 ____ x V_2 ____ = ____ gals.	
Final SWL @ TOC	0		Well Volume Factor (V_1)**	0.163	No: BV = L_1 ____ x (V_1 ____ + V_2 ____) = ____ gals.	
			Annular Volume Factor (V_2)**	0		
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	12.24 ~~9.81~~	Total Purge Volume = BV 12.0 x No. of bore volumes 3 = 6 gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2	0	Actual Gals. Purged	6 gals
Stick-up (ft.)	~2.5'		Porosity of Filter Pack (%)	40%	No. of BV's Purged	3

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	µS/cm Conductivity ~~mmhos/cm~~ x 100	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
2:05	1.2	6.52	3.65	59.6			clear, odorless
2:15	2.5	6.52	3.62	57.7			clear, odorless
2:30	4.5	6.55	3.62	57.6			clear, odorless
2:50	6.0	6.54	3.62	58.5			Clear, no odors

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS
MW-3	1445	glass	40 ml	HCL	3	VOCs	
		glass	125 ml	HCL/0	4	SVOCs / TPH-Dx	
		plastic	300 ml	HNO3	2	Metals - Total	
		plastic	~200 ml	0	2	Total & Dissolved Chromium VI	

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Well Volume Factor (V_1) gal./ft

Nominal Casing Dia. (in.)	Well Volume Factor (V_1)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Annular Volume Factor (V_2) gal./ft

Nominal Casing Dia. (in.)	Borehole Dia. (in.)	V_2		
		Porosity=30%	Porosity = 40%	Porosity = 50%
2	6	0.372	0.496	0.620
	7.25	0.573	0.764	0.955
	7.75	0.666	0.888	1.110
	8.25	0.765	1.020	1.275
	10.25	1.218	1.624	2.03
4	8.25	0.585	0.78	0.975
	10.25	1.038	1.384	1.73
	12.25	1.59	2.12	2.65
6	12.25	1.299	1.732	2.165

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak
\# 016066.11
WELL # MW-5
FIELD PERSONNEL: Chris Hyatt & Deonne Knill
DATE: 4-19-02
PAGE: 1 OF 1
SAMPLING METHOD: Solinst - Dedicated Bladder Pump
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Hach - pH, temp. & EC

WATER LEVEL DATA*			WELL DATA	
Initial SWL @ TOC	40.24	4/18	Casing Diameter (in.)	2 inch
Bottom of Well/ Total Length of Casing	50.05	4/18	Borehole Diameter (in.)	0
Final SWL @ TOC	0		Well Volume Factor (V_1)**	0.163
			Annular Volume Factor (V_2)**	0
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	9.81
SWL Elevation			Length of Filter Pack (ft.) = L_2	0
Stick-up (ft.)	~ 2.5'		Porosity of Filter Pack (%)	40%

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is $L_1>L_2$? Yes ______ No ✓

Yes: BV = L_1 ______ x V_1 ______ + L_2 ______ x V_2 ______ = ______ gals.

No: BV = L_1 ______ x (V_1 ______ + V_2 ______) = ______ gals.

Total Purge Volume = BV 1.6 x No. of bore volumes 3 = 4.8 gals.

Actual Gals. Purged	6 gals
No. of BV's Purged	3

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	µS/cm Conductivity mmhos/cm x 100	Temperature C [✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
1145	1.5	6.61	3.36	55.5			H_2O clear, no odor
1155	2.5	6.58	3.33	56.4			clear, no odor
1205	3.5	6.60	3.33	56.5			clear, no odor
1215	5.0	6.57	3.33	56.4			clear, no odors

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS
MW-5	1220	Plastic Glass		HCL HNO_3	11	VOC, SVOC, Total Metals, Dissolved Metals, Cr. VI & TPH-Dx	

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Well Volume Factor (V_1) gal./ft

Nominal Casing Dia. (in.)	Well Volume Factor (V_1)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Annular Volume Factor (V_2) gal./ft

Nominal Casing Dia. (in.)	Borehole Dia. (in.)	V_2		
		Porosity=30%	Porosity = 40%	Porosity = 50%
2	6	0.372	0.496	0.620
	7.25	0.573	0.764	0.955
	7.75	0.666	0.888	1.110
	8.25	0.765	1.020	1.275
	10.25	1.218	1.624	2.03
4	8.25	0.585	0.78	0.975
	10.25	1.038	1.384	1.73
	12.25	1.59	2.12	2.65
6	12.25	1.299	1.732	2.165

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GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak
0160606.11
WELL # MW-6
FIELD PERSONNEL: Chris Hayatt, Deonne Knill
DATE: 4/18/02
PAGE: 1 OF 1
SAMPLING METHOD: Bladder Pump
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Hach - pH, Temp, conductivity

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC	38.92		Casing Diameter (in.)	2 inch	Calculated Borehole Volume (BV) = ______ Is $L_1 > L_2$? Yes_____ No ✓	
Bottom of Well/ Total Length of Casing	53.71		Borehole Diameter (in.)		Yes: BV = L_1 ______ x V_1 ______ + L_2 ______ x V_2 ______ = ______ gals.	
Final SWL @ TOC	0		Well Volume Factor (V_1)**	0.163	No: BV = L_1 ______ x (V_1 ______ + V_2 ______) = ______ gals.	
			Annular Volume Factor (V_2)**	0		
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	14.79'	Total Purge Volume = BV 2.4 x No. of bore volumes 3 = 7.2 gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2		Actual Gals. Purged	8 gals
Stick-up (ft.)	Flush		Porosity of Filter Pack (%)	40%	No. of BV's Purged	3+

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	µS/cm Conductivity ~~mmhos/cm~~ x 100	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
4:05	2.5	6.46	3.93	58.1			clear, odorless
4:30	4	6.67	3.92	57.6			clear, odorless
4:45	6	6.54	3.90	57.2			clear, odorless

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Well Volume Factor (V_1) gal./ft

Nominal Casing Dia. (in.)	Well Volume Factor (V_1)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Annular Volume Factor (V_2) gal./ft

Nominal Casing Dia. (in.)	Borehole Dia. (in.)	V_2		
		Porosity=30%	Porosity = 40%	Porosity = 50%
2	6	0.372	0.496	0.620
	7.25	0.573	0.764	0.955
	7.75	0.666	0.888	1.110
	8.25	0.765	1.020	1.275
	10.25	1.218	1.624	2.03
4	8.25	0.585	0.78	0.975
	10.25	1.038	1.384	1.73
	12.25	1.59	2.12	2.65
6	12.25	1.299	1.732	2.165

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GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra PAK	#	WELL # MW-1
FIELD PERSONNEL: B. Timmins	DATE: 8/21/02	PAGE: OF
SAMPLING METHOD:		SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bladder Pump		

WATER LEVEL DATA*

Initial SWL @ TOC		
Bottom of Well/ Total Length of Casing	50.05	
Final SWL @ TOC	49.45	
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)		

WELL DATA

Casing Diameter (in.)	2
Borehole Diameter (in.)	6
Well Volume Factor (V_1)**	
Annular Volume Factor (V_2)**	
Length of Water Column (ft.) = L_1	0.60
Length of Filter Pack (ft.) = L_2	10
Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is L_1>L_2? Yes_____ No ____

Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.

No: BV = L_1________ x (V_1________+ V_2 _________) = _______ gals.

Total Purge Volume = BV 0.1 x No. of bore volumes 3 = 0.3 gals.

Actual Gals. Purged	_____ gals
No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
2:15	0.5	6.93	163.6	61.0			clear, no odor
2:35	1.0	6.70	166.0	60.1			clear, no odor
2:55	<1.5	6.90	161.7	60.4			clear, no odor

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

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GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak
#
WELL # MW - 2
FIELD PERSONNEL: B. Timmins
DATE: 8/21/02
PAGE: OF
SAMPLING METHOD:
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bladder Pump

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC			Casing Diameter (in.)		Calculated Borehole Volume (BV) = ______ Is $L_1>L_2$? Yes_____ No ✓	
Bottom of Well/ Total Length of Casing	50.05		Borehole Diameter (in.)		Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.	
Final SWL @ TOC	46.55		Well Volume Factor (V_1)**	0.163	No: BV = L_1 3.5 x (V_1 0.163 + V_2 .496) = 2.7 gals.	
			Annular Volume Factor (V_2)**			
Surveyed Elev. (TOC)	[illegible]		Length of Water Column (ft.) = L_1	3.5	Total Purge Volume = BV 0.56 ~~[illegible]~~ x No. of bore volumes 3 = 1.7 gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2	10	Actual Gals. Purged	> 3 gals
Stick-up (ft.)			Porosity of Filter Pack (%)		No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity ~~mmhos~~/cm uS	Temperature C / [✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
11:00	1.0	7.25	153.9	60.7			slightly turbid, no odor
11:25	2.0	6.84	152.6	60.4			clear, no odor
11:45	2.75	6.80	151.8	59.8			clear, no odor

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

1.38
3
5.14

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GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	#	WELL # MW-3
FIELD PERSONNEL: B. Timmins, D. Kwill	DATE: 8/20/02	PAGE: 1 OF 1
SAMPLING METHOD:		SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bladder pump		

8.43
45

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC			Casing Diameter (in.)	2	Calculated Borehole Volume (BV) = ______ Is $L_1>L_2$? Yes_____ No ____	
Bottom of Well/ Total Length of Casing	54.88		Borehole Diameter (in.)	6	Yes: BV = L_1 _____ x V_1 _____ + L_2 _____ x V_2 _____ = ______ gals.	
Final SWL @ TOC	48.43		Well Volume Factor (V_1)**		No: BV = L_1 ________ x (V_1 _______ + V_2 _________) = _______ gals.	
			Annular Volume Factor (V_2)**			
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	6.45	Total Purge Volume = BV ~~1.38~~ 1.38 x No. of bore volumes 3 = 5.14 gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2	10	Actual Gals. Purged	5.2 gals
Stick-up (ft.)			Porosity of Filter Pack (%)		No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity ~~mmhos/cm~~ uS/cm	Temperature C/[✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
12:45	1.75	6.92	99.5	60.1			clear, no odor
1:05	3.25	6.75	95.2	60.3			clear, no odor
1:35	5.00	6.92	92.7	60.8			clear, no odor

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak
\#
WELL # MW-5
FIELD PERSONNEL: B. Timmins
DATE: 8/21/02
PAGE: OF
SAMPLING METHOD:
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bladder Pump

WATER LEVEL DATA*

Initial SWL @ TOC		
Bottom of Well/ Total Length of Casing	50.18	
Final SWL @ TOC	46.25	
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)		

WELL DATA

Casing Diameter (in.)	2
Borehole Diameter (in.)	6
Well Volume Factor (V_1)**	
Annular Volume Factor (V_2)**	
Length of Water Column (ft.) = L_1	3.93
Length of Filter Pack (ft.) = L_2	
Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is $L_1>L_2$? Yes_____ No _____

Yes: BV = L_1 ______ x V_1 _____ + L_2______ x V_2 _____ = ______ gals.

No: BV = L_1__________ x (V_1________ + V_2 __________) = ________ gals.

Total Purge Volume = BV 663 x No. of bore volumes 3 = 1.9 gals.

Actual Gals. Purged	_____ gals
No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity ~~mmhos~~/cm uS	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
12:30	1.0	7.13	172.8	59.8			clear, no odor
12:55	1.75	6.80	173.3	60.5			clear, no odor
1:20	2.5	6.86	169.6	60.6			clear, no odor

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak

0160066.11

WELL # 7

PSI PERSONNEL:

DATE: 8/9/02

PAGE: OF

SAMPLING METHOD:

SPECIAL INSTRUCTIONS:

FIELD INSTRUMENT(S) USED: disposable bailer, pH /Conductivity /temp

WATER LEVEL DATA*		
Initial SWL @ TOC	44.39	
Bottom of Well	54.55	
Final SWL @ TOC		
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)		

WELL DATA	
Casing Diameter (in.)	2
Borehole Diameter (in.)	6
Well Volume Factor (V_1)**	0.163
Annular Volume Factor (V_2)**	0.372
Length of Water Column (ft.) = L_1	10.16
Length of Filter Pack (ft.) = L_2	15
Porosity of Filter Pack (%)	30%

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is L_1>L_2? Yes_____ No____

Yes: BV = L_1 10.16 x V_1 .163 + L_2 _____ x V_2 _____ = ______ gals.

No: BV = L_1 10.16 x (V_1 0.163 + V_2 0.372) = 5 gals.

Total Purge Volume = BV 5 x No. of bore volumes 3 = 15 gals.

Actual Gals. Purged _____ gals

No. of BV's Purged

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity k~~mhos~~/cm uS	Temperature C / [✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
10:50	5	6.55	143	57.2			slightly cloudy, no odor
11:10	10	6.96	135	57.3			cloudy, no odor
11:30	15	6.78	127	57.2			cloudy, no odor
12:00	20	6.69	127	58.0			cloudy, no odor

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS
MW-7	12:10	125 mL Amber	125 mL	None	2	SVOC	lightly cloudy

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

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GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	#	WELL # MW - 1	
FIELD PERSONNEL: Brian Timmins	DATE: 11/19/02	PAGE: 1 OF 1	
SAMPLING METHOD: Micro Purge		SPECIAL INSTRUCTIONS:	
FIELD INSTRUMENT(S) USED: Bladder Pump			

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC	49.64		Casing Diameter (in.)	2	Calculated Borehole Volume (BV) = ______ Is L_1>L_2? Yes_____ No ✓	
Bottom of Well/ Total Length of Casing	50.18		Borehole Diameter (in.)	6	Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.	
Final SWL @ TOC			Well Volume Factor (V_1)**		No: BV = L_1 0.54 x (V_1 0.163 + V_2 0.496) = 0.36 gals.	
			Annular Volume Factor (V_2)**			
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	0.54	Total Purge Volume = BV 0.36 x No. of bore volumes 3 = 1.1 gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2	NA	Actual Gals. Purged	_____ gals
Stick-up (ft.)			Porosity of Filter Pack (%)		No. of BV's Purged	

0.65

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
			Volume =		0.54 x	0.0218	ft² = 0.01177 ft³
							=(0.087 gal) x 3 = 0.2
11:30	200 mL	6.95	179.4	56.0			clear, no odor
11:45	350 mL	7.08	162.7	56.4			"
12:00	@ 500 mL	7.21	168.0	56.1			"

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

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GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	#		WELL # MW-2
FIELD PERSONNEL: B. Timmins	DATE: 11/18/02		PAGE: 1 OF 1
SAMPLING METHOD: M.P.			SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: B.P.			

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC	46.73		Casing Diameter (in.)	2	Calculated Borehole Volume (BV) = ______ Is $L_1>L_2$? Yes_____ No ____	
Bottom of Well/ Total Length of Casing	50.12		Borehole Diameter (in.)	6	Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.	
Final SWL @ TOC			Well Volume Factor (V_1)**	0.163	No: BV = L_1 3.39 x (V_1 ~~______~~ + V_2 0.659 ________) = 2.23 gals.	
			Annular Volume Factor (V_2)**	0.496		
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	3.39	Total Purge Volume = BV 2.23 x No. of bore volumes 3 = ~~6.7~~ gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2		Actual Gals. Purged	_____ gals
Stick-up (ft.)			Porosity of Filter Pack (%)		No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
			3.39 ft	x 0.0218 ft²		=	0.0739 ft³
							= 0.64 gal
							= (0.64 gal) x 3 = 1.9 gal
~~2:20~~	~~0.75~~	~~6.86~~	~~165.5~~	~~57.3~~			~~clear, no odor~~
4:20	~~0.25~~ 0.5	7.11	125.5	56.5			clear, no odor
4:40	1.0	7.23	132.7	56.4			"
5:00	1.5	7.17	130.2	56.0			"

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	#	WELL # MW - 3
FIELD PERSONNEL: B. TIMMINS	DATE: 11/18/02	PAGE: 1 OF 1
SAMPLING METHOD: M.P.		SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: B.P.		

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC	48.63		Casing Diameter (in.)	2	Calculated Borehole Volume (BV) = ______ Is $L_1>L_2$? Yes_____ No ____	
Bottom of Well/ Total Length of Casing	54.90		Borehole Diameter (in.)	6	Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.	
Final SWL @ TOC			Well Volume Factor (V_1)**		No: BV = L_1 6.27 x (V_1_______+ V_2 _________) = 4.13 gals.	
			Annular Volume Factor (V_2)**			
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	6.27	Total Purge Volume = BV ~~4.13~~ x No. of bore volumes 3 = ~~12.4~~ gals. 1.0 gal = 3.0	
SWL Elevation			Length of Filter Pack (ft.) = L_2		Actual Gals. Purged	_____ gals
Stick-up (ft.)			Porosity of Filter Pack (%)		No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
4:00	1.0	6.51	96.1	54.8			slightly turbid, no odor
4:30	2.0	6.53	93.7	54.0			clear, no odor
5:00	3.0	6.47	90.2	53.4			"

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tesla Park	#	WELL # MW-5	
FIELD PERSONNEL: B. Timmins	DATE: 11/18/02	PAGE: 1	OF 1
SAMPLING METHOD: B M.P.		SPECIAL INSTRUCTIONS:	
FIELD INSTRUMENT(S) USED: B.P.			

WATER LEVEL DATA*			WELL DATA	
Initial SWL @ TOC	46.42		Casing Diameter (in.)	2
Bottom of Well/ Total Length of Casing	50.28		Borehole Diameter (in.)	6
Final SWL @ TOC			Well Volume Factor (V_1)**	
			Annular Volume Factor (V_2)**	
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	3.86
SWL Elevation			Length of Filter Pack (ft.) = L_2	
Stick-up (ft.)			Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is $L_1>L_2$? Yes_____ No ✓

Yes: BV = L_1 _____ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.

No: BV = L_1 3.86 x (V_1 ~~_____~~ + V_2 0.659 _____) = 2.54 gals.

Total Purge Volume = BV 2.54 x No. of bore volumes 3 = 7.63 gals.

Actual Gals. Purged	_____ gals
No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
			3.86 x	0.0218 =			
						(0.62 gal)x3 =	1.86 gal
2:20	0.75	6.86	165.5	57.3			clear, no odor
3:20	1.25	7.05	167.3	57.6			"
3:40	2.0	6.94	164.3	57.5			"

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	#	WELL # MW-6	
FIELD PERSONNEL: Brian Timmins	DATE: 11/18/02	PAGE:	OF
SAMPLING METHOD: Micro Purge		SPECIAL INSTRUCTIONS:	
FIELD INSTRUMENT(S) USED: Bladder Pump			

WATER LEVEL DATA*

Initial SWL @ TOC	45.10	
Bottom of Well/ Total Length of Casing	52.88	
Final SWL @ TOC		
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)		

WELL DATA

Casing Diameter (in.)	2
Borehole Diameter (in.)	6
Well Volume Factor (V_1)**	0.163
Annular Volume Factor (V_2)**	0.496
Length of Water Column (ft.) = L_1	7.78
Length of Filter Pack (ft.) = L_2	~10
Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = 5.13

Is $L_1>L_2$? Yes_____ No x

Yes: BV = L_1 _____ x V_1 _____ + L_2 _____ x V_2 _____ = _____ gals.

No: BV = L_1 7.78 x (V_1 0.163 + V_2 0.496) = 5.13 gals.

Total Purge Volume = BV 5.13 x No. of bore volumes 3 = 15.4 gals.

Actual Gals. Purged	_____ gals
No. of BV's Purged	

,65,

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
1:55	5.0	73 6.72	183.0	55.6			clear, no odor
2:45	7.0	6.59	169.9	55.2			"
3:15	8.5	6.62	172.0	55.2			"

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	#		WELL # MW-7
FIELD PERSONNEL: B. Timmins	DATE: 11/18/02		PAGE: 1 OF 1
SAMPLING METHOD: M.P.			SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: B.P.			

WATER LEVEL DATA*			WELL DATA	
Initial SWL @ TOC	44.97		Casing Diameter (in.)	2
Bottom of Well/ Total Length of Casing	54.22		Borehole Diameter (in.)	6
Final SWL @ TOC			Well Volume Factor (V_1)**	0.163
			Annular Volume Factor (V_2)**	.416
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	9.25
SWL Elevation			Length of Filter Pack (ft.) = L_2	~10
Stick-up (ft.)			Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______

Is L_1>L_2? Yes_____ No ____

Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.

No: BV = L_1 9.25 x (~~V_1~~ ______ + V_2 0.659 ________) = 6.1 gals.

Total Purge Volume = BV 6.1 x No. of bore volumes 3 = 18.3 gals.

Actual Gals. Purged	_____ gals
No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity ~~mmhos/cm~~ uS	Temperature C [✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
		Recalc: V	= 9.25 ft x .0218 ft² = 0.2016 ft³				
							= (1.475 gal)3 = 4.5
10:00	0.5	6.94	126.9	55.0			clear, no odor
10:15	2.0	7.00	133.0	55.1			"
10:25	4.5	7.10	133.6	55.0			"
	4.75	SAMPLED					"

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra PAK	# MW-6	WELL # MW-6
FIELD PERSONNEL: B. Timmins	DATE: 2/24/03	PAGE: OF
SAMPLING METHOD: Bladder Pump		SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED:		

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC			Casing Diameter (in.)	2	Calculated Borehole Volume (BV) = ______ Is $L_1 > L_2$? Yes_____ No ____	
Bottom of Well/ Total Length of Casing	53.89		Borehole Diameter (in.)	6	Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.	
Final SWL @ TOC	43.73		Well Volume Factor (V_1)**		No: BV = L_1________ x (V_1_______+ V_2 _________) = _______ gals.	
			Annular Volume Factor (V_2)**			
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	10.16	Total Purge Volume = BV 1.65 x No. of bore volumes 3 = 4.97 gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2	x .163	Actual Gals. Purged	_____ gals
Stick-up (ft.)			Porosity of Filter Pack (%)		No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mm~~hos~~/cm mS	Temperature C/[✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
1:20	1.5	6.8	0.231	55.02	272.8	8.36	clear
1:55	3.5	6.9	0.229	55.17	270.8	8.76	"
2:15	5.0	7.0	0.227	55.15	275.1	8.91	"

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak
\# MW-3
WELL # MW-3
FIELD PERSONNEL: B. Timmins
DATE: 2/24/03
PAGE: OF
SAMPLING METHOD:
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bladder Pump

2:50

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC			Casing Diameter (in.)	2	Calculated Borehole Volume (BV) = ______ Is L_1>L_2? Yes_____ No ____	
Bottom of Well/ Total Length of Casing	54.99		Borehole Diameter (in.)	6	Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.	
Final SWL @ TOC	47.23		Well Volume Factor (V_1)**		No: BV = L_1_________ x (V_1________+ V_2 __________) = _______ gals.	
			Annular Volume Factor (V_2)**			
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1	7.76	Total Purge Volume = BV 1.26 x No. of bore volumes 3 = 3.8 gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2		Actual Gals. Purged	_____ gals
Stick-up (ft.)			Porosity of Filter Pack (%)		No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity ~~mmhos/cm~~ mS	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
3:10	1.0	8.12	0.071	51.07	242.2	10.2	slightly turbid
3:25	2.0	8.06	0.072	51.07	244.2	10.5	" "
3:45	4.0	7.82	0.068	51.12	256.4	10.3	Clear

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	# AKWTS	WELL # MW - 5
FIELD PERSONNEL: BT.	DATE: 2/25/03	PAGE: OF
SAMPLING METHOD:		SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bailer		

WATER LEVEL DATA*			WELL DATA		WELL PURGING DATA	
Initial SWL @ TOC			Casing Diameter (in.)	2	Calculated Borehole Volume (BV) = ______ Is $L_1>L_2$? Yes_____ No ____	
Bottom of Well/ Total Length of Casing	50.29		Borehole Diameter (in.)		Yes: BV = L_1 ______ x V_1 _____ + L_2_____ x V_2 _____ = ______ gals.	
Final SWL @ TOC	45.02	5.27	Well Volume Factor (V_1)**		No: BV = L_1_________ x (V_1_______+ V_2 _________) = _______ gals.	
			Annular Volume Factor (V_2)**			
Surveyed Elev. (TOC)			Length of Water Column (ft.) = L_1		Total Purge Volume = BV 0.86 x No. of bore volumes 3 = 2.6 gals.	
SWL Elevation			Length of Filter Pack (ft.) = L_2		Actual Gals. Purged	_____ gals
Stick-up (ft.)			Porosity of Filter Pack (%)		No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
10:00	1.0	7.05	0.206	53.8			Slightly turbid
10:10	2.0	6.85	0.204	53.1			"
10:20	3.0	6.9	0.211	52.8			"
			Sampled w/ Bailer				

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	#	WELL # MW-2	
FIELD PERSONNEL: B.T.	DATE: 2/25/03	PAGE:	OF
SAMPLING METHOD:		SPECIAL INSTRUCTIONS:	
FIELD INSTRUMENT(S) USED: bailer			

WATER LEVEL DATA*		
Initial SWL @ TOC		
Bottom of Well/ Total Length of Casing	50.11	
Final SWL @ TOC	45.32	
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)		

WELL DATA	
Casing Diameter (in.)	
Borehole Diameter (in.)	
Well Volume Factor (V_1)**	
Annular Volume Factor (V_2)**	
Length of Water Column (ft.) = L_1	
Length of Filter Pack (ft.) = L_2	
Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is L_1>L_2? Yes_____ No ____

Yes: BV = L_1 ______ x V_1 ______ + L_2______ x V_2 _____ = ______ gals.

No: BV = L_1________ x (V_1________+ V_2 _________) = _______ gals.

Total Purge Volume = BV 0.78 x No. of bore volumes 3 = 2.34 gals.

Actual Gals. Purged	_____ gals
No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity ~~mmhos/cm~~ mS	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
10:45	1.0	6.7	0.142	52.8			clear
10:59	2.0	6.7	0.154	54.1			slightly turbid
11:10	3.5	6.8	0.152	54.5			"

Sampled w/ Bailer

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak
\#
WELL # MW-7
FIELD PERSONNEL: BT
DATE: 2/25/03
PAGE: OF
SAMPLING METHOD:
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bailer Sampled w/ Pump

WATER LEVEL DATA*

Initial SWL @ TOC		
Bottom of Well/ Total Length of Casing	54.53	
Final SWL @ TOC	43.55	
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)		

WELL DATA

Casing Diameter (in.)	2
Borehole Diameter (in.)	
Well Volume Factor (V_1)**	
Annular Volume Factor (V_2)**	
Length of Water Column (ft.) = L_1	
Length of Filter Pack (ft.) = L_2	
Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is L_1>L_2? Yes_____ No ____
Yes: BV = L_1 ______ x V_1 _____ + L_2______ x V_2 _____ = ______ gals.
No: BV = L_1_________ x (V_1_________+ V_2 __________) = _______ gals.
Total Purge Volume = BV 1.79 x No. of bore volumes 3 = 5.4 gals.
Actual Gals. Purged _____ gals
No. of BV's Purged

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
11:30	2.0	6.6	0.102	52.8			slightly turbid
11:40	4.0	6.5	0.099	52.0			"
11:55	6.0	6.7	0.098	53.0			slightly turbid
					Let settle for 20 min AFTER		
					~~purging~~ bailing, still turbid		

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak
#
WELL # MW-1
FIELD PERSONNEL: BT.
DATE: 2/25/03
PAGE: OF
SAMPLING METHOD:
SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bailer

WATER LEVEL DATA*

Initial SWL @ TOC		
Bottom of Well/ Total Length of Casing	50.18	
Final SWL @ TOC	48.23	
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)		

WELL DATA

Casing Diameter (in.)	2
Borehole Diameter (in.)	
Well Volume Factor (V_1)**	
Annular Volume Factor (V_2)**	
Length of Water Column (ft.) = L_1	
Length of Filter Pack (ft.) = L_2	
Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is L_1>L_2? Yes_____ No ____
Yes: BV = L_1 ______ x V_1 _____ + L_2 _____ x V_2 _____ = ______ gals.
No: BV = L_1 ________ x (V_1 _______ + V_2 _________) = _______ gals.
Total Purge Volume = BV 0.32 x No. of bore volumes 3 = 0.95 gals.
Actual Gals. Purged _____ gals
No. of BV's Purged

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm mS	Temperature C [✓ F]	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
12:30	0.5	6.5	0.163	55.0			less than 6" per bail
12:45	1.0	6.7	0.172	54.8			
1:00	1.5	6.7	0.175	54.1			

Sampled w/ Bailer

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Kennedy/Jenks Consultants

GROUNDWATER SAMPLING DATA SHEET

PROJECT NAME: Tetra Pak	#	WELL # MW-8
FIELD PERSONNEL: BT.	DATE: 2/25/03	PAGE: OF
SAMPLING METHOD:		SPECIAL INSTRUCTIONS:
FIELD INSTRUMENT(S) USED: Bailer		

WATER LEVEL DATA*

Initial SWL @ TOC		
Bottom of Well/ Total Length of Casing	54.45	
Final SWL @ TOC	42.18	
Surveyed Elev. (TOC)		
SWL Elevation		
Stick-up (ft.)		

WELL DATA

Casing Diameter (in.)	
Borehole Diameter (in.)	
Well Volume Factor (V_1)**	
Annular Volume Factor (V_2)**	
Length of Water Column (ft.) = L_1	
Length of Filter Pack (ft.) = L_2	
Porosity of Filter Pack (%)	

WELL PURGING DATA

Calculated Borehole Volume (BV) = ______
Is $L_1 > L_2$? Yes_____ No ____

Yes: BV = L_1 ______ x V_1 _____ + L_2 _____ x V_2 _____ = ______ gals.

No: BV = L_1 _________ x (V_1 _______ + V_2 _________) = _______ gals.

Total Purge Volume = BV 2.0 x No. of bore volumes 3 = 6.0 gals.

Actual Gals. Purged	_____ gals
No. of BV's Purged	

WELL PURGING DATA

Time	Cumulative Gallons Purged	pH	Conductivity mmhos/cm	Temperature C / F	Redox (mV)	Dissolved Oxygen	COMMENTS (e.g., odor, sediment, content, etc.)
1:15	2.0	6.5	0.144	53.8			slightly turbid
1:30	4.5	6.5	0.147	54.8			"
1:45	6.0	6.7	0.150	54.1			"
				Sampled w/ Pump			

SAMPLE DATA

Sample I.D.	Time Collected	Container Type	Volume	Preservative	# Containers	Analysis Required	COMMENTS

TOC = top of PVC casing * Measured from TOC **see Well / Annular Volume Factors Table

Appendix D

Laboratory Analytical Data (CD)

Appendix E

Ensys® Soil Test System User's Guide

STRATEGIC DIAGNOSTICS INC.

PENTA EnSys®
SOIL TEST SYSTEM

RAPID IMMUNOASSAY SCREEN

User's Guide
Multiple Level Test

This method correctly identifies 95% of samples containing 0.5 ppm pentachlorophenol (PCP). A sample that develops less color than the standard is interpreted as positive. It contains PCP. A sample that develops more color than the standard is interpreted as negative. It contains less than 0.5 ppm PCP.

IMPORTANT NOTICE

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of pentachlorophenol. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

PENTA RISc SOIL TEST TROUBLESHOOTER GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

Wash Step - Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes.
Solution make sure that the operator washes four times vigorously.

Pipet Calibration - An out-of-calibration pipet may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume.
Solution Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipet is out of calibration is if the gold barrel is loose and will turn. (When set on 30µl there should be about 1/4 of an inch between the white plunger and the end of the clear pipet tip.)

Air bubbles in the pipet - The presence of air bubbles in the pipet tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes.
Solution Quickly examine the pipet tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the air bubble if necessary.

Mixing - Lack of thorough mixing, when instructed, can cause inconsistent results.
Solution Observe the mixing times in the instructions and mix with sufficient force to ensure homogeneity.

Timing - It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the test. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

Wiping the Tubes - Wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

Mixing Lot #'s - Never mix lots! Each kit's components are matched together for optimal performance and may give inaccurate results with the components from other kits. Also, the user must NEVER mix components from different types of kits (ex: Petro kit buffer can't be used with a PCP kit.)

Storage and Operating Temperatures. - Temperature requirements are very important and should be strictly adhered to. This test kit should be stored at less than 80°F/27°C, and operated between 55°F/13°C and 90°F/32°C.

Shelf Life - Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM

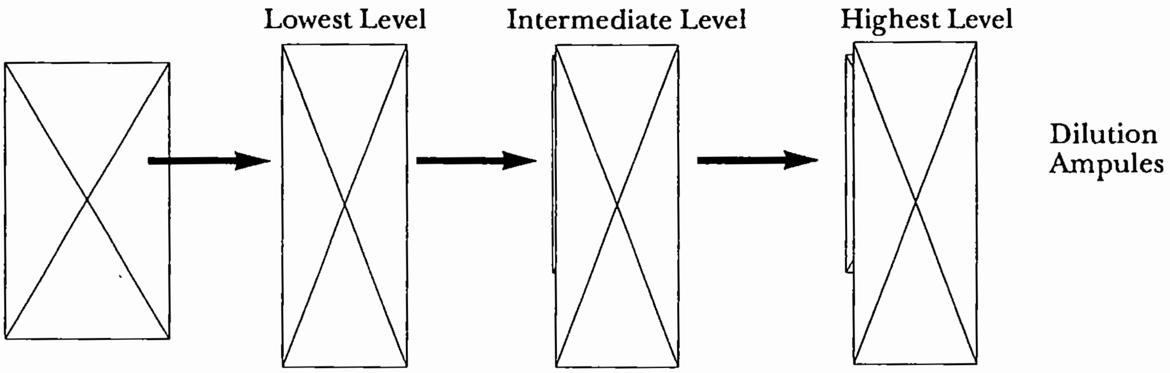
1. The sample dilution procedure on page 6 of the instructions is for 0.5, 5, and 50 ppm detection levels. The following diagram represents the sample dilution procedure for all **other detection levels.**

2. EVERY DILUTION AMPULE PROVIDED MUST BE USED!

If there are any questions concerning the dilution procedure please call Technical Services before running the samples to help avoid costly mistakes.

1-800-242-7472 or 919-941-5509.

EXAMPLE:



Note: Always transfer filtered sample to the dilution labeled with the lowest ppm level and then transfer from it to the next higher level dilution.

WORKSTATION SET-UP

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP FOR 1 SAMPLE AT 3 LEVELS

- 2 Mechanical pipet tips
- Stop solution
- 2 PENTA standard Tubes
- 5 Conjugate tubes
- Substrate A
- Filtration barrel & plunger
- 3 blue buffer tubes
- 5 antibody coated tubes
- Substrate B
- Bulb pipet
- 0.5, 5 and 50 ppm dilution ampules
- Eppendorf Tips

READ BEFORE PROCEEDING

- Follow diagram above to setup workstation.
- Items that you will need that are not provided in the test kit include:
  a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PCP at 0.5, 5 and 50 ppm.
- Label all Eppendorf tips. Tips can be reused for future analyses. Label the first 5mL tip "A", the second tip "B" & the third tip "Stop".

PHASE ONE

EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

1c

- **1a** Place unused weigh boat on pan balance.
- **1b** Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.
- **1c** Weigh out 10 $^{+/-}$ 0.1 grams of soil.
- **1d** If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.

Methanol Extraction Jar

Weigh Boat

Pan balance

Wooden spatula

EXTRACT PCP

2a

- **2a** Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar containing Methanol.
- **2b** Recap extraction jar tightly and shake **vigorously** for one minute.
- **2c** Allow to settle for one minute.

Repeat steps **1a - 2c** for each sample to be tested.

Sample extraction jar

FILTER SAMPLE

- **3a** Disassemble filtration plunger from filtration barrel.
- **3b** Insert bulb pipet into top (liquid) layer in extraction jar and draw up sample. Transfer **at least ½** bulb capacity into filtration barrel. **Do not use more than one full bulb.**
- **3c** Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps **3a - 3c** for each sample to be tested.

3c

Filtration plunger

Bulb pipet

Filtration barrel

PHASE TWO

SAMPLE AND STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

DILUTE AND BUFFER SAMPLE FOR 0.5, 5 & 50 PPM DETECTION LEVELS

See page 3 for other detection levels

4a Flick or tap to get buffer into the bottom of the ampule. Open dilution ampules.

4b Uncap enough conjugate and buffer tubes for **Samples** and **Standards.**

4f

4c Empty two Penta standard tubes into two conjugate tubes.

4d Empty a blue buffer tube into each remaining conjugate tube for samples.

4e Assemble tip onto mechanical pipet.

4f Withdraw 100 µL of sample from filter unit using mechanical pipet and dispense below the liquid level in **0.5 ppm** dilution ampule. Shake for 5 seconds. Wipe mechanical pipet tip.

4g

4g Withdraw 100 µL of diluted sample from **0.5 ppm** dilution ampule and dispense below the liquid level in the **5 ppm** dilution ampule. Shake 5 seconds. Wipe mechanical pipet tip.

4h

4h Withdraw 100 µL of diluted sample from **5 ppm** dilution ampule and dispense below the liquid level in **50 ppm** dilution ampule. Shake for 5 seconds. Wipe mechanical pipet tip.

4i

4i Withdraw 100 µL of diluted sample from **50 ppm** dilution ampule and dispense below the liquid level in **50 ppm** conjugate tube. Repeat with 5 and .5 ppm test levels.

4j Discard mechanical pipet tip.

Repeat steps **4e - 4i** for each sample to be tested.

4k Mix all conjugate tubes for 5 sec.

Dilution ampule (0.5, 5 & 50 ppm)

Plastic Safety Sleeve

Blue buffer tubes

Conjugate tubes

Mechanical pipet tip

Mechanical pipet

PHASE THREE

THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM CONJUGATE TUBE TO ANTIBODY COATED TUBE

5a. Label the antibody coated tubes with sample identification and test level.

5b. Set timer for 10 minutes.

5c. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding conjugate tubes.

2. **Start timer and immediately** invert **all** connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the (larger) antibody coated tube is on the bottom.

5d. Disconnect and discard the smaller glass conjugate tubes. [It is not important to worry about drops of liquid adhering to lips of tubes].

Antibody coated tubes (contained in resealable "zip-seal" aluminized pouch)

WASH PROCEDURE

- Washing must be done vigorously and with force.
- Place nozzle just above antibody coated tube, squeeze bottle to fill each tube with a vigorous stream and empty into liquid waste container.
- The wash solution is a harmless, dilute solution of detergent. Do not hesitate to wash vigorously even if the solution contacts gloved hands.

WASHING

6a. After the 10 minute incubation period, empty antibody coated tubes into liquid waste container.

6b. Wash antibody coated tubes with wash solution by vigorously filling and emptying a total of 4 times.

6c. Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

6a

6b

Wash Bottle

PHASE THREE

THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

COLOR DEVELOPMENT

7a Set the Eppendorf Repeater on 2, assemble the "A" tip and fill with Substrate A (TMB, yellow label).

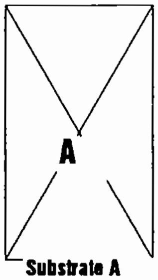
7b Dispense once (200μl) into each antibody coated tube.

7c Set timer for exactly 2 1/2 minutes

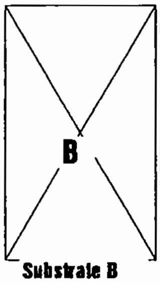
7d Assemble "B" tip, fill with Substrate B, (H_2O_2, green label) start timer, and dispense once (200μl) into each antibody coated tube.

7e Shake all tubes for 5 seconds. Solution will turn blue in some or all antibody coated tubes.

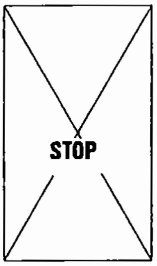
7f Assemble "Stop" tip, fill with Stop Solution (red label), and stop reaction at end of 2 1/2 minutes by dispensing once (200μl) into each antibody coated tube.



Substrate A



Substrate B



Stop

PHASE FOUR

INTERPRETATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT CONSERVATIVE STANDARD

8a Wipe outside of all antibody coated tubes.

8b Place both **Standard** tubes in photometer.

8c Switch tubes until the photometer reading is negative or zero. Record reading. If reading is greater than - 0.3 in magnitude, results are outside of QC limits. Retest the sample(s).

8d Remove and discard tube in right well. The tube in the left well is the conservative standard.

INTERPRET RESULTS

9a Place **0.5 ppm** sample tubes in right well of photometer and record reading.

If photometer reading is **negative** or zero, PCP is present.

If photometer reading is **positive**, concentration of PCP is less than **0.5 ppm**.

9b Place **5 ppm** tube in right well of photometer and record reading shown on display.

If photometer reading is **negative** or zero, PCP is present.

If photometer reading is **positive**, concentration of PCP is less than **5 ppm**.

9c Same as above for 50ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

How It Works

Standards, Samples, and color-change reagents are added to test tubes coated with a chemical specific to pentachlorophenol. The concentration of pentachlorophenol in an unknown **Sample** is determined by comparing its color intensity with that of a **Standard**.

Note: Pentachlorophenol concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of pentachlorophenol.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after its expiration date.
- Each analysis must include 2 **Standards**, with no more than a total of 12 antibody coated tubes.
- Do not exceed incubation periods prescribed by the specific steps.
- Results may not be valid if photometer reading for **Standards** exceeds 0.3 in magnitude.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If liquid from the extraction jar, or PCP Standard comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 13° C/55° F and less than 32° C/90° F.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

System Description

Each Penta RIS^{C®} Soil Test System contains enough material to perform twelve complete tests, at two different test levels.

The Penta RIS$^{C®}$ Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

Pentachlorophenol -free soil and soil containing 0.5 ppm of pentachlorophenol were tested with the EnSys Penta RIS$^{C®}$ analytical method. The method correctly identified 95% of these samples.

The company does not guarantee that the results with the Penta RIS$^{C®}$ Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

REPEATER PIPET & MECHANICAL PIPET

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE REPEATER PIPET

To Set Or Adjust Volume

To determine the pipetting volume, the dial setting (1-5) is multiplied by the minimum pipetting volume of the tip.

To Assemble Pipet Tip

Slide filling lever down until it stops. Then raise the locking clamp and insert the tip until it clicks into position. Be sure the tip plunger is fully inserted into the barrel before lowering the locking clamp to affix the tip in place.

To Fill Tip

With tip mounted in position on pipet, immerse end of tip into solution. Slide filling lever upward slowly.

To Dispense Sample

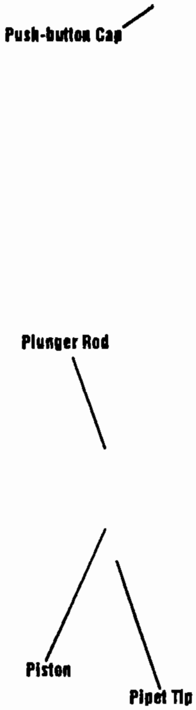
Check the volume selection dial to ensure pipetting volume. Place tip inside test tube so that tip touches the inner wall of tube. Completely depress the pipetting lever.

To Eject Tip

Empty tip of any remaining solution into appropriate container. Raise locking clamp upward, and remove the tip.

For additional information regarding operation and use of repeater, please refer to your Repeater pipet manual.

Mechanical <u>Pipet</u>



Repeater <u>Pipet</u>

HOW TO OPERATE THE MECHANICAL PIPET

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "100". Tighten volume lock screw and replace push-button cap.

To Assemble Pipet Tip

Slide larger mounting end of pipet tip onto end of pipet. Holding tip in place, press push-button until plunger rod enters pipet tip. **Ensure no gap exists between piston and plunger rod**

To Withdraw Sample

With tip mounted in position on pipet, press push-button to first stop and hold it.

Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipet, please refer to your pipet manual.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS
EnSys RIS^{c}® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. EnSys recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of SDI RIS^{c}® immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. **Method blank** - field analyze the contents of an unused extraction jar

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

EnSys technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives.

Data for PENTA RISC® Soil Test

Operator: ---------------------------------- Date: ------------------- Location: --

Sample ID	ΔOD	OD sample	Interpretation	OD sample	Interpretation	OD sample	Interpretation	Comments
	Standards	______ ppm		______ ppm		______ ppm		

Section 2 – Risk Assessment

Section 2: Risk Assessment

2.1 Introduction

Kennedy/Jenks Consultants, on behalf of the Tetra Pak Materials (Tetra Pak), has prepared this screening level risk assessment (SLRA) for the former Strebor property located at 3125 Thompson Avenue in Vancouver, Washington. This SLRA is a component of the Remedial Investigation and Feasibility Study (RI/FS) at the former Strebor site that is being conducted pursuant to the Model Toxics Control Act (MTCA) Cleanup Regulations under the Voluntary Cleanup Program (VCP) of the Washington State Department of Ecology (Ecology). Information and data generated during the remedial investigation at the site were used to develop this SLRA in general accordance with Ecology and U.S. Environmental Protection Agency (USEPA) guidelines for risk assessment.

The intent of the SLRA is to estimate potential risks to human health and the environment associated with current and potential future conditions at the former Strebor site, assuming that no further remediation will occur.

2.1.1 Ecological Receptors

A simplified terrestrial ecological evaluation was conducted for the site, as set forth in Washington Administrative Code (WAC) 173-340-7492. An experienced ecological risk assessor visited the site in the fall of 2001. The site is an industrial property, as defined in WAC 173-340-7490 (3)(c). The majority of the site is paved, with minimal vegetation. The vegetation that does exist at the site consists of nonnative grasses and weeds, which are mowed, a few seedlings, and a few larger trees. During the site visit, a couple of urban passerines were observed; however, other habitat areas of higher quality exist nearby. No evidence of use by mammals was observed during the site visit, nor is any likely.

An exposure analysis was conducted in accordance with WAC 173-340-7492 (2)(a)(ii), which is presented in Table 1. The results of the exposure analysis indicate that land use at the site and surrounding areas makes substantial wildlife exposure unlikely. Therefore, the simplified terrestrial ecological evaluation was terminated.

This SLRA does not further address ecological receptors, but rather focuses on potential risks to human health at the site.

2.1.2 Objectives

The objective of this SLRA is to estimate potential human health and environmental risks associated with current and potential future conditions at the site assuming that no further remediation will occur. The results of this risk assessment will help to establish acceptable exposure levels for use in developing appropriate response actions.

2.1.3 Approach

This SLRA follows the risk assessment approach outlined in the Remedial Investigation, Risk Assessment, and Feasibility Study (RI/RA/FS) Work Plan (Kennedy/Jenks 2001). The approach and methods used to perform this SLRA are derived from guidelines and parameters developed in the MTCA Cleanup Regulation (WAC 173-340); by EPA in *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A, Interim Final* (EPA 1989a); and other guidance documents, as appropriate.

This SLRA follows Ecology and EPA guidelines emphasizing health protection by incorporating conservative assumptions in estimating the potential health risk at a site (EPA 1989a). In general, the toxicity, exposure, and transport assumptions made in a risk assessment are conservative to provide a health-protective approach.

2.1.4 Report Organization

The organization of the SLRA report is as follows:

Section 2.2 Data Evaluation – This section summarizes data available for the site, describes the criteria used to select Chemicals of Potential Concern (COPCs), and identifies the COPCs for the site.

Section 2.3 Exposure Assessment - This section identifies potentially complete routes of exposure and potential receptor populations.

Section 2.4 Risk Characterization – This section estimates the potential for human health risks and characterizes them.

Section 2.5 Summary and Conclusions – This section summarizes and presents the conclusions of this SLRA.

References - This section provides the references used in the development of this SLRA.

2.2 Data Evaluation

The chemicals of potential concern (COPCs) for evaluation in this risk assessment were selected in accordance with MTCA regulations (WAC 173-340-703) and EPA guidelines (EPA 1989a). This section outlines the process used to select COPCs for further evaluation in this SLRA.

2.2.1 Summary of Data

Soil and groundwater data were collected during previous investigations by others at the site between 1987 and 1990. Based on that data, additional data needs were identified for completing the RI/FS at the site. Remedial investigation field activities were conducted by Kennedy/Jenks Consultants at the site in 2002 in accordance with the RI/RA/FS Work Plan previously submitted to and reviewed by Ecology (Kennedy/Jenks 2001), and groundwater monitoring continued into 2003. The field activities fulfilled the data collection objectives of the Work Plan.

Data from previous investigations and the remedial investigation field activities were used to select COPCs for the site. The following summarizes the available data.

2.2.1.1 Previous Investigations

Preliminary soil investigations were conducted at the site due to surface soil spills. A remedial investigation was conducted by others in 1988 that focused on soil and groundwater at the site. Additional groundwater samples were collected by others in 1990 as part of an area-wide groundwater quality investigation conducted by Ecology.

2.2.1.1.1 Groundwater

Historic groundwater analytical data are of unknown quality and detection limits were often higher than current risk-based screening levels. Volatile organic compounds (VOCs) were detected in groundwater samples collected in 1987, 1988, and 1990. VOCs detected in groundwater include cis-1,2-dichloroethene (cis-1,2-DCE), 1,2-dichloroethane, tetrachloroethene (PCE), trichloroethene (TCE), 1,2-dichloropropane, and 1,1,1-trichloroethane. Inorganic chemicals, specifically chromium, copper, zinc, arsenic, lead, and thallium, were detected in groundwater during the 1990 sampling event.

2.2.1.1.2 Soil

Soil samples were collected during previous investigations by others in 1987 and 1988. Soil samples were collected under the existing building at the site and in the former tank farm area. The only chemicals detected in soil during previous investigations were pentachlorophenol, total aliphatic and aromatic hydrocarbons, and octachlorodibenzo-p-dioxin (OCDD).

2.2.1.2 Remedial Investigation

Remedial investigation field activities were conducted at the former Strebor site in April 2002 by Kennedy/Jenks Consultants. The field activities included the collection and analysis of soil and groundwater samples.

2.2.1.2.1 Groundwater

Groundwater samples were collected from five existing monitoring wells at the site during the field activities in April 2002. Groundwater monitoring was then conducted for three additional quarters. Groundwater samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs), and inorganic compounds. These analyses were selected based on the results from previous investigations and historic activities at the site.

VOCs, specifically cis-1,2-DCE, TCE and PCE, were detected in all of the groundwater samples. SVOCs, specifically benzoic acid and pentachlorophenol, arsenic, chromium, and lead, were also detected in groundwater samples.

2.2.1.2.2 Soil

The nature and extent of soil impacts under the existing building at the site had been adequately characterized in previous investigations. As a result, additional soil samples were not collected under the building during the field activities in April 2002.

Soil samples were collected from the area along the rail spur, the former tank farm area, and immediate adjacent to the dry wells. These areas were selected based on past site operations including documentation and reporting, and visual evidence of the release of chemicals. In accordance with WAC 173-340-709, background soil samples were also collected in an area that is considered uninfluenced by releases from the site to provide site background metal concentrations. Soil samples were analyzed for VOCs, SVOCs, inorganic compounds, and dioxins.

VOCs, SVOCs, inorganic chemicals, specifically arsenic, chromium, and lead, and dioxin and furan congeners, were detected in soil samples.

2.2.2 Criteria for Selection of Chemicals of Potential Concern

General methods for selection of COPCs are outlined in EPA guidelines (1989a) and are in accordance with MTCA regulations (WAC 173-340-703). EPA (1989a) and Ecology recommend considering background concentrations, frequency of detection, and toxicity when selecting COPCs for a site. The selection process is conducted to limit the number of chemicals included in quantitative risk assessments, while also assuring that all significant chemicals will be addressed.

The following criteria were considered in the selection of COPCs for the site.

2.2.2.1 Comparison with Background Concentrations

A comparison with background concentrations was conducted to assure that only site-related chemicals were selected as COPCs, and that chemicals that are ubiquitous in the environment were omitted. For example, many metals are naturally occurring in both soils and groundwater but are not associated with the documented activities at the former Strebor site.

Background concentrations for soils at the site, which are presented in Table 2, were determined during the remedial investigation in accordance with MTCA regulations (WAC 173-340-709). The maximum detected concentration of each chemical was compared to the site-specific background concentration. If the maximum concentration was less than the site-specific background concentrations, the chemical was eliminated as a COPC.

2.2.2.2 Frequency of Detection

Chemicals that are detected very infrequently at a site generally are not likely to contribute significantly to the overall risk. This is especially true for sites where risks are strongly dominated by a few chemicals. Frequency of detection was therefore used as a screening criterion. In accordance with EPA guidelines (EPA 1989a), chemicals detected in less than 5 percent of the samples in a given medium were eliminated as COPCs. The frequency of detection for each chemical detected in soil and groundwater is presented in Tables 2 and 3, respectively.

2.2.2.3 Comparison with Toxicity Screening Criteria

Toxicity screening criteria used to select COPCs for soil included MTCA Method A and Method B Soil Levels, which are established to be protective of human health. Although the site is commercial/industrial, unrestricted or residential land use screening values were used as a conservative approach due to the proximity of residential receptors to the site. Table 2 presents risk-based screening values for each chemical detected in soil. For chemicals with carcinogenic as well as noncarcinogenic effects, the lower risk-based concentration was used in the COPC screening. For chemicals that do not have toxicity screening criteria, MTCA levels for surrogate chemicals with similar structures were used (e.g., pyrene for phenanthrene).

Toxicity screening criteria used to select COPCs for groundwater included MTCA Method A and Method B Groundwater Levels, which are established to be protective of human health. Although groundwater at the site is not used as a source of drinking water, screening values protective of drinking water uses were used as a conservative approach. Table 3 presents risk-based screening values for each chemical detected in groundwater. For chemicals with carcinogenic as well as noncarcinogenic effects, the lower risk-based concentration was used in the COPC screening.

The maximum detected concentration of each concentration was compared to the toxicity screening criteria. If the maximum detected concentration exceeded the screening criterion, the chemical was retained as a COPC.

2.2.3 Identification of Chemicals of Potential Concern

Based on review of the investigative data available for the site, the following chemicals were selected as COPCs for further review and quantitative evaluation in the SLRA.

2.2.3.1 Soil

Chemicals detected in soil with the potential for direct human contact, which is soil less than or equal to 15 feet below ground surface (bgs), were evaluated using the criteria described above to select COPCs. Soil samples collected at depths greater than 15 feet bgs were not included in the soil evaluation for direct human contact, in accordance with Ecology’s guidelines for developing soil cleanup standards (Ecology 2001). The following describes the rationale for selection or exclusion as COPCs for soil:

- The maximum detected concentration of pentachlorophenol exceeded the MTCA Method B Soil Level and pentachlorophenol was detected in more than 5 percent of the soil samples. As result, pentachlorophenol was selected as a COPC for soil.

- Dioxins and furans were analyzed as individual congeners. Only 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) has a risk-based screening value. Although the detected concentration of 2,3,7,8-TCDD did not exceed the screening value for residential soil, the presence of other congeners indicated the potential for exceeding the

2,3,7,8-TCDD toxicity equivalent, which is used to evaluate potential risks associated with individual congeners. Therefore, dioxin and furan congeners were selected as COPCs for soil. Because potential risks associated with the presence of dioxins and furans were evaluated using the individual congeners, total dioxins and furans were not considered COPCs for further evaluation.

- VOCs were not selected as COPCs because all of the maximum detected concentrations were less than the respective risk-based screening levels.

- With the exception of pentachlorophenol, SVOCs were not selected as COPCs because all of the maximum detected concentrations were less than the respective risk-based screening levels.

- Inorganic chemicals were not selected as COPCs because the detected concentrations were similar to or less than the site-specific background concentrations and less than the respective risk-based screening levels. The maximum detected concentration of arsenic exceeded the MTCA Method B Soil Level; however, it was similar to background for the site and less than the MTCA Method A Soil Level, which accounts for the natural background concentration of arsenic in the State of Washington.

The selected COPCs for soil, including the rationale for inclusion, are presented in Table 2.

2.2.3.2 Groundwater

Because recent data more accurately reflect current conditions at the site, data from groundwater samples collected by Kennedy/Jenks Consultants during the most recent four quarters of monitoring (April, August, and November 2002 and February 2003) were selected for use in the SLRA. Chemicals detected in groundwater were evaluated using the criteria described above to select COPCs. The following describes the rationale for selection or exclusion as COPCs for groundwater:

- The maximum detected concentration of pentachlorophenol exceeded the MTCA Method B Groundwater Level and pentachlorophenol was detected in more than 5 percent of the groundwater samples. As a result, pentachlorophenol was selected as a COPC for groundwater.

- The maximum detected concentration of TCE exceeded the MTCA Groundwater Levels and TCE was detected in more than 5 percent of the groundwater samples. However, the presence of TCE is due to a regional groundwater contamination plume and not a result of activities at the site (Ecology 2000). As a result, TCE was not selected as a COPC for groundwater.

- The maximum detected concentration of PCE exceeded the MTCA Groundwater Levels and PCE was detected in more than 5% of the groundwater samples. However, the presence of PCE is due to a regional groundwater contamination plume and not a result of activities at the site (Ecology 2000). As a result, PCE was not selected as a COPC for groundwater.

- With the exception of pentachlorophenol, PCE, and TCE, the maximum detected concentrations of VOCs and SVOCs were less than the MTCA Groundwater Levels, so other VOCs and SVOCs were not selected as COPCs for groundwater.

- Inorganic chemicals, with the exception of arsenic and chromium, were not selected as COPCs because the detected concentrations were less than MTCA Groundwater Levels.

- The maximum detected concentration of total chromium is not consistent with historic results nor is it consistent with results from other site monitoring wells on the same sampling date. As a result, the maximum detected concentration is considered an anomaly and was not used in the COPC selection process. The next highest detected concentration of chromium was less than the MTCA Groundwater Level, so chromium was not selected as a COPC.

- Arsenic was not selected as a COPC because it is naturally occurring and the maximum detected concentration was less than the MTCA Method A Groundwater Level, which is based on the background level for the State of Washington.

The selected COPCs for groundwater, including the rationale for inclusion, are presented in Table 3.

2.3 Exposure Assessment

The objective of this exposure assessment is to characterize potentially exposed populations and identify potential exposure pathways. The exposure assessment outline follows WAC 173-340-708(3) and EPA guidelines, and uses the recommended Reasonable Maximum Exposure (RME) methods. The conceptual site model representing all potentially exposed populations and complete exposure pathways is shown on Figure 1.

2.3.1 Identification of Potentially Exposed Populations

Potentially exposed populations were identified based on consideration of current and future uses of the site. The potential human receptors identified below represent those receptors that are anticipated to be present within the site under current and reasonably foreseeable future conditions. The receptors for current and future uses of the site include the following:

- Current and future onsite industrial workers

- Future onsite construction workers

- Current and future onsite trespassers

- Current and future offsite residents.

While other potential receptors may exist at the site, the above receptors are anticipated to have higher potential exposures and, therefore, should be protective of other receptors. By limiting the number of receptors quantitatively evaluated, this SLRA focuses on those receptors and pathways with the greatest potential risks.

2.3.2 Identification of Potential Exposure Pathways

Exposure pathways are defined as the physical ways in which chemicals may enter the human body (e.g., ingestion, inhalation, dermal absorption). A complete exposure pathway consists of the following four elements:

- A source of chemical release
- A retention or transport medium (or media in cases involving media transfer)
- An exposure point (a point of potential human contact with the contaminated medium)
- An exposure route (e.g., ingestion, dermal contact) at the exposure point.

A pathway is considered “complete” if there is a source or chemical release from a source, an exposure point where contact can occur, and an exposure route by which contact can occur. If any of the above elements are missing, the pathway is considered incomplete and exposure does not occur. The potentially complete exposure pathways for each receptor are discussed below.

2.3.2.1 Current and Future Onsite Industrial Workers

The site is currently an industrial facility and will likely continue to be used for industrial purposes in the foreseeable future. Potentially complete pathways for current and future onsite industrial workers and the relative significance of each pathway to the overall potential risk are presented below.

- Incidental Ingestion of and Dermal Contact with Soil: Potentially Complete and Significant. Onsite employees may contact COPCs in soil while working or taking breaks in areas with elevated concentrations of COPCs. Incidental ingestion of and dermal contact with soil are potentially complete exposure pathways that are likely to contribute to the overall risk.
- Inhalation of Airborne Particulates: Potentially Complete and Significant. Onsite commercial/industrial workers may inhale COPCs in airborne particulates resulting from wind erosion of soil. Inhalation of COPCs in air is a potentially complete exposure pathway for onsite employees at the site that is likely to contribute to the overall risk.

Groundwater at the site is not used as a source of drinking water and there are no plans to use it as a source of drinking water in the foreseeable future. Therefore, direct contact with COPCs in groundwater is not considered a complete exposure pathway for current or future onsite workers.

The identified COPCs in groundwater are not volatile. Therefore, potential exposure to COPCs in groundwater through inhalation of volatile emissions is not considered a complete exposure pathway for current or future onsite workers.

2.3.2.2 Future Onsite Construction Workers

If construction occurs at the site in the future, onsite construction workers could potentially be exposed to COPCs at the site. If construction were to occur at the site, it is anticipated that construction work involving direct contact with soil would occur over a relatively short duration. Potentially complete pathways for future onsite construction workers and the relative significance of each pathway to the overall potential risk are presented below.

- Incidental Ingestion of and Dermal Contact with Soil: Potentially Complete and Significant. Onsite future construction workers could contact COPCs in soil during digging and trenching activities in impacted areas of the site. Incidental ingestion of and dermal contact with soil are potentially complete exposure pathways that may contribute to the overall risk. These pathways are quantitatively evaluated in this SLRA.

- Inhalation of Airborne Particulates: Potentially Complete and Significant. Airborne particulates, which may be inhaled by construction workers, may be generated during construction. Therefore, inhalation of airborne particulates from soil is a potentially complete exposure pathway that may also contribute to the overall risk. These pathways are quantitatively evaluated in this SLRA.

Groundwater at the site is not used as a source of drinking water and there are no plans to use it as a source of drinking water in the foreseeable future. In addition, groundwater is encountered at depths greater than 15 feet bgs, which represents the maximum anticipated depth of any future excavation work. Therefore, direct contact with COPCs in groundwater is not considered a complete exposure pathway for future construction workers.

The identified COPCs in groundwater are not volatile. Therefore, potential exposure to COPCs in groundwater through inhalation of volatile emissions is not considered a complete exposure pathway for future construction workers.

2.3.2.3 Current and Future Onsite Trespassers

Although the site is private property and trespassing is discouraged (i.e. fencing), occasional trespassing might occur, however, it would be infrequent. Potentially complete pathways for current and future onsite trespassers and the relative significance of each pathway to the overall potential risk are presented below.

- Incidental Ingestion of and Dermal Contact with Soil: Potentially Complete and Significant. Trespassers may be exposed to COPCs in soil through incidental ingestion and dermal contact. Incidental ingestion of and dermal contact with soil are potentially complete exposure pathways that are likely to contribute to the overall risk.

- Inhalation of Airborne Particulates: Potentially Complete and Insignificant. Trespassers onto the site could theoretically inhale COPCs in airborne particulates. Generation of large quantities of airborne particulates generally only occurs during vehicle movement and construction activities. Therefore, this pathway is not expected to contribute significantly to the overall risk for trespassers.

Current and future onsite trespassers would not have direct contact with groundwater. Because the groundwater COPCs are not volatile, volatile emissions from groundwater will not occur. Therefore, all exposure pathways for groundwater are considered incomplete for the current and future onsite trespassers.

2.3.2.4 Current and Future Offsite Residents

Residential areas exist in proximity to the site. Current and future offsite residents could potentially be exposed to COPCs that originate at the site and are transported offsite into residential areas.

- Inhalation of Airborne Particulates: Potentially Complete and Significant. Soil may be suspended in ambient air as airborne particulates, and residents near the site could inhale COPCs in dust when outside in their yards. Because affected soil areas are relatively localized, large concentrations of dust in ambient air are not expected. However, as a conservative assumption, this pathway is assumed to contribute to the overall risk.

Offsite residents might use groundwater as a source of drinking water. However, the entire area is served by the City of Vancouver. There were no potable wells identified within a 1-mile radius of the site. In addition, no groundwater COPCs have been detected in the monitoring wells at the perimeter of the site, upgradient or downgradient from the source area. This indicates that COPCs in groundwater are not migrating offsite and therefore, COPCs are unlikely to be present in offsite groundwater. As a result, all exposure pathways to COPCs in groundwater for offsite residents are considered incomplete.

2.3.3 Exposure Point Concentrations

Exposure point concentrations (EPCs) were determined for soil based on available monitoring data for the site. EPCs were not estimated for groundwater because no exposure pathways involving groundwater were selected for quantitative evaluation.

In accordance with WAC 173-340-740(6d), all soils throughout the site from ground surface to 15 feet bgs were considered in developing the EPCs. The minimum, maximum, average, and 95 percent upper confidence limit (95% UCL) on the average were determined for each dataset. In calculating the average and the 95% UCL concentrations, one-half the detection limit was used for non-detects. Because the point of compliance applies to all soils, the maximum detected concentration was selected as the EPC. The EPCs are presented in Table 4. The process used to determine the EPCs for each of the soil COPCs is discussed below.

2.3.3.1 Dioxins and Furans

To evaluate potential risks associated with dioxin and furan congeners, EPCs were estimated for the 2,3,7,8-TCDD toxic equivalent. Toxicity equivalency factors (TEFs) from the *Interim Procedures for Estimating Risks Associated with Exposure to Mixtures of Chlorinated Dibenzo-*

p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update (EPA 1989b), in accordance with WAC 173-340-708(8d), were used to evaluate dioxin and furan congeners. For each sample, concentrations of congeners were multiplied by their TEFs to estimate the toxicity of these congeners relative to 2,3,7,8-TCDD; the resulting concentrations were then summed into a total 2,3,7,8-TCDD toxicity equivalent concentration. The 2,3,7,8-TCDD toxicity equivalent concentration was then used to determine the EPC for soil. The data and TEFs that were used to evaluate dioxins and furans are shown in Table 5.

Only dioxin and furan congeners that were detected in a sample were used in calculating the 2,3,7,8-TCDD toxic equivalent for that sample. Dioxin and furan congeners that were not detected in a given sample were not included in the TEF calculations for that sample.

2.3.3.2 Pentachlorophenol

A building currently exists at the site and is anticipated to remain at the site for the foreseeable future. The building is constructed with a concrete floor and prevents potential exposure to soil under the mixing room. Furthermore, the concentrations of pentachlorophenol detected in soil under the mixing room were significantly higher than concentrations detected throughout the rest of the site. As a result, EPCs were determined separately for the soils beneath the mixing room.

During the April 2002 investigations, soil samples were generally collected from the same locations where chemicals had been detected historically. These samples were analyzed with lower detection limits and for a wider suite of analytes. However, because the area below the mixing room had been adequately characterized during previous investigations and because it is unlikely that conditions below the building have changed significantly, the remedial field activities did not include collection of soil samples below the mixing room. Results from the remedial investigation, which are thought to best represent current soil conditions at the site, were used to determine EPCs for the site, excluding the soil under the mixing room. Historic data was used to estimate EPCs for soil under the mixing room floor as more recent data for this area of the site were not available.

Soil data used to estimate EPCs for the site outside of the mixing room and under the mixing room are shown in Tables 6 and 7, respectively.

2.4 Risk Characterization

To evaluate the potential for risks to human health at the site, the exposure point concentrations were compared with MTCA soil cleanup levels for the identified COPCs. Although the site is an industrial facility and will likely continue to be used for industrial purposes in the foreseeable future, cleanup levels protective of unrestricted land use were selected for comparison due to the proximity of residential areas to the site. Method A cleanup levels were not available for the COPCs, so Method B cleanup levels were used for comparison. The comparison of EPCs with cleanup levels is summarized in Table 8.

The EPC for the 2,3,7,8-TCDD toxic equivalent was greater than the Method B soil cleanup level. The comparison is based on the maximum 2,3,7,8-TCDD toxic equivalent and a soil cleanup level protective of residential land use conditions. Therefore, due to the numerous conservative assumptions in the comparison, exceedence of the Method B soil cleanup level does not necessarily indicate an unacceptable risk at the site based on current site operations.

The EPC for pentachlorophenol for the site, excluding the soil under the mixing room, was less than the Method B soil cleanup level. Even at the maximum detected concentration, pentachlorophenol, except for below the mixing room, did not exceed the soil cleanup level protective of residential land use conditions. Therefore, further evaluation of pentachlorophenol outside of the mixing room area is not warranted.

The EPC for pentachlorophenol under the mixing room floor was greater than the Method B soil cleanup level. The comparison is based on the maximum detected concentration of pentachlorophenol under the mixing room and a soil cleanup level protective of residential land use conditions. Due to the numerous conservative assumptions in the comparison and current site operations, exceedence of the Method B soil cleanup level does not necessarily indicate an unacceptable risk.

2.5 Summary and Conclusions

Soil and groundwater data from previous investigations and the RI were reviewed to identify COPCs at the site. Pentachlorophenol and dioxin and furan congeners were selected as COPCs in soil. Pentachlorophenol was the only chemical selected as a COPC in groundwater.

The site is currently an industrial facility and will likely continue to be used for industrial or commercial purposes in the foreseeable future. As a result, current and future onsite industrial workers were identified as a potentially exposed population. Future onsite construction workers were identified as a potentially exposed population, in the event that construction activities occur at the site. Due to the proximity of residential areas to the site, current and future offsite residents and onsite trespassers were also identified as potentially exposed populations.

Onsite receptor populations could be exposed to COPCs in soil through ingestion of or dermal contact with soil, or through inhalation of airborne particulates from soil. Offsite receptor populations could be exposed to COPCs in soil originating from the site through inhalation of airborne particulates from onsite soil transported offsite.

Because groundwater is encountered at depths greater than 15 feet bgs, no volatile COPCs have been identified, and no domestic wells exist onsite; there are no complete exposure pathways for groundwater at the site. COPCs have not been detected in monitoring wells located at the property boundaries, indicating that onsite COPCs are not migrating offsite. Therefore, there are no complete exposure pathways for offsite groundwater. Because there are no complete exposure pathways for groundwater, the presence of pentachlorophenol in onsite groundwater does not pose an unacceptable risk and does not warrant further evaluation.

To assess the potential for risks from COPCs in soil, detected concentrations were compared with MTCA Method B cleanup levels. The Method B cleanup levels are protective of residential use conditions and, therefore, provide a conservative approach to evaluate an industrial site. In addition, the maximum detected concentrations were used in comparisons because the point of compliance is all soils at the site.

The following summarizes the soil evaluation:

- The maximum detected concentration of pentachlorophenol for the site, excluding soil under the mixing room area, is less than the Method B cleanup level. Therefore, pentachlorophenol in soil at the site that is not under mixing room area does not need to be addressed in the FS.

- The maximum detected concentration of pentachlorophenol in soil under the mixing room floor exceeds the Method B cleanup level. Because this area of soil is currently covered with a building, pentachlorophenol in soil under the mixing room only needs to be addressed in the FS for potential future exposures if the building were removed.

- The maximum detected concentration of 2,3,7,8-TCDD toxic equivalent exceeds the Method B cleanup level. Therefore, dioxin and furan congeners in soil need to be addressed in the FS.

The comparisons of maximum detected concentrations with Method B cleanup levels were based on conservative assumptions, so exceedences of cleanup levels do not necessarily indicate unacceptable risks. Therefore, feasibility, practicality, and the potential for adverse impact associated with remedial strategies should also be considered in determining the need for further action.

References for Risk Assessment

Kennedy/Jenks Consultants (Kennedy/Jenks). 2001. Remedial Investigation/Risk Assessment/Feasibility Study Work Plan, Former Strebor Facility.

U.S. Environmental Protection Agency (EPA). 1989a. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A), Interim Final. Office of Emergency and Remedial Response, EPA/540/1-89/002.

U.S. Environmental Protection Agency. 1989b. Interim Procedures for Estimating Risks Associated with Exposure to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. Risk Assessment Forum. EPA/625/3-89/016.

Washington Department of Ecology (Ecology). 2000. Vancouver West Industrial District Ground Water Contaminant Source Identification/Screening. June 2000.

Washington Department of Ecology (Ecology). 2001. Developing Soil Cleanup Standards under the Model Toxics Control Act. Focus No. 01-09-071. August 2001.

Tables

Table 1: Simplified Terrestrial Ecological Evaluation[(a)]

	Exposure Analysis Criteria	Score
1.	Estimated area of contiguous (connected) undeveloped land on the site is approximately 1 acre.	6
2.	Property is designated as industrial, in accordance with WAC 173-340-7490	3
3.	Habitat quality of the site is classified as low. Vegetation consists of nonnative grasses and weeds with a few seedling trees and a few larger trees. The grass is mowed.	3
4.	The undeveloped land is unlikely to attract wildlife as other habitat areas exist nearby. Birds may visit to feed, but not frequently, and no evidence of use by mammals was observed during the site visit.	2
5.	Soil contaminants present at the site include dioxins and furans	1
	Total Score (Criteria 2 through 5):	**9**

Notes:

(a) In accordance with WAC 173-340-7492 (2)(a)(ii).
(b) Score is based on points defined in WAC Table 749-1.

Table 2: Chemicals of Potential Concern in Soil

CAS Number	Chemical	Sample Date(s)	Minimum Conc.	Maximum Conc.	Total Number of Samples	Number of Detections	Detection Frequency	Background Value	MTCA Method A Soil Level	MTCA Method B Soil Level (Direct Contact)	COPC?	Rationale
Volatile Organics			***µg/kg***	***µg/kg***					***µg/kg***	***µg/kg***		
71-43-2	Benzene	Apr-02	0.685	1.41	24	3	12.5		30	18200	N	Maximum concentration less than MTCA Method A and Method B Soil Levels
75-71-8	Dichlorodifluoromethane	Apr-02	0.582	1.09	24	4	16.7			16000000	N	Maximum concentration less than MTCA Method B Soil Level
100-41-4	Ethylbenzene	Apr-02	0.898	1.2	24	3	12.5		6000	8000000	N	Maximum concentration less than MTCA Method A and Method B Soil Levels
75-09-2	Methylene chloride	Apr-02	0.586	3.07	24	10	41.7		20	133000	N	Maximum concentration less than MTCA Method A and Method B Soil Levels
108-88-3	Toluene	Apr-02	0.671	14.7	24	7	29.2		7000	16000000	N	Maximum concentration less than MTCA Method A and Method B Soil Levels
75-69-4	Trichlorofluoromethane	Apr-02	0.755	3.03	24	5	20.8			24000000	N	Maximum concentration less than MTCA Method B Soil Level
1330-20-7	Xylenes, total	Apr-02	0.881	5.87	24	6	25.0		9000	160000000	N	Maximum concentration less than MTCA Method A and Method B Soil Levels
Semi-Volatile Organics			***µg/kg***	***µg/kg***					***µg/kg***	***µg/kg***		
120-12-7	Anthracene	Apr-02	4.41	9.11	24	6	25.0			24000000	N	Maximum concentration less than MTCA Method B Soil Level
56-55-3	Benzo(a)anthracene	Apr-02	10.8	16.4	24	2	8.3			137	N	Maximum concentration less than MTCA Method B Soil Level
50-32-8	Benzo(a)pyrene	Apr-02		20	24	1	4.2		30	137	N	Maximum concentration less than MTCA Method A and Method B Soil Levels
191-24-2	Benzo(g,h,i)perylene	Apr-02		9.36	24	1	4.2				N	Maximum concentration less than MTCA Method A and Method B Soil Levels for other PAHs
207-08-9	Benzofluoranthenes	Apr-02	9.05	24.6	24	2	8.3			137	N	Maximum concentration less than MTCA Method B Soil Level
65-85-0	Benzoic Acid	Apr-02	244	308	24	2	8.3			320000000	N	Maximum concentration less than MTCA Method B Soil Level
85-68-7	Butylbenzylphthalate	Apr-02		69.7	24	1	4.2			16000000	N	Maximum concentration less than MTCA Method B Soil Level
218-01-9	Chrysene	Apr-02	8.89	13.5	24	4	16.7			137	N	Maximum concentration less than MTCA Method B Soil Level
206-44-0	Fluoranthene	Apr-02	6.87	45.9	24	3	12.5			3200000	N	Maximum concentration less than MTCA Method B Soil Level
193-39-5	Indeno(1,2,3-cd)pyrene	Apr-02		8.98	24	1	4.2			137	N	Maximum concentration less than MTCA Method B Soil Level
87-86-5	**Pentachlorophenol**	**7/87; 6/88; 4/02**	**109**	**15200000**	**51**	**15**	**29.4**			**8330**	**Y**	**Maximum concentration greater than MTCA Method B and frequency of detection greater than 5%**
85-01-8	Phenanthrene	Apr-02	4.1	44.7	24	14	58.3				N	Maximum concentration less than MTCA Method B Soil Level for pyrene (2400000 µg/kg), which is a surrogate chemical for phenanthrene
108-95-2	Phenol	Apr-02	107	3830	24	22	91.7			48000000	N	Maximum concentration less than MTCA Method B Soil Level
129-00-0	Pyrene	Apr-02	7.24	38.2	24	4	16.7			2400000	N	Maximum concentration less than MTCA Method B Soil Level
Inorganics			***mg/kg***	***mg/kg***				***mg/kg***	***mg/kg***	***mg/kg***		
7440-38-2	Arsenic	Apr-02	1.34	11.8	24	24	100.0	7.5 - 11.2	20	0.667	N	Maximum concentration is similar to background and is less than the MTCA Method A level, which accounts for natural background in the State of Washington
	Chromium (Total)	Apr-02	9.67	25.4	24	24	100.0	18.7 - 24.6	2000		N	Maximum concentration is similar to background and is less than the MTCA Method A level
7440-47-3	Chromium VI	Apr-02	0.112	0.553	24	8	33.3		19	240	N	Maximum concentration less than MTCA Method A and Method B Soil Levels
7439-92-1	Lead	Apr-02	3.99	17.4	24	24	100.0	14.3 - 14.6	250		N	Maximum concentration is similar to background and is less than the MTCA Method A level
Dioxins and Furans			***ng/kg***	***ng/kg***					***ng/kg***	***ng/kg***		
	1,2,3,4,6,7,8-HpCDD	**Apr-02**	**4**	**74000**	**12**	**11**	**91.7**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,4,6,7,8-HpCDF	**Apr-02**	**4.8**	**10000**	**12**	**9**	**75.0**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,4,7,8,9-HpCDF	**Apr-02**	**4.4**	**1300**	**12**	**8**	**66.7**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,4,7,8-HxCDD	**Apr-02**	**2.9**	**210**	**12**	**7**	**58.3**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,4,7,8-HxCDF	**Apr-02**	**4.8**	**350**	**12**	**7**	**58.3**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,6,7,8-HxCDD	**Apr-02**	**3.1**	**1800**	**12**	**9**	**75.0**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,6,7,8-HxCDF	**Apr-02**	**4.5**	**440**	**12**	**7**	**58.3**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,7,8,9-HxCDD	**Apr-02**	**7.6**	**600**	**12**	**7**	**58.3**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,7,8,9-HxCDF	**Apr-02**	**7.3**	**9**	**12**	**2**	**16.7**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,7,8-PeCDD	**Apr-02**	**3.9**	**63**	**12**	**5**	**41.7**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	1,2,3,7,8-PeCDF	**Apr-02**	**3.7**	**27**	**12**	**3**	**25.0**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	2,3,4,6,7,8-HxCDF	**Apr-02**	**5.6**	**120**	**12**	**6**	**50.0**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	2,3,4,7,8-PeCDF	**Apr-02**	**3.5**	**17**	**12**	**3**	**25.0**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
1746-01-6	**2,3,7,8-TCDD**	**Apr-02**	**2.2**	**3.6**	**12**	**3**	**25.0**			**6.67**	**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	2,3,7,8-TCDF	**Apr-02**	**0.89**	**5.1**	**12**	**4**	**33.3**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	OCDD	**Apr-02**	**27**	**670000**	**12**	**12**	**100.0**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	OCDF	**Apr-02**	**8.6**	**51000**	**12**	**10**	**83.3**				**Y**	**Detected concentrations of dioxins and furans may exceed 2,3,7,8-TCDD toxicity equivalent**
	Total HpCDD	Apr-02	4.1	100000	12	12	100.0				N	Potential risks associated with dioxins and furans will be evaluated using individual congeners
	Total HpCDF	Apr-02	4	48000	12	10	83.3				N	Potential risks associated with dioxins and furans will be evaluated using individual congeners
	Total HxCDD	Apr-02	6.1	4800	12	9	75.0				N	Potential risks associated with dioxins and furans will be evaluated using individual congeners
	Total HxCDF	Apr-02	16	8200	12	8	66.7				N	Potential risks associated with dioxins and furans will be evaluated using individual congeners
	Total PeCDD	Apr-02	3.9	220	12	5	41.7				N	Potential risks associated with dioxins and furans will be evaluated using individual congeners
	Total PeCDF	Apr-02	17	590	12	5	41.7				N	Potential risks associated with dioxins and furans will be evaluated using individual congeners
	Total TCDD	Apr-02	1.2	24	12	8	66.7				N	Potential risks associated with dioxins and furans will be evaluated using individual congeners
	Total TCDF	Apr-02	0.77	100	12	6	50.0				N	Potential risks associated with dioxins and furans will be evaluated using individual congeners

Notes:
MTCA = Model Toxics Control Act from Washington Department of Ecology (2001)

Table 3: Chemicals of Potential Concern in Groundwater

CAS Number	Chemical	Sample Date(s)	Minimum Conc.	Maximum Conc.	Total Number of Samples	Number of Detections	Detection Frequency	MTCA Method A Groundwater Level	MTCA Method B Groundwater Level	COPC?	Rationale/Remarks
Volatile Organics			***µg/l***	***µg/l***				***µg/l***	***µg/l***		
156-59-2	cis-1,2-Dichloroethene	4/02; 8/02; 11/02; 2/03	0.672	5.35	24	10	42	NL	8	N	Maximum concentration less than MTCA Method B level
127-18-4	Tetrachloroethene	4/02; 8/02; 11/02; 2/03	1.08	3.68	24	13	54	5	0.858	N	PCE is part of a regional groundwater contamination plume and not a result of the site.
79-01-6	Trichloroethene	4/02; 8/02; 11/02; 2/03	0.514	9.69	24	18	75	5	3.98	N	TCE is part of a regional groundwater contamination plume and not a result of the site.
71-55-6	1,1,1-Trichloroethane	4/02; 8/02; 11/02; 2/03		0.634	24	1	4	200	7200	N	Maximum concentration less than MTCA Method A and Method B levels
75-34-3	1,1-Dichloroethane	4/02; 8/02; 11/02; 2/03	0.525	0.601	24	2	8	NL	800	N	Maximum concentration less than MTCA Method B level
Semi-Volatile Organics			***µg/l***	***µg/l***				***µg/l***	***µg/l***		
65-85-0	Benzoic Acid	4/02; 11/02	1.17	5.62	12	2	17	NL	64000	N	Maximum concentration less than MTCA Method B level
87-86-5	**Pentachlorophenol**	**4/02; 8/02; 11/02; 2/03**	**0.254**	**7.58**	**25**	**6**	**24**	**NL**	**0.729**	**Y**	**Maximum concentration greater than MTCA Method B level and frequency of detection greater than 5%**
Inorganics			***µg/l***	***µg/l***				***µg/l***	***µg/l***		
7440-38-2	Arsenic (Total)	Apr-02	1.09	1.65	5	3	60	5	0.0583	N	Arsenic is naturally occurring. The maximum detected concentration is less than the MTCA Method A level, which is based on background concentrations for the State of Washington.
7440-38-2	Arsenic (Dissolved)	Apr-02	1.12	2.06	5	5	100	5	0.0583	N	Arsenic is naturally occurring. The maximum detected concentration is less than the MTCA Method A level, which is based on background concentrations for the State of Washington.
7440-47-3	Chromium (Total)	4/02; 8/02; 11/02; 2/03	1.18	286	24	20	83	50	NL	N	The maximum concentration is anomalous. The next highest detected concentration of 41.9 µg/l is less than MTCA Method A level
7440-47-3	Chromium (Dissolved)	4/02; 8/02; 11/02; 2/03	0.86	5.02	24	24	100	50	NL	N	Maximum concentration less than MTCA Method A level
7439-92-1	Lead (Total)	Apr-02		0.757	5	1	20	15	NL	N	Maximum concentration less than MTCA Method A level

Notes:

MTCA = Model Toxics Control Act from Washington Department of Ecology (2001)
PCE = Tetrachloroethene
TCE = Trichloroethene
NL = No limit

Table 4: Exposure Point Concentrations

	2,3,7,8-TCDD toxic equivalent (mg/kg)	**Pentachlorophenol, excluding area under mixing room (mg/kg)**	**Pentachlorophenol, under mixing room (mg/kg)**
Maximum Concentration	2.0E-03	5.81	15200
Minimum Concentration	6.7E-08	0.02	9
Average Concentration	3.6E-04	0.72	2947
95% UCL Concentration	6.8E-04	1.25	NA
EPC	**2.0E-03**	**5.81**	**15200**

Notes:
2,3,7,8-TCDD: 2,3,7,8-Tetrachlorodibenzo-p-dioxin
mg/kg: milligrams per kilogram
95% UCL: Ninety five percent upper confidence limit
EPC: Exposure point concentration

Table 5: 2,3,7,8-TCDD Toxicity Equivalents

Sample Number	Parameter	Result (pg/g)	TEF	2,3,7,8-TCDD toxic equivalent (pg/g)
RS-1-2	1,2,3,4,6,7,8-HpCDD	3000	0.01	90.3
RS-1-2	1,2,3,4,6,7,8-HpCDF	260	0.01	
RS-1-2	1,2,3,4,7,8,9-HpCDF	17	0.01	
RS-1-2	1,2,3,4,7,8-HxCDD	8.7	0.1	
RS-1-2	1,2,3,4,7,8-HxCDF	19	0.1	
RS-1-2	1,2,3,6,7,8-HxCDD	160	0.1	
RS-1-2	1,2,3,6,7,8-HxCDF	7.5	0.1	
RS-1-2	1,2,3,7,8,9-HxCDD	35	0.1	
RS-1-2	1,2,3,7,8,9-HxCDF	ND	0.1	
RS-1-2	1,2,3,7,8-PeCDD	6.4	0.5	
RS-1-2	1,2,3,7,8-PeCDF	10	0.05	
RS-1-2	2,3,4,6,7,8-HxCDF	5.6	0.1	
RS-1-2	2,3,4,7,8-PeCDF	7.3	0.5	
RS-1-2	2,3,7,8-TCDD	ND	1	
RS-1-2	2,3,7,8-TCDF	5.1	0.1	
RS-1-2	OCDD	25000	0.001	
RS-1-2	OCDF	1100	0.001	
RS-1-2 DUP	1,2,3,4,6,7,8-HpCDD	2300	0.01	66.7
RS-1-2 DUP	1,2,3,4,6,7,8-HpCDF	190	0.01	
RS-1-2 DUP	1,2,3,4,7,8,9-HpCDF	13	0.01	
RS-1-2 DUP	1,2,3,4,7,8-HxCDD	8.6	0.1	
RS-1-2 DUP	1,2,3,4,7,8-HxCDF	14	0.1	
RS-1-2 DUP	1,2,3,6,7,8-HxCDD	110	0.1	
RS-1-2 DUP	1,2,3,6,7,8-HxCDF	4.9	0.1	
RS-1-2 DUP	1,2,3,7,8,9-HxCDD	28	0.1	
RS-1-2 DUP	1,2,3,7,8,9-HxCDF	ND	0.1	
RS-1-2 DUP	1,2,3,7,8-PeCDD	4.8	0.5	
RS-1-2 DUP	1,2,3,7,8-PeCDF	7.9	0.05	
RS-1-2 DUP	2,3,4,6,7,8-HxCDF	4.3	0.1	
RS-1-2 DUP	2,3,4,7,8-PeCDF	5.5	0.5	
RS-1-2 DUP	2,3,7,8-TCDD	ND	1	
RS-1-2 DUP	2,3,7,8-TCDF	3.6	0.1	
RS-1-2 DUP	OCDD	18000	0.001	
RS-1-2 DUP	OCDF	800	0.001	
RS-4-2	1,2,3,4,6,7,8-HpCDD	4700	0.01	122.2
RS-4-2	1,2,3,4,6,7,8-HpCDF	630	0.01	
RS-4-2	1,2,3,4,7,8,9-HpCDF	80	0.01	
RS-4-2	1,2,3,4,7,8-HxCDD	14	0.1	
RS-4-2	1,2,3,4,7,8-HxCDF	22	0.1	
RS-4-2	1,2,3,6,7,8-HxCDD	110	0.1	
RS-4-2	1,2,3,6,7,8-HxCDF	20	0.1	
RS-4-2	1,2,3,7,8,9-HxCDD	37	0.1	
RS-4-2	1,2,3,7,8,9-HxCDF	ND	0.1	
RS-4-2	1,2,3,7,8-PeCDD	3.9	0.5	
RS-4-2	1,2,3,7,8-PeCDF	ND	0.05	
RS-4-2	2,3,4,6,7,8-HxCDF	7.7	0.1	

Table 5: 2,3,7,8-TCDD Toxicity Equivalents

Sample Number	Parameter	Result (pg/g)	TEF	2,3,7,8-TCDD toxic equivalent (pg/g)
RS-4-2	2,3,4,7,8-PeCDF	ND	0.5	
RS-4-2	2,3,7,8-TCDD	ND	1	
RS-4-2	2,3,7,8-TCDF	ND	0.1	
RS-4-2	OCDD	42000	0.001	
RS-4-2	OCDF	3100	0.001	
RS-5-0-1	1,2,3,4,6,7,8-HpCDD	15000	0.01	413.8
RS-5-0-1	1,2,3,4,6,7,8-HpCDF	1500	0.01	
RS-5-0-1	1,2,3,4,7,8,9-HpCDF	120	0.01	
RS-5-0-1	1,2,3,4,7,8-HxCDD	35	0.1	
RS-5-0-1	1,2,3,4,7,8-HxCDF	33	0.1	
RS-5-0-1	1,2,3,6,7,8-HxCDD	360	0.1	
RS-5-0-1	1,2,3,6,7,8-HxCDF	30	0.1	
RS-5-0-1	1,2,3,7,8,9-HxCDD	120	0.1	
RS-5-0-1	1,2,3,7,8,9-HxCDF	ND	0.1	
RS-5-0-1	1,2,3,7,8-PeCDD	26	0.5	
RS-5-0-1	1,2,3,7,8-PeCDF	3.7	0.05	
RS-5-0-1	2,3,4,6,7,8-HxCDF	16	0.1	
RS-5-0-1	2,3,4,7,8-PeCDF	3.5	0.5	
RS-5-0-1	2,3,7,8-TCDD	2.2	1	
RS-5-0-1	2,3,7,8-TCDF	0.89	0.1	
RS-5-0-1	OCDD	160000	0.001	
RS-5-0-1	OCDF	11000	0.001	
RS-5-2	1,2,3,4,6,7,8-HpCDD	3400	0.01	76.9
RS-5-2	1,2,3,4,6,7,8-HpCDF	320	0.01	
RS-5-2	1,2,3,4,7,8,9-HpCDF	33	0.01	
RS-5-2	1,2,3,4,7,8-HxCDD	ND	0.1	
RS-5-2	1,2,3,4,7,8-HxCDF	4.8	0.1	
RS-5-2	1,2,3,6,7,8-HxCDD	73	0.1	
RS-5-2	1,2,3,6,7,8-HxCDF	4.5	0.1	
RS-5-2	1,2,3,7,8,9-HxCDD	7.6	0.1	
RS-5-2	1,2,3,7,8,9-HxCDF	ND	0.1	
RS-5-2	1,2,3,7,8-PeCDD	ND	0.5	
RS-5-2	1,2,3,7,8-PeCDF	ND	0.05	
RS-5-2	2,3,4,6,7,8-HxCDF	ND	0.1	
RS-5-2	2,3,4,7,8-PeCDF	ND	0.5	
RS-5-2	2,3,7,8-TCDD	ND	1	
RS-5-2	2,3,7,8-TCDF	ND	0.1	
RS-5-2	OCDD	28000	0.001	
RS-5-2	OCDF	2400	0.001	
RS-6-0-1	1,2,3,4,6,7,8-HpCDD	2900	0.01	223.8
RS-6-0-1	1,2,3,4,6,7,8-HpCDF	180	0.01	
RS-6-0-1	1,2,3,4,7,8,9-HpCDF	12	0.01	
RS-6-0-1	1,2,3,4,7,8-HxCDD	46	0.1	
RS-6-0-1	1,2,3,4,7,8-HxCDF	8.1	0.1	
RS-6-0-1	1,2,3,6,7,8-HxCDD	84	0.1	
RS-6-0-1	1,2,3,6,7,8-HxCDF	11	0.1	

Table 5: 2,3,7,8-TCDD Toxicity Equivalents

Sample Number	Parameter	Result (pg/g)	TEF	2,3,7,8-TCDD toxic equivalent (pg/g)
RS-6-0-1	1,2,3,7,8,9-HxCDD	150	0.1	
RS-6-0-1	1,2,3,7,8,9-HxCDF	ND	0.1	
RS-6-0-1	1,2,3,7,8-PeCDD	35	0.5	
RS-6-0-1	1,2,3,7,8-PeCDF	ND	0.05	
RS-6-0-1	2,3,4,6,7,8-HxCDF	7.8	0.1	
RS-6-0-1	2,3,4,7,8-PeCDF	ND	0.5	
RS-6-0-1	2,3,7,8-TCDD	3.6	1	
RS-6-0-1	2,3,7,8-TCDF	1.1	0.1	
RS-6-0-1	OCDD	140000	0.001	
RS-6-0-1	OCDF	1000	0.001	
RS7-0-1	1,2,3,4,6,7,8-HpCDD	74000	0.01	1971.3
RS7-0-1	1,2,3,4,6,7,8-HpCDF	10000	0.01	
RS7-0-1	1,2,3,4,7,8,9-HpCDF	1300	0.01	
RS7-0-1	1,2,3,4,7,8-HxCDD	210	0.1	
RS7-0-1	1,2,3,4,7,8-HxCDF	350	0.1	
RS7-0-1	1,2,3,6,7,8-HxCDD	1800	0.1	
RS7-0-1	1,2,3,6,7,8-HxCDF	440	0.1	
RS7-0-1	1,2,3,7,8,9-HxCDD	600	0.1	
RS7-0-1	1,2,3,7,8,9-HxCDF	7.3	0.1	
RS7-0-1	1,2,3,7,8-PeCDD	63	0.5	
RS7-0-1	1,2,3,7,8-PeCDF	27	0.05	
RS7-0-1	2,3,4,6,7,8-HxCDF	120	0.1	
RS7-0-1	2,3,4,7,8-PeCDF	17	0.5	
RS7-0-1	2,3,7,8-TCDD	3	1	
RS7-0-1	2,3,7,8-TCDF	2.6	0.1	
RS7-0-1	OCDD	670000	0.001	
RS7-0-1	OCDF	51000	0.001	
RS7-2	1,2,3,4,6,7,8-HpCDD	290	0.01	7.5
RS7-2	1,2,3,4,6,7,8-HpCDF	37	0.01	
RS7-2	1,2,3,4,7,8,9-HpCDF	4.4	0.01	
RS7-2	1,2,3,4,7,8-HxCDD	ND	0.1	
RS7-2	1,2,3,4,7,8-HxCDF	ND	0.1	
RS7-2	1,2,3,6,7,8-HxCDD	5.4	0.1	
RS7-2	1,2,3,6,7,8-HxCDF	ND	0.1	
RS7-2	1,2,3,7,8,9-HxCDD	ND	0.1	
RS7-2	1,2,3,7,8,9-HxCDF	ND	0.1	
RS7-2	1,2,3,7,8-PeCDD	ND	0.5	
RS7-2	1,2,3,7,8-PeCDF	ND	0.05	
RS7-2	2,3,4,6,7,8-HxCDF	ND	0.1	
RS7-2	2,3,4,7,8-PeCDF	ND	0.5	
RS7-2	2,3,7,8-TCDD	ND	1	
RS7-2	2,3,7,8-TCDF	ND	0.1	
RS7-2	OCDD	3400	0.001	
RS7-2	OCDF	200	0.001	
RS-4-10	1,2,3,4,6,7,8-HpCDD	43	0.01	5.8
RS-4-10	1,2,3,4,6,7,8-HpCDF	4.8	0.01	

Table 5: 2,3,7,8-TCDD Toxicity Equivalents

Sample Number	Parameter	Result (pg/g)	TEF	2,3,7,8-TCDD toxic equivalent (pg/g)
RS-4-10	1,2,3,4,7,8,9-HpCDF	ND	0.01	
RS-4-10	1,2,3,4,7,8-HxCDD	ND	0.1	
RS-4-10	1,2,3,4,7,8-HxCDF	ND	0.1	
RS-4-10	1,2,3,6,7,8-HxCDD	ND	0.1	
RS-4-10	1,2,3,6,7,8-HxCDF	ND	0.1	
RS-4-10	1,2,3,7,8,9-HxCDD	ND	0.1	
RS-4-10	1,2,3,7,8,9-HxCDF	ND	0.1	
RS-4-10	1,2,3,7,8-PeCDD	ND	0.5	
RS-4-10	1,2,3,7,8-PeCDF	ND	0.05	
RS-4-10	2,3,4,6,7,8-HxCDF	ND	0.1	
RS-4-10	2,3,4,7,8-PeCDF	ND	0.5	
RS-4-10	2,3,7,8-TCDD	ND	1	
RS-4-10	2,3,7,8-TCDF	ND	0.1	
RS-4-10	OCDD	5300	0.001	
RS-4-10	OCDF	16	0.001	
RS-5-5	1,2,3,4,6,7,8-HpCDD	69000	0.01	1398.2
RS-5-5	1,2,3,4,6,7,8-HpCDF	5500	0.01	
RS-5-5	1,2,3,4,7,8,9-HpCDF	410	0.01	
RS-5-5	1,2,3,4,7,8-HxCDD	6.9	0.1	
RS-5-5	1,2,3,4,7,8-HxCDF	63	0.1	
RS-5-5	1,2,3,6,7,8-HxCDD	1000	0.1	
RS-5-5	1,2,3,6,7,8-HxCDF	20	0.1	
RS-5-5	1,2,3,7,8,9-HxCDD	35	0.1	
RS-5-5	1,2,3,7,8,9-HxCDF	9	0.1	
RS-5-5	1,2,3,7,8-PeCDD	ND	0.5	
RS-5-5	1,2,3,7,8-PeCDF	ND	0.05	
RS-5-5	2,3,4,6,7,8-HxCDF	7.1	0.1	
RS-5-5	2,3,4,7,8-PeCDF	ND	0.5	
RS-5-5	2,3,7,8-TCDD	ND	1	
RS-5-5	2,3,7,8-TCDF	ND	0.1	
RS-5-5	OCDD	490000	0.001	
RS-5-5	OCDF	45000	0.001	
TF-1-15	1,2,3,4,6,7,8-HpCDD	ND	0.01	0.076
TF-1-15	1,2,3,4,6,7,8-HpCDF	ND	0.01	
TF-1-15	1,2,3,4,7,8,9-HpCDF	ND	0.01	
TF-1-15	1,2,3,4,7,8-HxCDD	ND	0.1	
TF-1-15	1,2,3,4,7,8-HxCDF	ND	0.1	
TF-1-15	1,2,3,6,7,8-HxCDD	ND	0.1	
TF-1-15	1,2,3,6,7,8-HxCDF	ND	0.1	
TF-1-15	1,2,3,7,8,9-HxCDD	ND	0.1	
TF-1-15	1,2,3,7,8,9-HxCDF	ND	0.1	
TF-1-15	1,2,3,7,8-PeCDD	ND	0.5	
TF-1-15	1,2,3,7,8-PeCDF	ND	0.05	
TF-1-15	2,3,4,6,7,8-HxCDF	ND	0.1	
TF-1-15	2,3,4,7,8-PeCDF	ND	0.5	
TF-1-15	2,3,7,8-TCDD	ND	1	

Table 5: 2,3,7,8-TCDD Toxicity Equivalents

Sample Number	Parameter	Result (pg/g)	TEF	2,3,7,8-TCDD toxic equivalent (pg/g)
TF-1-15	2,3,7,8-TCDF	ND	0.1	
TF-1-15	OCDD	76	0.001	
TF-1-15	OCDF	ND	0.001	
TF-5-5	1,2,3,4,6,7,8-HpCDD	4	0.01	0.067
TF-5-5	1,2,3,4,6,7,8-HpCDF	ND	0.01	
TF-5-5	1,2,3,4,7,8,9-HpCDF	ND	0.01	
TF-5-5	1,2,3,4,7,8-HxCDD	ND	0.1	
TF-5-5	1,2,3,4,7,8-HxCDF	ND	0.1	
TF-5-5	1,2,3,6,7,8-HxCDD	ND	0.1	
TF-5-5	1,2,3,6,7,8-HxCDF	ND	0.1	
TF-5-5	1,2,3,7,8,9-HxCDD	ND	0.1	
TF-5-5	1,2,3,7,8,9-HxCDF	ND	0.1	
TF-5-5	1,2,3,7,8-PeCDD	ND	0.5	
TF-5-5	1,2,3,7,8-PeCDF	ND	0.05	
TF-5-5	2,3,4,6,7,8-HxCDF	ND	0.1	
TF-5-5	2,3,4,7,8-PeCDF	ND	0.5	
TF-5-5	2,3,7,8-TCDD	ND	1	
TF-5-5	2,3,7,8-TCDF	ND	0.1	
TF-5-5	OCDD	27	0.001	
TF-5-5	OCDF	ND	0.001	
TF-6-10	1,2,3,4,6,7,8-HpCDD	130	0.01	7.3
TF-6-10	1,2,3,4,6,7,8-HpCDF	ND	0.01	
TF-6-10	1,2,3,4,7,8,9-HpCDF	ND	0.01	
TF-6-10	1,2,3,4,7,8-HxCDD	2.9	0.1	
TF-6-10	1,2,3,4,7,8-HxCDF	ND	0.1	
TF-6-10	1,2,3,6,7,8-HxCDD	3.1	0.1	
TF-6-10	1,2,3,6,7,8-HxCDF	ND	0.1	
TF-6-10	1,2,3,7,8,9-HxCDD	ND	0.1	
TF-6-10	1,2,3,7,8,9-HxCDF	ND	0.1	
TF-6-10	1,2,3,7,8-PeCDD	ND	0.5	
TF-6-10	1,2,3,7,8-PeCDF	ND	0.05	
TF-6-10	2,3,4,6,7,8-HxCDF	ND	0.1	
TF-6-10	2,3,4,7,8-PeCDF	ND	0.5	
TF-6-10	2,3,7,8-TCDD	ND	1	
TF-6-10	2,3,7,8-TCDF	ND	0.1	
TF-6-10	OCDD	5400	0.001	
TF-6-10	OCDF	8.6	0.001	

Notes:
pg/g: Picograms per gram
TEF: Toxicity equivalent factor. TEFs are from EPA 1989.
ND: Not detected

Table 6: Soil Data for Site, Excluding Area Under Mixing Room

Sample Number	COPC	Result (ug/kg)	MDL (ug/kg)	Conc. for Calculating Average (ug/kg)
RS-1-2	Pentachlorophenol	109	29	109
RS-1-5	Pentachlorophenol	ND	32.2	16.1
RS-2-10	Pentachlorophenol	ND	36.3	18.15
RS-3-10	Pentachlorophenol	ND	35.8	17.9
RS-4-10	Pentachlorophenol	472	33.3	472
RS-4-15	Pentachlorophenol	ND	38.4	19.2
RS-4-2	Pentachlorophenol	609	30.4	609
RS-5-0-1	Pentachlorophenol	2960	30.3	2960
RS-5-10	Pentachlorophenol	192	36.6	192
RS-5-2	Pentachlorophenol	3180	30.2	3180
RS-5-5	Pentachlorophenol	3440	32.5	3440
RS-6-0-1	Pentachlorophenol	177	30.5	177
RS-6-2	Pentachlorophenol	ND	33.4	16.7
RS7-0-1	Pentachlorophenol	5810	29.3	5810
RS7-2	Pentachlorophenol	ND	31.8	15.9
RS7-5	Pentachlorophenol	ND	31.8	15.9
RS8-10	Pentachlorophenol	ND	35.3	17.65
TF-1-15	Pentachlorophenol	ND	36	18
TF-2-15	Pentachlorophenol	ND	33.7	16.85
TF-3-15	Pentachlorophenol	ND	33.6	16.8
TF-5-5	Pentachlorophenol	ND	34.7	17.35
TF-6-10	Pentachlorophenol	ND	35.1	17.55
TF-6-15	Pentachlorophenol	ND	37.7	18.85
TF-7-15	Pentachlorophenol	ND	30.6	15.3

Notes:
COPC: Chemical of potential concern
ug/kg: Micrograms per kilogram
MDL: Method detection limit

Table 7: Soil Data Under Mixing Room

Sample Number	COPC	Result (ug/kg)	MDL (ug/kg)	Conc. for Calculating Average (ug/kg)
B7-6-6.5-7	Pentachlorophenol	15200000	unk	15200000
ISB-1-12.5	Pentachlorophenol	890000	unk	890000
ISB-2-5.5	Pentachlorophenol	690000	unk	690000
ISB-2-10.5	Pentachlorophenol	490000	unk	490000
ISB-3-10.5	Pentachlorophenol	400000	unk	400000
ISB-5-10.5	Pentachlorophenol	ND	18000	9000

Notes:
COPC: Chemical of potential concern
ug/kg: Micrograms per kilogram
MDL: Method detection limit

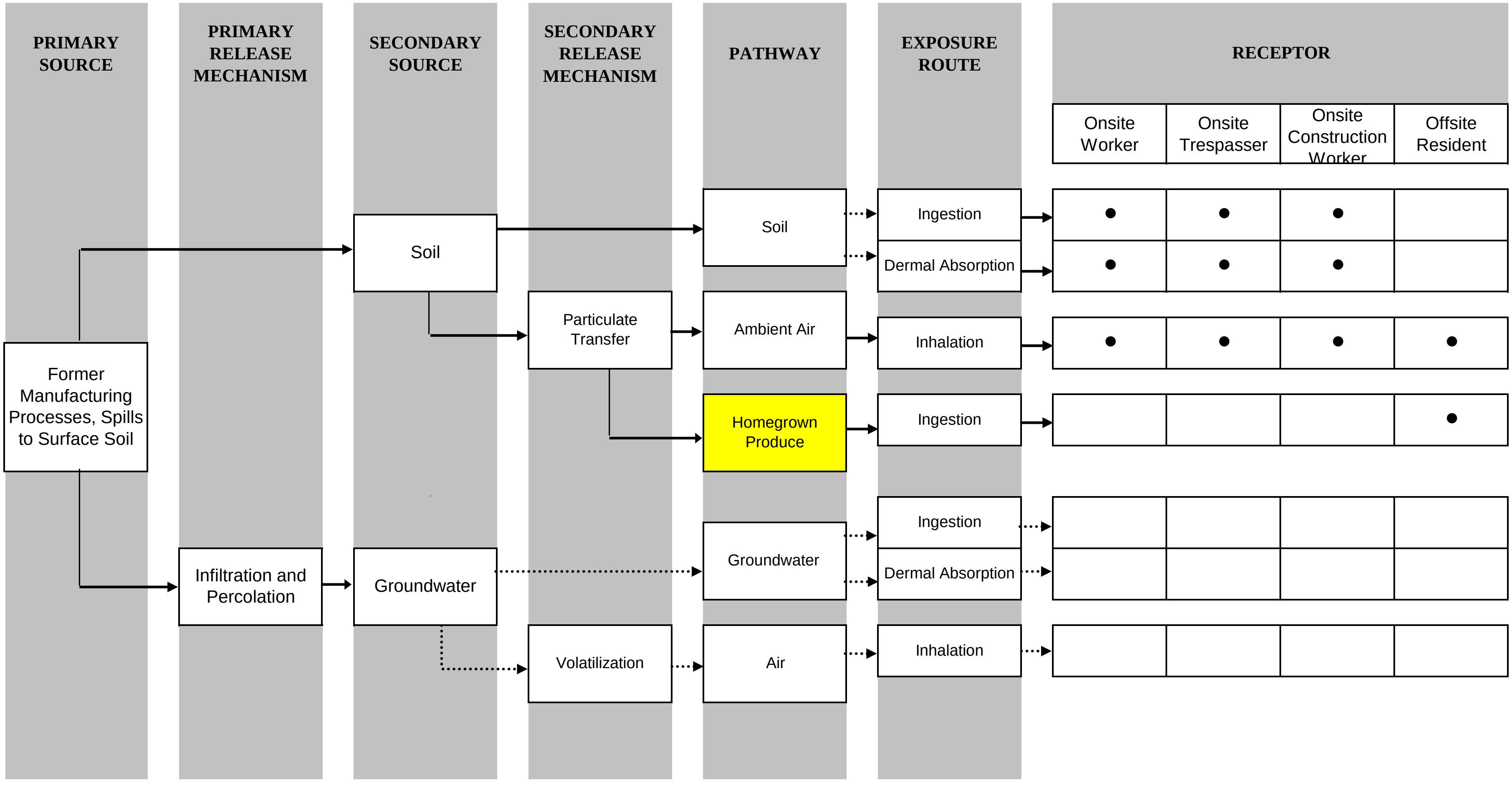
Table 8: Comparison With Cleanup Levels

	EPC (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Unrestricted Land Use (mg/kg)
2,3,7,8-TCDD toxic equivalent	2.0E-03	NA	6.67E-06
Pentachlorophenol, excluding area under mixing room	5.81	NA	8.33
Pentachlorophenol, under mixing room	15200	NA	8.33

Notes:
mg/kg: milligrams per kilogram
EPC: Exposure point concentration

Figure

Figure 1: Conceptual Site Model



Pathway	Exposure Route	Onsite Worker	Onsite Trespasser	Onsite Construction Worker	Offsite Resident
Soil	Ingestion	●	●	●	
Soil	Dermal Absorption	●	●	●	
Ambient Air	Inhalation	●	●	●	●
Homegrown Produce	Ingestion				●
Groundwater	Ingestion				
Groundwater	Dermal Absorption				
Air	Inhalation				

Conceptual Site Model - Potential Exposure to Soil and Groundwater at Tetra Pak Site

● Potentially complete exposure pathway for receptor

→ Complete Pathway

⋯→ Incomplete Pathway

Section 3 – Feasibility Study

Section 3: Feasibility Study

The Feasibility Study (FS) for the former Strebor facility (site) is presented in two sections: the first section addresses the selection of cleanup standards and the second section presents the rationale for selection of remedial actions for the study area.

3.1 Selection of Cleanup Standards

This section addresses the selection of cleanup standards for the study area and is presented in the following eight subsections:

- Section 3.1.1 presents the chemicals of concern (COC) for the site.
- Section 3.1.2 discusses potential receptors and exposure routes.
- Section 3.1.3 describes MTCA Regulation cleanup methods (A, B, and C).
- Section 3.1.4 describes applicable or relevant and appropriate requirements (ARARs) for the site.
- Section 3.1.5 provides justification for using the MTCA Method B residential cleanup level at the site.
- Section 3.1.6 discusses remediation levels established for the site.
- Section 3.1.7 presents the points of compliance for attainment of the soil cleanup level.
- Section 3.1.8 presents an estimate of the volume of soil at the site that exceeds the MTCA Method B cleanup level.

3.1.1 Chemicals of Concern

Pentachlorophenol and dioxin compounds are identified as the COC at the site. Low levels of VOCs, including PCE, TCE, and 1,2-DCE were detected in groundwater samples collected at the site. These compounds are part of a regional groundwater contaminant plume from offsite sources, and are not addressed as part of this FS.

3.1.2 Potential Receptors

The site is currently used for industrial operations and the proposed future use is also industrial. Potential site receptors include employees and contractors who work at the site and authorized visitors. These individuals could ingest small quantities of soil, absorb chemicals through their skin, or inhale chemicals adsorbed to fugitive dust particles.

3.1.3 Cleanup Levels

MTCA outlines three basic approaches for establishing cleanup levels: Methods A, B, and C.

Method A is appropriate for routine cleanup projects involving relatively few hazardous substances and for sites where numerical standards are available for indicator hazardous substances.

Method B is the standard method for determining cleanup levels for soil, groundwater, surface water, and air. Method B consists of two approaches: standard and modified. Standard Method B uses default formulas, assumptions, and procedures to develop cleanup levels. Modified Method B uses chemical-specific or site-specific information to change certain assumptions to calculate different cleanup levels.

Method C is a conditional method for establishing cleanup levels. Method C provides cleanup levels that protect human health and the environment for specified site uses. Method C soil cleanup levels may only be established where the area under consideration is an industrial property and meets the criteria for establishing industrial site cleanup levels under WAC 173-340-745.

3.1.4 Potential Applicable or Relevant and Appropriate Requirements (ARARs)

MTCA requires that all cleanup actions comply with ARARs (WAC 173-340-710). MTCA presents the definitions for ARARs [WAC 173-340-710(3) and (4)] as follows:

Legally applicable requirements include "... those cleanup standards, standards of control, and other environmental protection requirements, criteria, or limitations adopted under state or federal law that specifically address a hazardous substance, cleanup action, location or other circumstance at the site."

Relevant and appropriate requirements include "...those cleanup standards, standards of control, and other environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site."

ARARs can be location-specific, action-specific, or chemical-specific. Location-specific ARARs address restrictions on activities or permissible chemical concentrations in a particular location. An example of a location-specific ARAR would include the Shoreline Management Act of 1971 (Chapter 13.10 of City of Vancouver Code), which requires construction activities within 200 feet of the shoreline to be performed in accordance with applicable City codes. There are no location-specific ARARs for this site.

Action-specific ARARs regulate technologies or activities that involve handling or treating hazardous wastes. Action-specific ARARs are typically technology-based or activity-based requirements or limitations. Table 1 describes the potential action-specific ARARs for the site.

Chemical-specific ARARs are typically health-based or risk-based numerical values that result in acceptable concentrations of chemicals that may be detected in or discharged to the environment. The ARARs for chemicals detected onsite include standards such as maximum contaminant levels under the Safe Drinking Water Act and associated state regulations. Potential chemical-specific ARARs for the site are identified on applicable analytical tables presented in the RI sections of this FS. Chemical-specific ARARs are also identified in Table 2 and will be used to evaluate the need for remedial action.

3.1.5 Identification and Justification of Site Cleanup Levels

Method A standards have not been developed for PCP or dioxin compounds; therefore, Method A cleanup levels are not appropriate for this site. The Method B cleanup level for PCP and dioxins is appropriate for the site because the site meets the criteria for Method B.

Method C Industrial Cleanup Levels may be appropriate for this site since current and expected future use is continued industrial activity. However, non-industrial land uses are present adjacent to the site. Method B Cleanup levels, unrestricted land use, provide the most protective cleanup scenario. Although the site may qualify for use of Method C because it is an industrial site, the Method B unrestricted land use scenario will be used to evaluate remedial alternatives for the site.

3.1.5.1 Soil Cleanup Levels

MTCA Method B cleanup levels will be used to evaluate the need for soil remedial action at the site and to address the direct contact exposure pathway. The PCP and dioxin cleanup levels were determined by evaluating the most stringent criteria considering all exposure pathways; direct contact exposure and protection of groundwater (leachability). The soil cleanup levels, calculated from values in the CLARC Version 3.1 database [Washington State Department of Ecology 2001], are 0.0116 mg/kg for PCP and 6.67×10^{-6} mg/kg for dioxin as 2,3,7,8-TCDD. The most stringent cleanup level for dioxin compounds was under the direct contact exposure scenario. The most stringent cleanup level for PCP was under the protection of groundwater scenario.

3.1.5.2 Groundwater Cleanup Levels

MTCA Method B cleanup levels for groundwater are appropriate comparison standards. The groundwater cleanup level for PCP is 0.729 µg/L as tabulated in the CLARC Version 3.1 database Method B (Ecology 2001).

3.1.5.3 Surface Water Cleanup Levels

As identified in the RI, there are no surface water discharges from the site and shallow groundwater is not expected to migrate to nearby surface water in the immediate vicinity of the site.

3.1.6 Remediation Levels

MTCA anticipates a combination of remedial methods in developing cleanup alternatives for a site. Remediation levels are the chemical concentration levels where differing remedial methods may be employed. Remediation levels may be established by a variety of methods, including risk assessment, disproportionate cost analysis, or other means.

3.1.6.1 Soil Remediation Levels

Cleanup levels for soil have been established that: 1) address direct contact exposures, and 2) address the protection of groundwater that could be used for drinking water. Site physical conditions already provide some level of protection to limit exposures. The existing building effectively "caps" much of the contaminated soil, limiting direct contact exposure and infiltration of rainwater that can leach contaminants to groundwater. Cleanup levels for the COC are very low, at or near detection levels. Removal of the building is impractical given ongoing operations at the site. The COC are contained and exposure routes are eliminated for those impacted soils beneath the building. In addition, conventional treatment technologies are not practical for treating the soil to achieve such low cleanup levels. The existence of these physical conditions will be incorporated into this FS analysis and alternatives will be developed assuming the existing building is maintained. Institutional controls can be implemented to require additional actions for soil below the building if impacted soils remain and the building foundations are removed.

Based on the aforementioned, a remediation level for PCP and dioxin compounds will be established to protect for direct contact exposures (using MTCA Method B), as might be encountered by construction workers during site maintenance activities, or from near surface (upper 15 feet as required under MTCA) soil outside of the building, that may be contacted by site workers or the public. The MTCA Method B direct contact exposure value for PCP is 8.33 mg/kg and 6.67×10^{-6} mg/kg for dioxin compounds (as 2,3,7,8-TCDD equivalents). Institutional controls, including requirements to maintain containment, continued industrial land use, and access restrictions, will be part of all remedial alternatives that do not address impacted soil beneath the existing building. Institutional controls will address soils with residual COC at concentrations between the remediation levels and cleanup levels.

3.1.6.2 Groundwater Remediation Levels

PCP has been sporadically detected in three monitoring wells above laboratory detection levels, including three wells that indicated PCP concentrations above cleanup levels on three occasions. Active remediation of PCP in groundwater is impractical since PCP has not been consistently detected and active remedial technologies cannot be effectively employed to remove PCP at sporadic trace concentrations. Therefore, since it is impractical to actively treat groundwater, a combination of source control, groundwater use restrictions, and monitoring can be employed to address PCP that has been detected and possible ongoing groundwater impacts. Soil cleanup and remediation levels will address the possible ongoing leaching of PCP to groundwater. Use restrictions will prohibit the use of onsite groundwater for drinking water purposes and monitoring will evaluate potential changing conditions and the effectiveness of source control measures. Source control actions will reduce possible PCP migration to groundwater.

This approach is consistent with MTCA in that the point of compliance with cleanup levels can be established at the site boundary when groundwater remediation is impractical. Since consistent detections of PCP have not been found to date, it is not expected that PCP would migrate beyond the site boundary at detectable concentrations, especially following source control. Ongoing monitoring at the site boundary will provide a mechanism to evaluate whether PCP is migrating offsite above cleanup levels.

3.1.7 Points of Compliance

The point of compliance, based on the expected exposure route, is the point (or points) where cleanup levels established for the site are to be achieved. The potential exposure routes at this site are:

- Human exposure via direct contact or ingestion of site soils.
- Human consumption of groundwater.

The points of compliance for site media were established as follows:

- Soil: Throughout the site to a depth of 15 feet below ground surface for direct contact.
- Soil: Throughout the site to the depth of groundwater for groundwater protection.
- Groundwater: As discussed in the RI, groundwater is not a potable water source at the site. Use restrictions will be included in all alternatives to be considered. Since it is impracticable to actually remediate PCP in groundwater, the point of compliance will be the site boundary.

3.1.8 Estimated Areas and Volume of Site Material that May Require Remediation

3.1.8.1 Soil

Based on the results of the RI, the remediation areas include portions of the site where COC were detected in soil at concentrations exceeding MTCA Method B soil cleanup levels. For purposes of this FS, PCP and dioxin compounds have been detected at two principal areas onsite.

- Shallow soils along the railroad spur (see Figure 1) exceeded remediation levels for dioxin compounds. PCP results for soil samples collected along the railroad spur were below the established remediation level.
- Soils under the floor of the building, beneath the former mixing room, exceeded the cleanup and remediation level for PCP and dioxin compounds.

Based on estimated depth of impacted soils and concentrations above the remediation level, the approximate volume of material along the railroad spur is estimated at 55 cubic yards (yd^3). The approximate volume of material under the floor of the building above the established remediation level is estimated at 3,100 yd^3. As discussed above, the existing building effectively caps the impacted soil beneath the building. Institutional controls will be included for all alternatives that do not address impacted soil beneath the building.

3.1.8.2 Groundwater

As discussed above, the groundwater cleanup level for PCP, based on MTCA Method B residential groundwater cleanup, is 0.729 µg/l. Compliance with this cleanup level shall be assessed at the property boundary and monitored in selected perimeter monitoring wells.

3.2 Rationale for Selecting the Remedial Action

This section presents the rationale for selecting potential remedial actions that address soil containing PCP and dioxin at concentrations exceeding the cleanup levels.

3.2.1 Identification and Evaluation of Potential Remedial Methods

This FS evaluated general response actions, remedial technologies, and process options that may be appropriate for addressing site conditions. General response actions are broad categories of remedial methods that can address the cleanup of a specific matrix (i.e., soil). Remedial technologies are various techniques within the general response actions. Process options are specific processes within each remedial technology category. For example, ex-situ treatment is a general response action. Physical/chemical treatment is a remedial technology within the aboveground treatment category, and chemical oxidation is a process option within the physical/chemical remedial technology class.

Process options were then screened for their effectiveness, implementability, and relative cost.

Effectiveness involves the option’s ability to:

- Process the anticipated volume of soil.
- Meet the established remediation level and/or cleanup level.
- Protect human health and the environment during construction and implementation.

The second criterion for evaluating process options (i.e., implementability) includes technical and administrative considerations. This criterion focuses on the ability to technically address chemicals in the soil at concentrations detected during the RI. It also evaluates the permits necessary for onsite and offsite activities and discharges, and the availability of offsite facilities, services, and materials.

Cost, the final criterion for evaluating process options, is based on engineering judgments rather than detailed estimates. Process options that are judged to be similar in effectiveness and feasibility, yet cost much more than other process options in the same technology category, were eliminated from further consideration.

Process options were eliminated from further consideration if they were determined to be inappropriate for site conditions or planned future site uses. Process options that are innovative but not yet proven were also eliminated. If more than one process option in a remedial technology group was identified as potentially appropriate for the site, one process option was selected to represent that technology group. Table 3 presents the identification and evaluation of general response actions, remedial technologies, and process options for soil.

3.2.2 Identification and Description of Remedial Alternatives

This section identifies alternatives that may be appropriate for site remediation. Section 3.2.2.1 presents site-specific descriptions of the remedial process options that are combined into site alternatives. Section 3.2.2.2 identifies the alternatives for the site, and Section 3.2.2.3 presents descriptions of the remedial alternatives.

3.2.2.1 Description of Process Options Selected for Developing Remedial Alternatives

This section presents site-specific descriptions of the process options shown in Table 3.

Institutional Controls

Institutional controls include physical barriers (i.e., fencing) and deed restrictions. The facility is currently fenced. Deed restrictions are controls on land use that are described in a covenant on the property, as executed by the property owner and recorded with the Registrar of Deeds for Clark County. Deed restrictions are required whenever contaminants remain onsite at concentrations exceeding appropriate site cleanup levels, for the purposes of the FS, MTCA Method B. Deed restrictions meet the requirement of institutional controls as defined in WAC 173-340-440 (b). In addition, long-term monitoring would be required if institutional controls or containment is the selected cleanup action for a portion of this site, as defined in WAC 173-340-410. Institutional controls would also include a periodic review (at least every five years) by Ecology if institutional controls and/or financial assurance is required as part of the cleanup action. This review entails evaluating the remedial actions to assess whether human health and the environment remain protected.

Containment

Containment options for this site could include covers and caps. Cover and cap material options include soil, clay, concrete, asphalt, or an engineered RCRA cap. Covers and caps provide a physical barrier to prevent direct contact with impacted soils and reduce leaching to groundwater. Capping and/or covers may require periodic inspections and repairs (as needed) to maintain integrity.

Soils under the former mixing room floor are currently covered. The floor of the warehouse building is concrete and prevents direct contact with soils by employees. The flooring and the roof of the warehouse prevent exposure to stormwater and reduces leaching to groundwater.

Construction of a cover along the railroad spur would require removal of the spur. Prior to construction of the cover, soils impacted with COC may need to be excavated and transported offsite for treatment and/or disposal.

Ex-Situ Treatment

Ex-situ treatment options for this site could include offsite biological treatment. Treated soils would be disposed of in a landfill.

Landfarming is a full-scale bioremediation technology, and involves the bio-oxidation of organic contaminants by microorganisms. This method usually incorporates liners and other methods to control leaching of contaminants. Contaminated soils are excavated and applied to lined beds and periodically turned over or tilled for aeration. Soil conditions are often controlled for moisture content, pH, and soil amendments (i.e., bulking agents, nutrients for microorganisms). This technology will most likely require a limited bench-scale test to identify the optimal approach for treatment.

In-Situ Treatment

An in-situ treatment option for this site could include chemical oxidation. Chemical oxidation using liquid hydrogen peroxide can rapidly degrade a variety of organic compounds. Oxidant delivery systems often employ vertical or horizontal injection wells and sparge points with forced advection (horizontal movement) to rapidly move the oxidant into the subsurface. The rate and extent of degradation are dictated by the properties of the chemical itself and its susceptibility to oxidative degradation, as well as the matrix conditions, most notably, pH, temperature, soil moisture content, the concentration of oxidant, and the concentration of other oxidant-consuming substances such as natural organic matter and reduced minerals as well as carbonate and other free radical scavengers.

Disposal

Impacted site soils could be excavated and trucks could transport soils to a permitted offsite facility for disposal. A total of 55 yd^3 of soil that exceeds the proposed remediation levels would be excavated and removed from along the railroad spur. Soils removed along the rail spur would not be designated as hazardous waste; the specific source of PCP is unknown in this area. Soils removed from this area would be managed at a permitted disposal facility.

3.2.2.2 Development of Alternatives

This section identifies alternatives that could be appropriate for each remediation area. These alternatives are identified using the requirements and expectations described in the MTCA [WAC 173-340-360 (3)(f)], which include:

- **Protectiveness** of human health and the environment.
- **Permanence** to the degree which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances.
- **Cost** to implement the alternative.
- **Effectiveness over the long-term**.
- **Management of short-term risks**.

- **Technical and administrative implementability**.
- **Consideration of public concerns**.

In addition to these requirements, Ecology has the following expectations for cleanup actions (WAC 173-340-370):

- Using treatment technologies whenever practicable.
- Minimizing the need for long-term management of contaminated materials by destroying, detoxifying, or removing hazardous substances that are above cleanup levels.
- Recognizing the need to use engineering controls, such as containment for sites with large volumes of relatively low levels of hazardous substances.
- Using institutional controls to supplement engineering controls.
- Minimizing contact of precipitation and subsequent runoff from coming into contact with contaminated media.
- Consolidating hazardous substances to the maximum extent practicable if the hazardous substances remain onsite.
- Preventing or minimizing releases to surface water and not depending solely on dilution to demonstrate compliance with the cleanup standard.
- Using natural attenuation of hazardous substances, under some circumstances, may be appropriate.
- Not undertaking cleanup actions that will result in a greater overall threat to human health and the environment when compared to other alternatives.

MTCA recognizes that treatment may not be practicable for all sites. Treatment is required, wherever practicable, for sites containing liquid wastes, areas contaminated with high concentrations of hazardous substances, highly mobile materials, or discrete areas of hazardous substances that lend themselves to treatment. As stated above, MTCA also recognizes that engineering controls (such as containment, caps, and covers) are appropriate for sites or portions of sites that contain large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable [WAC 173-340-370 (3)].

The following alternatives were evaluated for this site:

- No treatment or removal action. Institutional controls would be implemented for the property and include maintenance of onsite covers, access restrictions, deed notices, and water use restrictions.
- Removal of the rail spur and installation of an asphalt cap from the end of the spur to the north end of the former UST farm. Soils along the spur and underneath the building

would remain in place. Institutional controls would be implemented for the property and include maintenance of onsite covers, access restrictions, deed notices, and water use restrictions.

- Excavation, removal, and offsite disposal of soils along the rail spur that contain COC above remediation levels (MTCA Method B direct contact exposure). Excavated soils would be replaced with clean fill. An asphalt cap would be installed from the end of the spur to the north end of the former UST farm to contain residual contamination between remediation and cleanup levels. Soils underneath the building would remain in place, capped by the current structure. Institutional controls would be implemented for the property and include maintenance of onsite covers, access restrictions, deed notices, and water use restrictions.

- In-situ chemical treatment of PCP and dioxin impacted soils under the building and along the railroad spur using an injected chemical oxidant (Fenton's reagent) into the subsurface. Institutional controls would be implemented for the property and include maintenance of onsite covers, access restrictions, deed notices, and water use restrictions.

Institutional controls included in areas of the site that contain PCP and/or dioxin above MTCA Method B soil cleanup levels. A remedial action that includes capping will reduce infiltration of surface water and potential contaminant migration into groundwater. However, each alternative will include periodic groundwater monitoring (we have assumed semi-annual monitoring) for a period of 3 to 5 years to assess changing site conditions.

All alternatives meet the MTCA expectations to avoid cleanup actions that result in a greater overall threat to human health and the environment. MTCA requirements for meeting threshold requirements, using permanent solutions to the maximum extent practicable, providing for a reasonable restoration time frame, and addressing public comments are addressed in Sections 3.2.3 and 3.2.4.

3.2.2.3 Description of Alternatives

This section describes the four remedial alternatives identified in Section 3.2.2.2 presented in order of permanence as required by WAC 173-340-360 (3)(e)(ii).

Alternative 4: In-situ Chemical Oxidation / Institutional Controls / Groundwater Monitoring

This alternative involves chemical treatment of soils along the rail spur and beneath the floor of the former mixing room using chemical oxidation. This process would involve the injection of chemical oxidants (modified Fenton's Reagent) to oxidize the PCP and dioxin in the subsurface. A network of injection wells would be drilled through the floor of the mixing room into the shallow groundwater. Depending on in-situ conditions, moisture injection may be required to achieve optimal chemical oxidation. This would involve a pretreatment injection of water throughout the vadose zone using the injection wells. Afterward, oxidant injection would occur throughout the length of the injection wells, from near surface into the groundwater. Shallow soils along the rail spur would also be chemically treated through direct mixing instead of injection. Confirmation samples would be collected and analyzed to assess treatment progress. The treatment goal for this process would be the established remediation levels if cleanup levels cannot be achieved.

A pilot study would be required prior to implementation of full-scale treatment to determine the oxidant demand and soil moisture conditions. The pilot study would require removal of approximately 20 pounds of soils from beneath the mixing room floor to provide an example of in-situ conditions, including COC concentrations, soil moisture content, etc.

Scheduled semi-annual groundwater monitoring would be performed for 3 to 5 years to assess changes in site conditions. This alternative would also include institutional controls (deed restrictions) if remaining treated soils contained COC above the site cleanup level.

Alternative 3: Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap / Institutional Controls / Groundwater Monitoring

This alternative involves removal of the rail spur and excavation of contaminated soils from the area along the rail spur that exceed remediation levels for dioxin; PCP levels along the rail spur do not exceed remediation levels. Imported clean soil would be used for backfill material. The asphalt cap would be placed from the south end of the rail spur to approximately 15 feet north of the former UST tank farm (beyond boring RS-6). The cap would consist of a suitable base course material and 4 inches of asphalt. The asphalt cap would address the dioxin and PCP remaining onsite by providing a physical barrier to minimize direct contact and leaching of COC to the shallow groundwater. Removed soils would be loaded into a truck, covered, and transported to a permitted offsite disposal facility. Soils under the building would remain in place. Scheduled semi-annual groundwater monitoring would be performed for 3 to 5 years to assess changes in site conditions.

This alternative would include institutional controls (deed restrictions) because soils under the building that exceed cleanup levels would not be removed and soils along the rail spur may contain COC between remediation and cleanup levels.

Alternative 2: Asphalt Cap / Institutional Controls / Groundwater Monitoring

This alternative involves removal of the rail spur and installation of an asphalt cap. The cap would be placed from the south end of the rail spur to approximately 15 feet north of the former UST tank farm (beyond boring RS-6). The cap would consist of a suitable base course material and 4 inches of asphalt. The asphalt cap would address the dioxin and PCP remaining onsite by providing a physical barrier to minimize direct contact and leaching of COC to the shallow groundwater. Soils under the building would remain in place. Scheduled semi-annual groundwater monitoring would be performed for 3 to 5 years to assess changes in site conditions.

This alternative would also include institutional controls (deed restrictions) because soils exceeding cleanup levels would not be removed.

Alternative 1: Institutional Controls / Groundwater Monitoring

This alternative involves institutional controls (i.e., deed restrictions) and groundwater monitoring only. Deed restrictions would reduce the possibility that soil would be excavated, exposing workers to direct contact and ingestion threats. Institutional controls would also be effective in limiting groundwater use (none currently) to non-potable applications. Deed restrictions would be required because site soils exceeding cleanup levels would not be removed. Scheduled semi-annual groundwater monitoring would be performed for 3 to 5 years to assess changes in site conditions.

3.2.3 Preliminary Analysis of Alternatives

A remedial action must meet certain threshold criteria to be considered a “cleanup” under the MTCA [WAC 173-340-360 (2)]. An alternative is not available for selection if it cannot meet these threshold requirements. This section presents the evaluation of potential alternatives using these criteria to assess whether the alternatives are available for selection for the site.

MTCA threshold criteria are described in Section 3.2.3.1. These criteria were used to perform the preliminary analysis of alternatives in Section 3.2.3.2.

3.2.3.1 Description of MTCA Threshold Criteria

To meet threshold criteria, remedial alternatives must:

- Protect human health and the environment.
- Comply with cleanup standards.
- Comply with applicable state and federal laws.
- Provide for compliance monitoring.

A cleanup is presumed to be protective of human health and the environment at the site if it achieves the COC cleanup levels. Compliance with cleanup standards involves achieving cleanup levels, establishing points of compliance, and complying with applicable federal and state laws.

Compliance monitoring assesses the protection of human health and the environment during construction and the operation and maintenance period of a cleanup action. Compliance monitoring confirms that the remedial action has met cleanup standards and verifies its long-term effectiveness.

Compliance with the threshold requirements does not mean that untreated hazardous substances cannot remain onsite. The MTCA recognizes that containment can comply with cleanup standards, provided that compliance monitoring is included to ensure the long-term integrity of the containment system.

Table 1 identifies potential action-specific ARARs and Table 2 identifies the chemical-specific ARARs for the site. Tables 4 and 5 present an evaluation of each alternative’s ability to meet these potential ARARs.

3.2.3.2 Preliminary Analysis of Alternatives

Four alternatives were developed to address site conditions. These alternatives include one institutional control and monitoring option, two containment alternatives (one with partial removal and offsite disposal), and one alternative that may achieve the cleanup levels through treatment. Table 6 summarizes the evaluation of these alternatives in relation to the MTCA's threshold criteria.

The MTCA requires that alternatives meet the threshold criteria, at a minimum, to be eligible for selection as a cleanup action. Based on the evaluation presented in Table 6, all alternatives meet the threshold criteria. All alternatives can achieve the cleanup levels either through offsite disposal, treatment, or compliance monitoring; meet all ARARs; have an acceptable point of compliance; and provide for compliance monitoring throughout remediation.

3.2.4 Detailed Analysis of Alternatives

In addition to meeting the threshold criteria, the MTCA requires [WAC 173-340-360 2 (b)] that cleanup actions:

- Use permanent solutions to the maximum extent practicable.
- Provide for a reasonable restoration time frame.
- Consider public concerns raised during the public comment period.

Ecology recognizes that permanent solutions may not be practicable for all sites. The following criteria are used to determine whether a cleanup action is permanent to the maximum extent practicable.

The detailed analysis of alternatives using these MTCA criteria is presented in Tables 7 through 10.

3.2.4.1 Overall Protection of Human Health and the Environment

This criterion evaluates the degree to which existing risks are reduced, the time required to reduce the risks and achieve cleanup standards, onsite and offsite risks resulting from implementation of the alternative, the degree the cleanup action may surpass the specific standards in WAC 173-340-700 through -760, and improvement of the overall environmental quality. Because overall protection of human health and the environment was evaluated for each alternative in Section 3.2.3, it is not evaluated further in this section.

3.2.4.2 Compliance with ARARs

This criterion evaluates how each alternative complies with federal and state ARARs. Tables 4 and 5 present evaluations of ARARs for each alternative.

3.2.4.3 Permanent Reduction of Toxicity, Mobility, and Volume of Hazardous Substance

This criterion evaluates an alternative's ability to permanently and significantly reduce toxicity, mobility, or volume of the contaminated material. This criterion includes an evaluation of the alternative's adequacy in destroying the hazardous substance, reduction or elimination of the hazardous substance releases and source of releases, degree of irreversibility of the waste treatment process, and the characteristics and quantity of treatment residuals generated.

3.2.4.4 Cost

The cost criterion is used to select from among two or more cleanup action alternatives that are equivalent with respect to cleanup technologies and process options. Costs are also used to determine practicability. A cleanup action is not considered practicable if the incremental cost of the cleanup action is substantial and disproportionate to the incremental degree of protection achieved, compared to a lower preference cleanup action.

3.2.4.5 Long-term Effectiveness

Long-term effectiveness evaluates the degree of certainty that the alternative will be successful, long-term reliability, the magnitude of residual risk, and the effectiveness of controls required to manage treatment residues or untreated materials remaining onsite. This factor addresses the uncertainties associated with land disposal, difficulties associated with replacing technical components, and the potential exposure pathway and risks posed should the remedial feature require replacement.

3.2.4.6 Short-term Effectiveness

Short-term effectiveness describes the protection of human health and the environment during remediation and the degree of risk prior to achieving cleanup standards. This criterion includes evaluating the protection of the community and workers, impacts of the remedial action on the environment, and amount of time needed to achieve remedial action objectives.

3.2.4.7 Implementability

Implementability considers whether the alternative is technically possible; the availability of necessary offsite facilities, services and materials; administrative and regulatory requirements; scheduling, size, and complexity; monitoring requirements; access for construction, operations, and monitoring; and integration with existing facility operations and other current or potential remedial actions.

Selection of a cleanup alternative must also consider the restoration time frame. Establishment of a restoration time frame should take into account:

- Potential risks posed by the site.
- Practicability of achieving a shorter restoration time frame.
- Current and future uses of the site, surrounding areas, and associated resources that are, or could be, affected by releases of hazardous substances.
- Availability of alternative water supplies.
- Likely effectiveness and reliability of institutional controls.
- Ability to control and monitor hazardous substance migration from the site.

- Toxicity of the hazardous substances.
- Natural processes that reduce concentrations of hazardous substances and have been documented to occur onsite or under similar site conditions.

3.2.4.8 Consideration of Public Concerns

Community concerns would be addressed by fulfilling the requirements described in WAC 173-340-360 (3)(f)(vii) and 173-340-545.

Under WAC 173-340-545, adequate public notice for independent remedial actions is summarized below.

Except for emergency remedial actions, written notification must be mailed at least 15 days before beginning construction of the interim action or cleanup action to the following:

1. The department (which shall publish a summary of the notice in the *Site Register*).
2. The local jurisdictional health department/district.
3. The town, city, or county with land use jurisdiction
4. The land owners identified by the tax assessor at the time the action is begun for that portion of the facility where the interim action or cleanup action is being conducted.
5. Persons potentially liable under RCW 70.105D.040 known to the person conducting the interim action or cleanup action. In identifying persons potentially liable under RCW 70.105D.040 who are to be noticed under this provision, the person conducting the remedial action need only make a reasonable effort to review information currently readily available. Where the interim action or cleanup action is complex, written notification before beginning detailed design is recommended but not required.

The written notification should include: 1) a brief statement describing the releases being remedied and the interim actions or cleanup actions expected to be conducted; 2) the schedule for these interim actions or cleanup actions; and 3) for persons potentially liable under RCW 70.105D.040 known to the person conducting the interim actions or cleanup actions, a statement that they could be held liable for the costs of remedial actions being conducted.

In addition, a sign should be posted at the site at a location visible to the general public indicating what interim actions or cleanup actions are being conducted and identifying a person to contact for more information. Except for emergency remedial actions, this sign should be posted not later than the beginning of construction of any interim action or cleanup action and should remain posted for the duration of the construction. For emergency remedial actions, posting of a sign should be done as soon as practicable.

3.2.5 Comparative Analysis of Alternatives

3.2.5.1 Overall Protection of Human Health and the Environment

Alternative 4 chemically treats the COC by oxidation and converting to chloride ion, carbon dioxide, and water. Remediation levels may be achievable along the rail spur and under the building, although a pilot test would be required. Alternative 3 removes soils along the rail spur where COC were identified above remediation levels. Excavation and disposal of soil at a permitted facility could further protect human health and the environment by removing accessible soils with elevated COC from the site and, thereby, reducing the magnitude of the residual risk. Asphalt covers reduce risk by eliminating a potential exposure pathway (i.e., ingestion of surface soil). Institutional controls would still be necessary due to COC left in place under the building and residual COC above cleanup levels along the rail spur. Alternative 2 would provide additional protection with the asphalt cover and institutional controls. Asphalt covers reduce risk by eliminating a potential exposure pathway (i.e., ingestion of surface soil). Alternative 1 would provide some protection to human health and the environment compared to current site conditions; institutional controls would reduce the possibility that soils would be excavated and workers exposed by direct soil contact without sufficient protection.

3.2.5.2 Long-term Effectiveness

Each alternative offers varying degrees of long-term effectiveness. The institutional controls address the COC in the soil above cleanup levels for each alternative. Alternative 4 chemically oxidizes the COC in areas along the rail spur and underneath the mixing room. This alternative has the highest degree of long-term effectiveness since the COC are chemically converted into significantly less toxic compounds (chloride ion, carbon dioxide, and water); however, this technology is unproven at this site. Alternative 3 would remove soils with COC above the remediation level along the rail spur in areas where direct contact would be more probable. The asphalt cover would decrease the infiltration of stormwater and would provide protection from direct contact of residual COC below the established remediation level. Provided that the existing building remains in place, the COC in soil below the building should remain effectively contained. In Alternative 2, the asphalt cover would decrease the infiltration of stormwater and would provide a higher level of protection from direct contact. Alternatives 2, 3, and 4 reduce the magnitude of residual risk to an acceptable level by capping or removing outside soils above remediation levels. Only implementing deed restrictions, as presented in Alternative 1, would be the least effective in the long-term.

3.2.5.3 Short-term Effectiveness

Each alternative offers similar degrees of short-term effectiveness. Alternative 4 involves injecting an oxidant into the soils and groundwater to chemically treat the COC; there is a potential of “flushing” the COC into the groundwater. Alternative 4 could have a negative impact if chemical injection cannot be highly controlled. Excavated soils from Alternative 3 would be managed in accordance with applicable state and federal regulations. During the implementation of Alternatives 2, 3, and 4, remedial workers could be adequately protected by personal protective equipment (i.e., Tyvek and steel-toe shoes). Alternatives 2 and 3 involve the disruption of surface soils containing COC and the potential to produce fugitive dust. None of the alternatives would significantly impact remedial workers, the community, or the environment.

3.2.5.4 Permanent Reduction of Toxicity, Mobility, and Volume of Hazardous Substance

Alternative 4 would treat the COC in the soil to the remediation level and may achieve permanent reduction of toxicity and volume of COC. Alternative 3 would also involve management of COC at a permitted landfill where long-term mobility of COC should not pose a significant concern. Alternatives 2 and 3 reduce the mobility of residual COC by placing a low permeability surface above the impacted soils not already covered by the building. Alternatives 1, 2, and 3 do not involve treatment that would reduce the toxicity, mobility, or volume of COC.

3.2.5.5 Cost

Alternative 4 is the most expensive remedial alternative with estimated costs more than four times higher than Alternatives 2 and 3. Alternative 1 is the least expensive remedial alternative, followed by Alternatives 2 and 3. A cost summary of the alternatives is presented in Table 11 and detailed cost information is provided in Appendix A.

3.2.5.6 Implementability

Alternative 4 is the most complex alternative to implement. It involves uncertainties regarding the chemical oxidation process and the ability to treat soils throughout the vadose zone and down into the groundwater table. Numerous injection points must be drilled with at least one point in-between the existing USTs. Multiple treatments to achieve complete oxidation are anticipated. An additional monitoring well would need to be installed to monitor for potential flushing of COC into the shallow aquifer during injection. Effectiveness of the technology would not be known until after the completion of a pilot study.

Alternatives 2 and 3 are similar in complexity and involve routine construction activity that is not expected to pose much difficulty. However, under Alternative 3, soil removal near the building will require shoring. Alternatives 2 and 3 can be monitored effectively during the remediation implementation to assess the attainment of cleanup levels. Alternative 1 is the simplest to implement because it involves no construction or remedial activity.

3.2.5.7 Consideration of Public Concerns

Community concerns will be addressed as described in Section 3.2.4.8.

3.2.6 Recommended Alternative

Site conditions and the relatively small area of soils available for direct contact exposure pose a unique remedial advantage. Alternatives 2, 3, and 4 can achieve a similar level of protection provided containment systems are maintained. Alternatives 2 and 3 have advantages over Alternative 4 due to implementability and lower cost; Alternative 3 provides additional protection since soils at higher concentrations with the greatest current exposure risk are easily accessible and removed from the site. The recommended alternative for the site is Alternative 3. This includes:

- Removal of the rail spur and removal of soils along the spur in areas where COC were identified above remediation levels. In this area, dioxin compounds are the driver for removal. Excavated soils will be loaded into a truck, covered, and transported to a permitted offsite disposal facility. Soils will be replaced with clean fill.

- After rail spur removal and excavation activities are complete, the area will be covered with an asphalt cap. This will further limit exposure via direct contact and infiltration of rainwater with COC at concentrations between cleanup and remediation levels.
- Soils under the building will remain in place. These soils are capped - direct contact and rainwater infiltration exposure pathway are limited under current site conditions.
- Institutional controls (deed restrictions) will be established for the site, limiting future groundwater use (none currently) to non-potable applications. Fencing and land use restrictions would be maintained. Deed restrictions would provide for notice to future occupants and site workers of the presence of COC. Any disturbance of the cap would require controls or additional actions to address residual contamination.
- Compliance monitoring would be implemented to assess changing conditions, including monitoring for PCP in groundwater at the site boundary.

This alternative provides several advantages over the others presented. These include:

- Alternative 3 provides a high degree of protection to human health and the environment. Because impacted soils are removed from the site and then capped with asphalt, future concerns regarding the exposure of COC would be substantially reduced. Human exposure through direct contact would be reduced or eliminated by placing clean backfill and the asphalt cap. Offsite disposal also offers a relatively short time requirement for achieving established remediation levels in exposed areas of the site.
- Uncertainties exist with Alternative 4 regarding the effectiveness of chemical oxidation treatment due to low-moisture content of soils and the potential of mobilizing generally immobile COC into the shallow groundwater. Alternative 3 involves proven and commonly employed practices for remedial action.
- Although Alternative 3 does not include treatment to achieve cleanup levels, exposure pathways are limited. Long-term maintenance of the containment system can be easily accomplished. The entire site is addressed, with removal of soils where practicable and capping over areas with residual COC above the cleanup level.
- Alternative 3 is significantly less expensive than Alternative 4 and only slightly higher in cost than Alternative 2.

References for Feasibility Study

Washington State Department of Ecology. 2001. Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC. Ecology Publication No. 94-06, Amended 12 February 2001.

Tables

Table 1: Potential Action-Specific ARARs

Federal Citation	State Citation	Description	Potential Requirement	Justification
29 CFR 1910.120	WAC 296-62	General safety and health standards for workers, including requirements for responses involving hazardous substances.	Applicable	Required for protection of remedial action workers.
40 CFR 50.6 and .12 40 CFR 60.5	WAC 173-400 WAC 173-460 WAC 173-470 PSAPCA Regulations I, II, and III	General regulations for air pollution sources; particulate matter emissions standards; control standards for toxic air pollutants.	Applicable	Applicable for remedial processes emitting air pollutants.
40 CFR 262.12, 262.20 through .33, and 262.40 through .43	WAC 173-303-160, 170, 180, 190, 210, and 220	Requirements for generators of hazardous and dangerous waste.	Applicable	Required if hazardous or dangerous wastes are transported offsite.
40 CFR 268	WAC 173-303-140	Land disposal restrictions.	Applicable	Applicable if dangerous wastes are disposed in offsite landfill.
None	WAC 173-304	Standards for disposal of solid waste.	Applicable	Applicable for disposal of solid waste.
49 CFR 107, 171 through 179	WAC 446-50	Transportation regulations for hazardous materials.	Applicable	Applicable for offsite transportation of dangerous or hazardous waste.
None	WAC 173-160 WAC 173-162	Regulations for construction and maintenance of new water wells; licensing of drillers.	Applicable	Applicable for new and existing wells.
None	WAC 173-340-360	MTCA requirements for selection of cleanup actions.	Applicable	Regulations outline requirements for hazardous substance cleanups.
None	WAC 173-340-370	MTCA expectations for cleanup action alternatives.	Applicable	Regulations outlining the seven criteria for evaluating and selecting a cleanup alternative.
None	WAC 173-340-410	MTCA requirements regarding compliance monitoring during remedial activities.	Applicable	Required for protecting human health and confirming attainment of cleanup standards.
None	WAC 173-340-440 and -702 (13)	MTCA requirements regarding institutional controls to limit activities at a site that may result in exposure to hazardous substances.	Applicable	Applicable if residual concentrations exceed cleanup levels or if conditional points of compliance have been established.
None	WAC 173-340-704,-705, and -706	Use of Methods A, B, and C for determining cleanup levels.	Applicable	Applicable methods for determining cleanup levels.
None	WAC 173-340-707	MTCA analytical methods for evaluating the effectiveness of a cleanup action.	Applicable	Applicable if remedial action requires chemical analyses.

Table 1: Potential Action-Specific ARARs

Federal Citation	State Citation	Description	Potential Requirement	Justification
None	WAC 173-340-708	MTCA regulation on human health risk assessment procedures.	Applicable	Required for determining site cleanup levels.
None	WAC 173-340-720 and -740	MTCA cleanup standards for groundwater and soil.	Applicable	Required for determining site cleanup levels.
None	WAC 197-11	Washington State Environmental Policy Act (SEPA).	Potentially applicable	Required to ensure environmental concerns are adequately addressed.

Table 2: Summary of Analytes Exceeding Cleanup Levels and/or ARARs

Chemicals	Analytical Units	Concentration Range	Cleanup Level/ARAR	Basis	Remediation Level	Basis
Soil Exceedances						
Pentachlorophenol	mg/kg[a]	0.109 J[b] – 15,200	0.0115	MTCA Method B[c] Protection of Groundwater	8.33	MTCA Method B – Direct Contact
Dioxin[d]	pg/g[e]	0.046 – 1,971	6.67	MTCA Method B	6.67	MTCA Method B
Groundwater Exceedances						
cis 1,2-dichloroethene	µg/l[f]	0.672 J - 200	70	U.S. EPA Maximum Contaminant Level (MCL)	NA	Regional groundwater plume. Site not source.
	µg/l		8	MTCA Method B		
1,2-dichloropropane	µg/l	<1[g] – 1.8	5	U.S. EPA MCL	NA	Regional groundwater plume. Site not source.
Trichloroethene	µg/l	0.703 J – 26	5	U.S. EPA MCL	NA	Regional groundwater plume. Site not source.
	µg/l		3.98	MTCA Method B		
Tetrachloroethene	µg/l	<1 - 11	5	U.S. EPA MCL	NA	Regional groundwater plume. Site not source.
	µg/l		0.858	MTCA Method B		
Pentachlorophenol	µg/l	<0.189 – 7.58	1	U.S. EPA MCL	0.729	MTCA Method B
	µg/l		0.729	MTCA Method B		
Arsenic (total)	µg/l	<0.5 – 13	50	U.S. EPA MCL	NA	
	µg/l		0.0583	MTCA Method B		

Notes:

(a) Milligrams per kilogram.
(b) J denotes positively identified, but numerical value is an estimated quantity.
(c) Model Toxics Control Act (MTCA) cleanup levels based on CLARC Version 3.1 Carcinogenic values used if available.
(d) Concentrations are given as toxicity equivalents (TEQ), in accordance with Washington State Department of Ecology guidance.
(e) Picograms per gram (1x10^{-6} mg/kg).
(f) Micrograms per liter.
(g) "<" denotes analyte was not detected at the indicated detection limit.

Table 3: Evaluation of General Response Actions, Remedial Technologies, and Process Options

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Institutional Controls	Access Restrictions	Physical Restrictions	Physical restrictions (e.g., fencing and signs) limit contact with media.	Potentially implementable.
		Deed Restrictions	Restrictive covenants recorded in the property deed prohibit site activities (e.g., excavation) that could result in exposure to chemicals of concern (COC).	Potentially implementable.
Containment	Covers / Cap	Soil	Clean soil is placed over the ground surface and compacted. Provides a physical barrier to prevent direct contact and leaching of COC.	Requires the removal of the rail spur. Chemicals under the building are covered with concrete (floor).
		Clay	Low permeability clay layer overlain with soil and compacted. Provides physical barrier to prevent direct contact and leaching of COC.	Requires the removal of the rail spur. Chemicals under the building are covered with concrete (floor).
		Concrete	Similar to clay cover description except concrete is used as the low permeability barrier.	Requires the removal of the rail spur. Chemicals under the building are covered with concrete (floor).
		Asphalt	Similar to clay cover description except asphalt is used as the low permeability barrier.	Requires the removal of the rail spur. Chemicals under the building are covered with concrete (floor).
		RCRA	Multi-media barrier consisting of low-permeability layer, synthetic liner, drainage layer, and vegetative cover. Provides a physical barrier to prevent direct contact with and leaching of COC.	Requires the removal of the rail spur. Chemicals under the building are covered with concrete (floor).

Table 3: Evaluation of General Response Actions, Remedial Technologies, and Process Options

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Containment Cont'd	Vertical Barriers	Slurry Wall	Subsurface vertical barrier consisting of low-hydraulic conductivity material surrounds a subsurface source to prevent chemical migration.	Not appropriate for impacted surface soils or subsurface site conditions.
		Grout Curtain	Subsurface vertical barrier consisting of low-hydraulic conductivity material is pressure injected into soil or rock. Performs function similar to slurry wall.	Not appropriate for impacted surface soils or subsurface site conditions.
		Sheet Pile Cutoff Wall	Interlocking sheet piling driven vertically into subsurface to form a low permeability barrier. Performs function similar to slurry wall.	Not appropriate for impacted surface soils or subsurface site conditions.
	Horizontal Barriers	Grout Injection	Injection of grout to form a horizontal barrier in the ground underneath chemical source to reduce vertical movement of chemicals.	Not appropriate for impacted surface soils or subsurface site conditions.
		Block Displacement	Vertical barrier (slurry trench or grout curtain) surrounds source. Continued injection of grout through injection holes causes displacement of source and forms a barrier beneath source.	Not appropriate for impacted surface soils or subsurface site conditions.
	Surface Controls	Revegetation	Planting grasses, shrubs, or trees to minimize direct contact with soil, reduce dust generation, and control surface runoff.	Potentially implementable for surface soil around rail spur. Chemicals under the building are covered with concrete (floor).
Disposal	Excavation / Disposal	Backhoe, Excavators, Loaders, Dozers	Excavate impacted soil for subsequent disposal in a permitted offsite management unit. Removal of the USTs under the building would be required.	Potentially implementable. Soils must be below LDRs for PCP and dioxin or disposal would require pretreatment or a permitted facility in Canada.

Table 3: Evaluation of General Response Actions, Remedial Technologies, and Process Options

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Ex-situ Treatment	Excavation / Thermal Treatment	Incineration	Excavate impacted soil for subsequent incineration and disposal. Thermal conversion of organic material into solid, liquid, and gaseous components.	Partially implementable. Incinerators will not accept F027 listed waste (soils beneath building). Soils along spur could be treated by incineration.
	Excavation / Offsite Biological Treatment	Landfarming	Excavate impacted soil for offsite treatment and disposal. Excavated soils are applied into lined beds and periodically turned over or tilled to aerate the waste. Soil conditions (moisture, pH, nutrients) are often controlled to optimize the rate of contaminant degradation.	Potentially implementable. Dioxin degradation is extremely slow and landfarming is an unproven treatment. Landfarming is eliminated from further consideration.
	Excavation / Solidification / Disposal	Pozzolanic Solidification	Excavated soils are mixed with siliceous materials and combined with a setting agent (e.g., lime, cement, or gypsum). Treatment results in a solidified product that resists leaching.	Not a proven technology for PCP.
		Cement-based Solidification	Excavated soils are mixed with Portland Cement into a leach-resistant matrix.	Not a proven technology for PCP.
		Organic Polymer Solidification	Urea formaldehyde and several specialty organic polymers are mixed with excavated soil to seal chemicals in a sponge-like polymer matrix.	Not a proven technology for PCP.
		Thermoplastic Microencapsulation	Mixing of heated dried excavated soil within asphalt bitumen, paraffin, or polyethylene matrix, resulting in a solid mass suitable for land disposal.	Not a proven technology for PCP.

Table 3: Evaluation of General Response Actions, Remedial Technologies, and Process Options

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
Ex-situ Treatment Cont'd	Excavation / On Site Treatment	Landfarming	Excavate impacted soil for offsite treatment and disposal. Excavated soils are applied into lined beds and periodically turned over or tilled to aerate the waste. Soil conditions (moisture, pH, nutrients) are often controlled to optimize the rate of contaminant degradation.	Not implementable due to lack of sufficient land at the site. Dioxin degradation is extremely slow and landfarming is an unproven treatment. Landfarming is eliminated from further consideration.
In-Situ treatment	Physical / Chemical	Chemical Oxidation	Destroys organic COC in-situ via injection of chemical oxidants (e.g., Fenton's reagent) into the subsurface. Removes both sorbed and dissolved phases of organic chemicals in the subsurface.	Potentially implementable for both vadose zone and surface soils.
		Soil Vapor Extraction (SVE)	A vacuum is applied through extraction wells to create a pressure/concentration gradient that induces gas-phase volatiles to be removed from vadose zone soil through extraction wells. Requires multiple extraction wells, vacuums, and aboveground off gas treatment.	Not implementable due to low vapor pressure of PCP.
		Thermal (Three Phase Electrical Resistance Heating) w/ SVE	Electrical resistance heating uses an electrical current to heat less permeable soils so that water and chemicals trapped in these regions are vaporized and ready for vacuum extraction. Requires SVE and aboveground treatment of off gas.	Not implementable due to low vapor pressure of PCP and low moisture content of soils under building.

Table 3: Evaluation of General Response Actions, Remedial Technologies, and Process Options

General Response Action	Remedial Technologies	Process Options	Description	Evaluation Comments
In-Situ treatment Cont'd	Biological Treatment	Cometabolism	The activity of naturally occurring microbes is stimulated by circulating air-based or water-based amendments through contaminated soils to enhance *in situ* biological degradation of organic contaminants. Nutrients, oxygen, or other amendments may be used to enhance bioremediation and contaminant desorption from subsurface materials.	Not a proven technology for highly chlorinated organics and halogenated SVOCs.
		Phytoremediation	Phytoremediation is a set of processes that uses plants to remove, transfer, stabilize, and destroy organic/inorganic contamination in ground water, surface water, and leachate.	Not implementable for vadose zone due to depth of impacted soils too deep for root development.
		Bioventing	Oxygen is delivered to contaminated unsaturated soils by forced air movement (either extraction or injection of air) to increase oxygen concentrations and stimulate biodegradation.	Not implementable due to requirement of cometabolic substrate.
	Natural Attenuation		Natural subsurface processes - such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials - are allowed to reduce contaminant concentrations to acceptable levels.	Potentially implementable.

Table 4: Compliance of Alternatives with Potential Chemical-Specific ARARs

ARAR		ALTERNATIVE 1 - Institutional Controls / Groundwater Monitoring	ALTERNATIVE 2 - Asphalt Cap/Institutional Controls / Groundwater Monitoring	ALTERNATIVE 3 - Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 4 - In-situ Chemical Oxidation / Groundwater Monitoring
Citation	**Description**				
Model Toxics Control Act Cleanup Regulation Section VII (WAC 173-340-740)	Specifies cleanup level that protects human health and the environment.	Chemicals of concern (COC) above cleanup are addressed by institutional controls. Exposure pathways for outside soils remain unmitigated. Institutional controls and groundwater monitoring implemented for protection of human health and environment.	Exposed soil with COC above cleanup levels are addressed via capping. Institutional controls and groundwater monitoring implemented for long-term protection of human health and environment.	Exposed soils with COC above remediation levels removed through excavation and offsite disposal of soil. Institutional controls and groundwater monitoring implemented for long-term protection of human health and environment.	Remediation levels may be achievable through treatment of soil (pilot study required). Institutional controls and groundwater monitoring implemented for long-term protection of residual risks.

Table 5: Compliance of Alternatives With Potential Action-Specific ARARs

ARAR		ALTERNATIVE 1 - Institutional Controls / Groundwater Monitoring	ALTERNATIVE 2 - Asphalt Cap/Institutional Controls / Groundwater Monitoring	ALTERNATIVE 3 - Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 4 In-situ Chemical Oxidation / Groundwater Monitoring
Citation	**Description**				
• 29 CFR 1910.120 • WAC 296-62	General safety and health standards for workers, including requirements for responses involving hazardous substances.	Alternative can meet requirements.	Remedial action workers can be adequately protected.	Remedial action workers can be adequately protected.	Remedial action workers can be adequately protected.
• 40 CFR 50.6 and .12 • WAC 173-400 • WAC 173-460 • WAC 173-470	General regulations for air pollution sources; particulate matter emissions standards; control standards for toxic air pollutants.	Alternative can meet requirements.	Alternative can meet requirements. Standard dust control measures can be implemented.	Alternative can meet requirements. Standard dust control measures can be implemented.	Alternative can meet requirements. Standard dust control measures can be implemented.
• 40 CFR 262.12, 262.20 through .33, and 262.40 through .43 • WAC 173-303-160, 170, 180, 190, 210, and 220	Requirements for generators of dangerous and hazardous waste.	Generation of hazardous or dangerous waste would not occur under this alternative.	Generation of hazardous or dangerous waste would not occur under this alternative.	Alternative can meet requirements.	Generation of dangerous and hazardous waste would not occur under this alternative.
• 40 CFR 268 • WAC 173-303-140 • WAC 173-304	Land disposal restrictions for hazardous or dangerous waste; standards for solid waste.	Generation of hazardous or dangerous waste would not occur under this alternative. Purge water is not considered dangerous or hazardous and will be managed accordingly.	Generation of hazardous or dangerous waste would not occur under this alternative. Purge water is not considered dangerous or hazardous and will be managed accordingly.	Alternative can meet requirements. Purge water is not considered dangerous or hazardous and will be managed accordingly.	Generation of hazardous or dangerous waste would not occur under this alternative. Purge water is not considered dangerous or hazardous and will be managed accordingly.
• 49 CFR 107, 171 through 179 • WAC 446-50	Transportation regulations for hazardous materials.	Hazardous materials will not be transported under this alternative.	Hazardous materials will not be transported under this alternative.	Alternative can meet requirements.	Hazardous materials will not be transported under this alternative.
• None • WAC 173-340-360	Model Toxics Control Act (MTCA) requirements regarding selection of cleanup actions.	Institutional controls are a low-preference remedial method. Meets other requirements.	Capping and institutional controls are low-preference remedial methods. Meets other requirements.	Offsite disposal is a lower-preference remedial method compared to treatment. Meets other requirements.	Treatment is a preferred method as it meets the requirements and provides permanent reduction of toxicity.
• None • WAC 173-340-410	MTCA requirements regarding compliance monitoring during remedial activities.	Semi-annual ground water monitoring. Meets requirements.	Semi-annual ground water monitoring. Meets requirements.	Semi-annual ground water monitoring. Meets requirements.	Semi-annual ground water monitoring. Meets requirements.
• None • WAC 173-340-440 and -702 (13)	MTCA requirements regarding institutional controls to limit activities at a site that may result in exposure to hazardous substances.	Meets requirements.	Meets requirements.	Meets requirements.	Meets requirements.
• None • WAC 173-340-705	Use of Method B for determining cleanup level.	Alternative does not mitigate risk from exposed soil.	Alternative does not reduce chemicals of concern concentrations to the cleanup level on site. Exposure pathways mitigated through capping.	Remediation level achieved through removal and offsite disposal for outside soils. Offsite disposal is a lower-preference remedial method compared to treatment.	Remediation level may be achievable through treatment.
• None • WAC 173-340-707	MTCA analytical methods for evaluating the effectiveness of a cleanup action.	Approved methods will be used.	Approved methods will be used.	Approved methods will be used.	Approved methods will be used.

Table 6: Alternative Evaluation with MTCA's Threshold Criteria

Threshold Criteria	ALTERNATIVE 1 - Institutional Controls / Groundwater Monitoring	ALTERNATIVE 2 - Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 3 - Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap/Institutional Controls / Groundwater Monitoring	ALTERNATIVE 4 - In-situ Chemical Oxidation / Groundwater Monitoring
Overall Protection of Human Health and Environment	Institutional controls offer some protection of human health by prohibiting construction activities as specified in the deed restriction. Overall improvement to the environment is low. The remedial action does not address surface and shallow subsurface exposed soils above cleanup and remediation levels.	The asphalt cap eliminates the direct contact pathway and limits stormwater infiltrating site soils. Low risks to workers during performance. Overall improvement to environment is high because direct contact pathway is eliminated.	Achieves remediation levels in areas not currently capped through removal and offsite disposal with acceptable time frame. The asphalt cap reduces the direct contact pathway with residual chemicals of concern (COC) in soil and limits stormwater from infiltrating site soils. Low risks to workers during performance. Overall improvement to environment is high because remediation levels are achieved in areas with potential worker and stormwater contact. Residual contamination addressed through capping.	Reduces risks to remediation level through treatment. Alternative has unknown time frame for achieving cleanup standards. Low risk to workers during performance. Overall improvement to environment may be high if cleanup standards are achieved; however, risks of chemical injection are unknown.
Point of Compliance	Soil throughout the site to a depth of 15 feet below ground surface (bgs) for human contact and to groundwater for protection of groundwater. Groundwater point of compliance is the site boundary.	Soil throughout the site to a depth of 15 feet bgs for human contact and to groundwater for protection of groundwater. Groundwater point of compliance is the site boundary.	Soil throughout the site to a depth of 15 feet bgs for human contact and to groundwater for protection of groundwater. Groundwater point of compliance is the site boundary.	Soil throughout the site to a depth of 15 feet bgs for human contact and to groundwater for protection of groundwater. Groundwater point of compliance is the site boundary.
Applicable State and Federal Laws	Does not achieve applicable or relevant and appropriate requirements (ARARs).	Can achieve ARARs.	Can achieve ARARs.	Can achieve ARARs.
Compliance Monitoring	Includes semi-annual groundwater monitoring to assess changes in site conditions.	Includes semi-annual groundwater monitoring to assess changes in site conditions.	Includes semi-annual groundwater monitoring to assess changes in site conditions.	Includes performance sampling to confirm that soil containing COC at concentrations above the cleanup level have been adequately treated. Also includes semi-annual groundwater monitoring to assess changes in site conditions.

Table 7: Evaluation of Permanent Reduction of Toxicity, Mobility, or Volume

Subcriteria	ALTERNATIVE 1 - **Institutional Controls / Groundwater Monitoring**	ALTERNATIVE 2 - **Asphalt Cap / Institutional Controls / Groundwater Monitoring**	ALTERNATIVE 3 - **Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap / Institutional Controls / Groundwater Monitoring**	ALTERNATIVE 4 - **In-situ Chemical Oxidation / Groundwater Monitoring**
Adequacy of alternative in destroying hazardous substances.	Does not include treatment.	Does not include treatment.	Does not include treatment.	Chemical oxidation is expected to destroy organic chemicals of concern (COC). Level of treatment and ability to destroy chemicals through the vadose zone is unknown.
Reduction or elimination of hazardous substance releases and sources of releases.	Does not destroy or treat hazardous materials; however, deed restrictions limit direct contact.	Does not destroy or treat hazardous materials; however, capping and deed restrictions would limit direct contact. Asphalt cap and building foundation is effective for reducing surface water infiltration that could potentially transport COC in subsurface soils to shallow groundwater.	Does not destroy or treat hazardous materials; however, approximately 55 cubic yards (yd^3) of material would be excavated and disposed of at a permitted offsite landfill, thereby eliminating one source. Asphalt cap is effective for reducing surface water infiltration that could potentially transport COC in subsurface soils to shallow groundwater	Chemical oxidation would treat soil containing organic COC above the cleanup levels (approximately 3,200 yd^3). Effectiveness of treatment is unknown.
Irreversibility of waste treatment process.	Does not include treatment.	Does not include treatment.	Does not include treatment.	Treatment is irreversible.
Characteristics and quantity of treatment residuals generated.	Does not include treatment.	Does not include treatment.	Does not include treatment.	Organic COC destroyed during treatment. Residuals may be a threat to groundwater if process mobilizes contaminants.

Table 8: Evaluation of Long-Term Effectiveness for Remedial Alternatives

Subcriteria	ALTERNATIVE 1 - Institutional Controls / Groundwater Monitoring	ALTERNATIVE 2 - Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 3 - Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 4 - In-situ Chemical Oxidation / Groundwater Monitoring
Degree of certainty that alternative will be successful.	Institutional controls are frequently selected for addressing sites containing hazardous substances. Alternative expected to be successful.	Long-term effectiveness concerns would not be significant because soil containing chemicals of concern (COC) above the cleanup levels would be capped preventing direct contact. Asphalt cap is effective for reducing surface water infiltration that could potentially transport COC in subsurface soils and shallow groundwater. Institutional controls are frequently selected for addressing sites containing hazardous substances. Alternative expected to be successful.	Long-term effectiveness concerns would not be significant because soil containing COC above the established remediation levels would be excavated for disposal at a permitted facility. COC remaining in the soil containing COC above the cleanup levels would be capped preventing direct contact. Institutional controls will be implemented as in Alternative 2. Alternative expected to be successful.	Technologies involved in this alternative are relatively new remedial methods. Bench scale testing would be necessary.
Long-term reliability.	This alternative would include long-term groundwater monitoring. Groundwater monitoring is not expected to pose significant operations and maintenance (O&M) problems.	Long-term reliability at the site is not a significant concern because soil containing COC above the remediation levels would be capped limiting direct contact. Covers are well-demonstrated and reliable physical measures. This alternative would include long-term groundwater monitoring. Groundwater monitoring is not expected to pose significant O&M problems.	Long-term reliability at the site is not a significant concern because soil containing COC above the remediation levels would be capped limiting direct contact. Exposed soils containing COC above the remediation level and not currently capped would be removed and the area would be capped preventing direct contact with residual COC. Long-term reliability of a permitted disposal facility is expected to be adequate. This alternative would include long-term groundwater monitoring. Groundwater monitoring is not expected to pose significant O&M problems.	Long-term controls may not be required depending on the effectiveness of treatment. This alternative would include long-term groundwater monitoring. Groundwater monitoring is not expected to pose significant O&M problems.
Magnitude of residual risk.	Residual risks would be reduced slightly from existing site conditions due to the implementation of institutional controls.	Cover and institutional controls would reliably reduce long-term risks by reducing exposure routes; however, long-term management would be necessary (i.e., inspection and repair of the asphalt cover and maintenance of the building).	Concentrations of COC remaining in soil in areas not already capped would be below remediation levels. Soils containing COC above the remediation levels are capped with an existing building preventing direct contact with soils; however, long-term management would be necessary (i.e., inspection and repair of the asphalt cover and maintenance of the building) to keep residual risk low. Institutional controls would protect site occupants and future construction workers.	Concentrations of COC remaining in soil are not known. Capping may be required to address residual risk.
Effectiveness of controls required to manage treatment residues or remaining wastes.	The effectiveness of institutional controls and long-term monitoring is expected to be high.	The effectiveness of the asphalt cover, institutional controls, and long-term monitoring is expected to be high.	Implementation of this alternative would have a high degree of effectiveness because soils removed from the site would be managed at a permitted disposal facility. Containment (cap of existing building) and institutional controls would reduce the potential exposure remaining in soil.	The effectiveness of any cap to contain residual risk, institutional controls, and long-term monitoring is expected to be high.

Table 9: Evaluation of Short-Term Effectiveness for Remedial Alternatives

Subcriteria	ALTERNATIVE 1 - Institutional Controls / Groundwater Monitoring	ALTERNATIVE 2 - Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 3 - Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 4 - In-situ Chemical Oxidation / Groundwater Monitoring
Protection of human health during construction and implementation.	No construction activities in this alternative. Groundwater monitoring would not significantly impact facility operations, the community, or environment.	Fugitive dust emissions could be generated during rail spur removal. Water spray can control fugitive dust. General risks to remedial workers because of moving heavy equipment and direct contact with soil. Offsite tracking of contaminants on construction vehicles could occur. Increased vehicular traffic should not be a concern. This situation would be temporary and the impact would not significantly impact operations, the community, or environment. Groundwater monitoring would not significantly impact facility operations, the community, or environment.	Fugitive dust emissions could be generated during soil excavation and handling. Use of water would control fugitive dust. Potential for contamination of runon/runoff. Risks to remedial workers because of moving heavy equipment and direct contact with soil. Groundwater monitoring would not significantly impact facility operations, the community, or environment.	Potential for fugitive dusts generated during treatment process in area along rail spur; however, soils must be moist and dust generation would be minimal. Risks to remedial workers because of moving heavy equipment, direct contact with soil, and contact with oxidation chemicals. Potential risks due to chemical injection and potential mobilization of existing chemicals of concern is unknown. Groundwater monitoring would not significantly impact facility operations, the community, or environment.
Degree of risk prior to attainment of cleanup standards.	Remediation levels would not be attained in this alternative. Degree of risks would be the same as described above.	Degree of risk can be controlled. Spraying the site with water would minimize generation and release of fugitive dust, if needed. Remediation workers would wear protective clothing. Vehicles would be decontaminated if needed before departing offsite.	Degree of risk can be controlled. Spraying the site with water would minimize generation and release of fugitive dust, if needed. Remediation workers would wear protective clothing. Vehicles would be decontaminated if needed before departing offsite.	Degree of risk may be controllable. Pilot testing is required. Remediation workers would wear protective clothing.

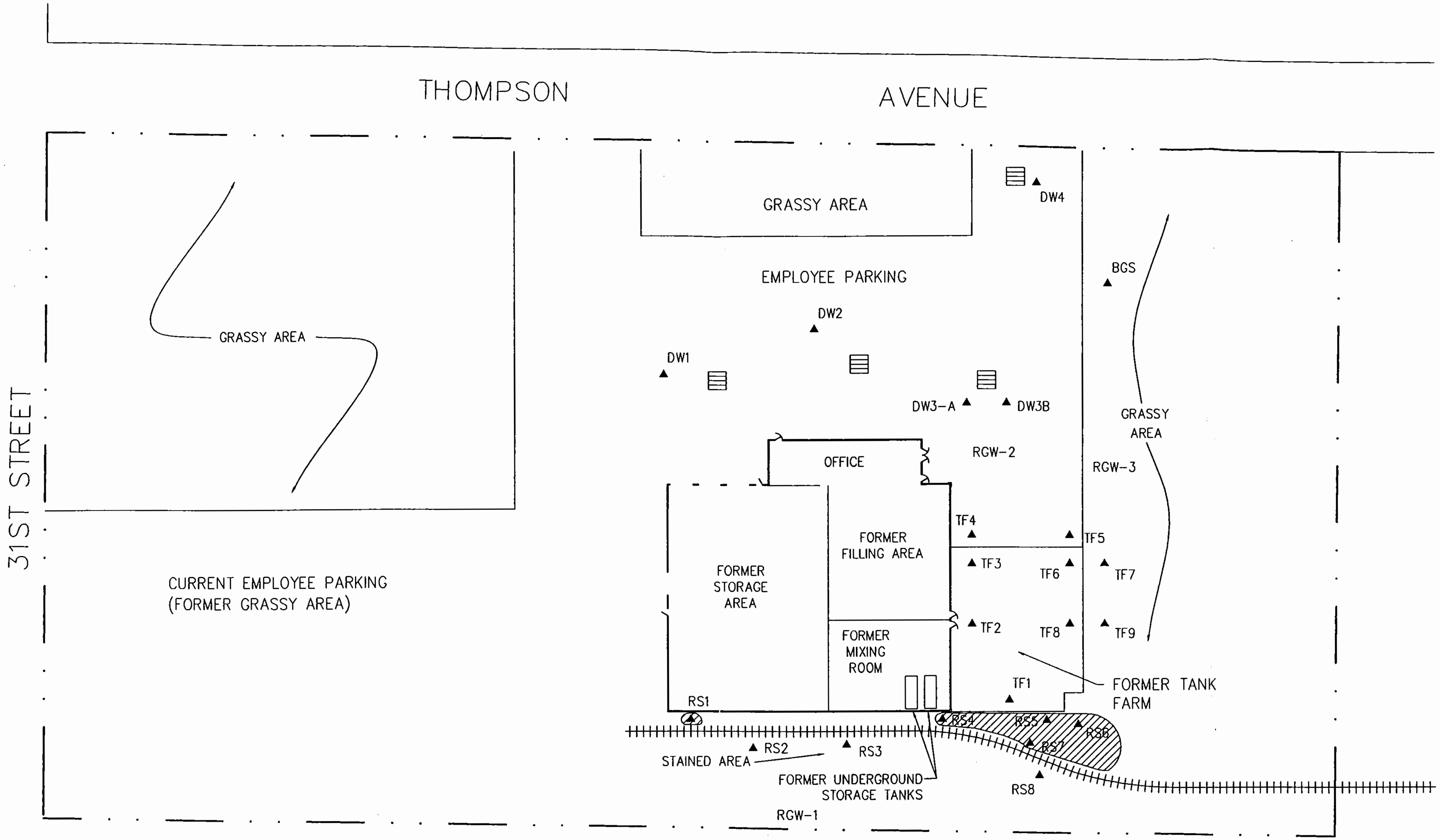
Table 10: Evaluation of Ability to Implement Remedial Alternatives

Subcriteria	ALTERNATIVE 1 - Institutional Controls / Groundwater Monitoring	ALTERNATIVE 2 - Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 3 - Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap / Institutional Controls / Groundwater Monitoring	ALTERNATIVE 4 - In-situ Chemical Oxidation / Groundwater Monitoring
Consideration of whether alternative is technically possible.	Technically possible.	Technically possible.	Technically possible.	Technologies involved in this alternative are relatively new remedial methods and are unproven for this site.
Availability of necessary offsite facilities, services, and materials.	Adequate services are available.	Adequate offsite facilities, services, and materials are available.	Adequate offsite facilities, services, and materials are available.	Adequate services and materials are available.
Administrative and regulatory requirements.	Additional requirements would not be necessary.	Requirements include clearing and grading permit. A State Environmental Policy Act (SEPA) checklist may also be necessary.	Requirements include clearing and grading permit. A SEPA checklist may also be necessary.	Requirements may include a SEPA checklist.
Scheduling, size, and complexity.	Deed restrictions can be implemented at any time. Complexity is low.	Routine construction operation can be scheduled at most times of year. Dry season is more suitable for construction activities. Complexity is low.	Dry season is more suitable for construction activities. Complexity is low.	Routine construction operation that can be scheduled at most times of year. Complexity is moderate to high.
Monitoring requirements.	Semi-annual groundwater monitoring would be implemented to evaluate changes in site conditions.	Semi-annual groundwater monitoring would be implemented to evaluate changes in site conditions.	Soil samples would be collected and analyzed during excavation activities to evaluate compliance with remediation levels. Semi-annual groundwater monitoring would be implemented to evaluate changes in site conditions.	Soil samples would be collected and analyzed during remediation to evaluate compliance with cleanup levels. Semi-annual groundwater monitoring would be implemented to evaluate changes in site conditions.
Access for construction, operations, and monitoring.	Available.	Available. Construction activities will require coordination with Tetra Pak personnel.	Available. Construction activities will require coordination with Tetra Pak personnel.	Available. Activities will require coordination with Tetra Pak personnel.
Integration with existing facility operations and other current or potential remedial actions.	Impact on existing facility operations is not anticipated.	Alternative can be easily integrated into site conditions.	Alternative can be easily integrated into site conditions.	Alternative would have moderate impact on facility operations. Coring through the warehouse floor would be necessary for pilot study and for treatment operations. Achievement of cleanup level may limit for future remedial action.

Table 11: Summary of Cost Estimates for Alternatives

Alternative	Description	Estimated Total Present Worth
1	Institutional Controls / Groundwater Monitoring	$50,000
2	Asphalt Cap/Institutional Controls / Groundwater Monitoring	$105,000
3	Excavation and Offsite Disposal of Contaminated Soils / Asphalt Cap / Institutional Controls/Groundwater Monitoring	$122,000
4	In-situ Chemical Oxidation / Institutional Controls / Groundwater Monitoring	$647,000

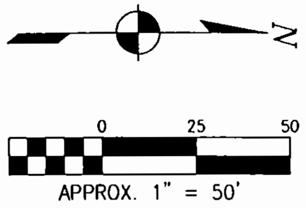
Figure



LEGEND

▲	RECONNAISSANCE SOIL EXPLORATION LOCATION
▤	STORMWATER CATCH BASIN
—··—	APPROXIMATE SITE BOUNDARY
┼┼┼┼┼┼┼┼	RAILROAD SPUR
▨	APPROXIMATE AREA OF DIOXIN EXCEEDING REMEDIATION LEVEL

NOTE:
ALL LOCATIONS APPROXIMATE.



REFERENCE: SITE PLAN PROVIDED BY TETRA PAK

Kennedy/Jenks Consultants

TETRA PAK
FORMER STREBOR SITE

SOILS EXCEEDING REMEDIATION LEVELS

K/J 016066.11/P02SK003

FIGURE 1

Appendix A

Engineers' Estimate of Probable Cost

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**

Project: Former Strebor Site - Feasibility Study - Alternative 1

Building, Area: ____

Prepared By: DMK
Date Prepared: 9/12/2003
K/J Proj. No. 16066.11

Current at ENR ____
Escalated to ENR ____

Estimate Type:
☒ **Conceptual**
☐ **Preliminary (w/o plans)**
☐ **Design Development @** ____ **% Complete**
☐ **Construction**
☐ **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Labor $/Unit	Labor Total	Sub-contractor $/Unit	Sub-contractor Total	Total	Source
DIVISION 1 - GENERAL REQUIREMENTS												
		Semi-annual GW monitoring	5	yr			5,040.00	25,200	2,800	14,000	39,200	
SUBTOTAL - DIVISION 1								25,200		14,000	39,200	
DIVISION 2 - SITE CONSTRUCTION												
SUBTOTAL -												
		Subtotals						25,200		14,000	39,200	
		Taxes	@	0%								
		Subtotals						25,200		14,000	39,200	
		Contractor OH&P	@									
		Subtotals						25,200		14,000	39,200	
		Estimate Contingency	@	15%							5,880	
		Estimated Bid Cost									45,080	
		Engineering	@	0%								
		Legal									4,000	
		Total Estimate (rounded)									50,000	

Assumptions:
* Includes 10% markup
Semi-annual groundwater monitoring, PCP/TCP only. Annual letter report.
These activities are tax exempt - investigation/remediation activities

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**

Project: **Former Strebor Site - Feasibility Study - Alternative 2**

Building, Area:

Prepared By: DMK
Date Prepared: 9/12/2003
K/J Proj. No. 16066.11

Current at ENR
Escalated to ENR

Estimate Type: ☒ **Conceptual** ☐ **Construction**
☐ **Preliminary (w/o plans)** ☐ **Change Order**
☐ **Design Development @** __________ **% Complete**

Spec. No.	**Item No.**	**Description**	**Qty**	**Units**	**Materials $/Unit**	**Materials Total**	**Labor $/Unit**	**Labor Total**	**Sub-contractor $/Unit**	**Sub-contractor Total**	**Total**	**Source**
DIVISION 1 - GENERAL REQUIREMENTS												
		Semi-annual GW monitoring	5	yr			5,040.00	25,200	2,800	14,000	39,200	
		Utility locate	1	ea					500	500	500	
		Data Review/Report to Agency	32	hr			100.00	3,200			3,200	
		Permitting	24	hr			100.00	2,400			2,400	
SUBTOTAL - DIVISION 1								30,800		14,500	45,300	
DIVISION 2 - SITE CONSTRUCTION												
		Railroad spur removal	1	ea					4,866	4,866	4,866	proposal dated 6/16/2003, RMCat
		Paving mobilization/demob.	6	ea					200	1,200	1,200	RSMeans 02305-250-0020
		Grading	270	SY					3	815	815	RSMeans 02310-440-0010
		Asphalt paving	2,400	SF					2	4,128	4,128	RSMeans 02740-315-0020
		Construction Oversight	40	hr			100.00	4,000			4,000	Eng. Estimate
SUBTOTAL -								4,000			15,009	
		Subtotals						34,800		14,500	60,309	
		Taxes	@	0%								
		Subtotals						34,800		14,500	60,309	
		Contractor OH&P	@	15%				5,220		2,175	7,395	
		Subtotals						40,020		16,675	67,704	
		Estimate Contingency	@	35%							23,697	
		Estimated Bid Cost									91,401	
		Engineering	@	10%							9,140	
		Legal									4,000	
		Total Estimate (Rounded)									105,000	

Assumptions:

Semi-annual groundwater monitoring PCP/TCP only. Annual letter report.
RSMeans Heavy Construction Cost Data, 2003, 17th Edition. Contractor OH&P included in estimate
Spur to be removed from southern end north to driveway (just south of property boundary)
Spur area for paving: 12' x 200' = 2400 S.F. ~270 S.Y.
Mobilization/demob for grader, paver, and roller
These activities are tax exempt - investigation/remediation activities

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**

Project: Former Strebor Site - Feasibility Study - Alternative 3

Building, Area:

Prepared By: DMK
Date Prepared: 9/12/2003
K/J Proj. No. 16066.11

Current at ENR
Escalated to ENR

Estimate Type:
☒ **Conceptual**
☐ **Preliminary (w/o plans)**
☐ **Design Development @** ________ **% Complete**
☐ **Construction**
☐ **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials		Labor		Sub-contractor		Total	Source
					$/Unit	Total	$/Unit	Total	$/Unit	Total*		
DIVISION 1 - GENERAL REQUIREMENTS												
		Semi-annual GW monitoring	5	yr			5,040.00	25,200	2,800	14,000	39,200	
		Utility locate	1	ea					500	500	500	
		Data Review/Report to Agency	32	hr			100.00	3,200			3,200	
		Permitting	24	hr			100.00	2,400			2,400	
SUBTOTAL - DIVISION 1								30,800		14,500	45,300	
DIVISION 2 - SITE CONSTRUCTION												
		Railroad spur removal	1	ea					4,866	4,866	4,866	proposal dated 6/16/2003, RMCat
		Excavation/Disposal/Backfill	55	CY					152	8,360	8,360	
		Paving mobilization/demob.	6	ea					200	1,200	1,200	RSMeans 02305-250-0020
		Grading	270	SY					3	815	815	RSMeans 02310-440-0010
		Asphalt paving	2,400	SF					2	4,128	4,128	RSMeans 02740-315-0020
		Surface prep for seed	500	SF					0.38	188	188	RSMeans 02920-340-0100
		Hydroseed, with mulch/fert.	500	SF					0.45	225	225	RSMeans 02920-510-4600
		Construction Oversight	40	hr			100.00	4,000			4,000	Eng. Estimate
SUBTOTAL -								4,000		19,782	23,782	

Subtotals				34,800	34,282	69,082
Taxes	@	0%				
Subtotals				34,800	34,282	69,082
Contractor OH&P	@	15%		5,220	5,142	10,362
Subtotals				40,020	39,424	79,444
Estimate Contingency	@	35%				27,805
Estimated Bid Cost						107,250
Engineering	@	10%				10,725
Legal						4,000
Total Estimate (Rounded)						122,000

Assumptions:

Semi-annual groundwater monitoring PCP/TCP only. Annual letter report.
RSMeans Heavy Construction Cost Data, 2003, 17th Edition. Contractor OH&P included in estimate
Spur to be removed from southern end north to driveway (just south of property boundary)
Spur area for paving: 12' x 200' = 2400 S.F. ~270 S.Y.
Mobilization/demob for grader, paver, and roller
These activities are tax exempt - investigation/remediation activities

ENGINEER'S ESTIMATE OF PROBABLE COST

KENNEDY/JENKS CONSULTANTS

Project: **Former Strebor Site - Feasibility Study - Alternative 4**

Building, Area: ____________________

Prepared By: DMK
Date Prepared: 9/12/2003
K/J Proj. No. 16066.11

Current at ENR __________
Escalated to ENR __________

Estimate Type:
☒ **Conceptual**
☐ **Preliminary (w/o plans)**
☐ **Design Development @** __________ **% Complete**
☐ **Construction**
☐ **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials		Labor		Sub-contractor		Total	Source
					$/Unit	Total	$/Unit	Total	$/Unit	Total		
DIVISION 1 - GENERAL REQUIREMENTS												
		Semi-annual GW monitoring	5	yr			5,040	25,200	2,800	14,000	39,200	
		Bench Test	1	ea					7,500	7,500	7,500	
		Confirmation sampling	6	ea					950	5,700	5,700	Recent analytical price.
		Data review, report to agency	80	hr			100	8,000			8,000	
		Permitting	40	hr			100	4,000			4,000	
		Bench Test Report	32	hr			100	3,200			3,200	
SUBTOTAL - DIVISION 1								40,400		27,200	67,600	
DIVISION 2 - SITE CONSTRUCTION												
		New monitoring well installation	1	ea					3,500	3,500	3,500	Previous well install invoice
		Drilling/bench sample collection	1	ea					3,500	3,500	3,500	Previous well install invoice
		Injection well installation	20	ea					3,500	70,000	70,000	Previous well install invoice
		Site Remediation - beneath floor	1	ea					230,000	230,000	230,000	ISOTEC budget est. 5/30/03
		Site Remediation - spur area	1	ea					60,000	60,000	60,000	ISOTEC budget est. 5/30/03
		Drilling/confirmation sample	1	ea					3,500	3,500	3,500	
		Construction/Remed oversight	30	day			800.00	24,000			24,000	
SUBTOTAL -								24,000			394,500	

				Materials	Labor	Sub-contractor	Total
	Subtotals				64,400	27,200	462,100
	Taxes	@	0%				
	Subtotals				64,400	27,200	462,100
	Contractor OH&P	@	15%		9,660	4,080	13,740
	Subtotals				74,060	31,280	475,840
	Estimate Contingency	@	35%				166,544
	Estimated Bid Cost						642,384
	Engineering	@					
	Legal						4,000
	Total Estimate (Rounded)						647,000

Assumptions:

Semi-annual groundwater monitoring, PCP/TCP only. Annual letter report.
Confirmation samples analyzed for dioxin and SVOC
Drilling for bench sample and confirmation sample beneath building assumes hollow-stem auger rig
Construction oversight assumes 15 days construction time and 15 days remediation oversight
Remediation assumes entire mixing room, for a total of 20 injection wells.
These activities are tax exempt - investigation/remediation activities