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Draft Remedial Investigation Report
J.H. Baxter Arlington Plant
Arlington, Washington

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Prepared for
J.H. Baxter

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DRAFT REMEDIAL INVESTIGATION REPORT
J. H. BAXTER ARLINGTON PLANT
ARLINGTON, WASHINGTON

INTRODUCTION

This Draft Report presents the findings from remedial investigation work performed in the fall of 1999 and winter of 2000 for the J. H. Baxter wood preserving facility located in southwest Arlington, Washington. The J.H. Baxter (Baxter) wood preserving facility is a 52-acre pole processing and preservation plant. The site lies just southwest of the intersection of 67th Avenue NE and NE 188th Street as shown on Figure 1.

Pentachlorophenol (PCP) and dioxin have been detected in storm water and groundwater at the Arlington facility. The purpose of the remedial investigation is to collect data on the extent of PCP in groundwater, and to identify and evaluate potential sources of PCP to groundwater. The scope of work for this study was outlined in the Final Work Plan, J.H. Baxter Arlington Site, Remedial Investigation/Feasibility Study, Arlington, Washington; Prepared for J.H. Baxter by Hart Crowser, dated September 27, 1999.

The site lies within an area zoned Industrial by the City of Arlington (Figure 1). Land to the north, south, east, and west is zoned Industrial. The closest property zoned Residential is more than 300 feet from the site, hydraulically upgradient, and separated from the site by other industrial land use and Highway 67th Avenue (Figure 1).

The Baxter property consists of three parcels. Parcel A is about 15 acres and occupies the northern part of the site. Treated wood storage and the main treatment plants are located on Parcel A. Parcel B lies to the south of Parcel A and is roughly 30 acres in area. Untreated wood poles are stored and peeled on Parcel B. A closed, woodwaste landfill occupies the remaining property just west of the south half of Parcel A.

SCOPE OF INVESTIGATION

The Work Plan (Hart Crowser, 1999) outlines the Remedial Investigation (RI) and Feasibility Study (FS) being conducted to address identified contamination. This report builds on the data summarized in the Work Plan by presenting the results of the current field investigation, analyses of the data, and evaluation of the nature, extent, and fate and transport of potential contaminant sources. Another technical memorandum will be forthcoming that identifies feasible remedial alternatives for the issues identified in this report.

The scope of the current field investigation included:

- Collecting composite surface soil samples from six locations, primarily in the areas of wood treatment and treated wood storage, but also in one location outside of the site operations in the downgradient wind direction;
- Drilling ten soil borings to collect and analyze surface soil, subsurface soil, and groundwater grab samples; and
- Installing three monitoring wells and sampling the groundwater from these wells in October 1999 and January 2000.

In addition to the activities outlined in the Work Plan, we conducted a closure investigation for a butt treating tank which had been out of use for ten years. Two additional borings were drilled in close proximity to the tank to investigate soil and groundwater beneath the tank. These borings, BT-S (for Butt Tank—south side) and BT-W (for Butt Tank—west side), are shown on Figure 5 along with other explorations completed to date on the site.

In December of 1999, we assisted Baxter in the installation of dedicated bladder pumps in three wells, MW-2, MW-3, and BXS-1, because of the importance of obtaining samples of low turbidity. Groundwater samples collected from the wells prior to the installation of the dedicated pumps and analyzed for TSS typically contained high concentrations of suspended solids. Review of the field forms also indicated groundwater samples were often "cloudy" or "slightly cloudy." Given the nature of the dioxins and PCP being investigated at the site, the data collected in January 2000 provide a more accurate portrayal of dissolved chemical concentrations.

Appendix A provides additional details of the current field investigation and presents the boring logs and grain size analyses completed. Appendix B provides tables that summarize the results of the chemistry data collected during this investigation and includes relevant data for the last two years from concurrent NPDES and landfill monitoring being conducted by Baxter. These data are supplemental to NPDES and landfill monitoring data collected between 1988 and 1998 which were previously reported in the Work Plan.

SITE HISTORY AND POTENTIAL CONTAMINANT SOURCES

Much of the Baxter site was farmland until the mid-1960s when Ted Butcher Inc. developed a wood treating facility on the southern portion of Parcel A. EPA records indicate Mr. Butcher peeled logs and treated them with a solution of PCP and/or creosote. The earliest record we found relating to pole treating operations on site is a 1967 aerial photograph, in which logs appear in the Parcel A area, although there is no clear evidence of treating operations. The photo shows a large pit excavated in central Parcel A, beneath the northern half of what is now drip pads, and extending eastward to the current butt treatment area. Aerial photographs from 1969 and 1970 show logs and structures suggesting wood treating operations and darker ground in the areas of the pit, the current butt treating plant, and the former butt-treating thermal tank (Figure 2) suggesting significant staining.

Additional Background Information

Additional background information was collected during this investigation to assist in locating our field explorations. We collected additional County files, reviewed the aerial photographs, and interviewed plant workers. The map of historical features from the Work Plan was updated based on data from these sources and is presented on Figure 2. A summary of the findings is presented below.

1990 Butt Tank Spill

Snohomish County Health District files for the Baxter site were reviewed. Information available included field notes by the Environmental Health Division Supervisor Jeff Defenbach for the 1990 butt tank overflow. The notes indicated that the PCP/oil solution did not appear to permeate below the top 1 to 2 inches of soil. Concerns were expressed about the quality of surface soil to the east of the butt tank; however, the file indicated that this soil was later removed and disposed of. Soil boring SB-7 was placed to the east of the butt tank in the approximate area (Figure 5) to explore for indications of the spill.

Tar-Like Material Removed

Prior to locating HCMW-5, we interviewed Bob Crane, a long-time employee at the Baxter facility. Mr. Crane assisted in identifying the location of the tar-like substance that had been removed in the 1970s during construction of the yard train tracks and switch system. According to Mr. Crane, the substance removed was not creosote (a wood treating chemical reported to have been formerly used at the site). Although no chemical profile of the substance was available, Mr. Crane recalled that its consistency was like tar. Well HCMW-5 was placed in the middle of this area (Figure 5).

Stained Soil Areas

Aerial photographs from the 1960s that showed possible areas of stained soil (indicated by darker ground) were reviewed with Mr. Crane. Based on this review, it was determined that the darker ground appearing in the photos in the northeast and south areas of Parcel A was more likely vegetation than oil or other staining. According to Mr. Crane, in the 1960s and early 1970s, several areas on site remained vegetated. The dark ground appearing in the photos in the area of the former excavated pit (Figure 2), however, appears more likely to have been a former drainage pathway (possibly for butt tank overflows) based on field exploration data (e.g., SB-6).

Mr. Crane also identified the location of a former butt treating thermal tank, south of the current butt treatment complex. According to Mr. Crane, this tank was filled in-place when decommissioned. Boring SB-8 was located on the west (hydraulically downgradient) side of this former tank location (Figure 5) to explore for potential sources in this area.

Area Water Well Survey

Several well inventories have been conducted around the Baxter site. In 1990, Mr. Defenbach noted in his spill report that residences in the area were connected to the City of Arlington water supply, with the exception of the Airway Mobile Home Park (whose well was subsequently abandoned by Baxter). Terry Castle, of the City of Arlington Public Works Department, confirmed that water mains are located along both NE 188th Street and 67th Avenue NE and that all public streets are serviced around the Baxter site. Mr. Castle did not recall any new construction near the Baxter site having installed their own well for water supply.

To identify historical wells, which may still be in use, two field well inventories were conducted. In 1988, Sweet-Edwards performed a field survey and identified several possible existing wells near the site (See Work Plan, Appendix B). We conducted a further field inventory by visiting residences within 2,000 feet of the Baxter site. The survey identified several active wells in the site vicinity. The locations of these wells are shown on Figure 3 and are listed in Table 1. None of these wells are located directly downgradient of the site.

HYDROGEOLOGIC SETTING

The site is situated within the Marysville trough, a broad outwash plain located generally between Arlington and Marysville. The trough was originally carved out by river and/or glacial erosion and then subsequently filled in with a thick sequence of coarse-grained glacial meltwater deposits placed as the last glacier retreated from the area. The coarse-grained outwash deposits, described as the Marysville sand member (Qvrm) by Minard (1985) and Newcomb (1952) are estimated to be at least 100 feet thick in the area of the site. Figure 3 presents a geologic map of the area and Figure 4 presents a regional hydrogeologic cross section.

The Getchell Hill upland lies to the east of the site. This glaciated upland sequence includes a till cap underlain by a relatively thick sequence of advance outwash. The advance outwash (Qva) was mapped by Minard (1985) in the hillside east of the site to occur from the valley floor to elevations of over 250 feet. We estimate the Qva is at least 50 feet thick based on area well logs, although Minard (1985) and Newcomb (1952) describe these deposits as being several hundreds of feet thick in the area. The Qva is underlain by fine sand, silt, and clay of the transitional beds unit (Qtb). The water level data for the Baxter site indicates that the Qva, and/or other deposits within the hillside to the east, recharge the sand and gravel outwash deposits beneath the site.

Recharge also occurs from direct infiltration of precipitation falling on the site. We estimated the recharge rate to be approximately 25 inches per year on an average annual basis. This estimate was based on an average precipitation of 47 inches, evapotranspiration of 24 inches (WSU, 1966), and assuming no runoff.

The outwash plain results in topography that is largely flat. Little or no natural drainage occurs within outwash because of the thick sequence and relatively high infiltration capacity of the outwash sands and gravels. Because of this geology it is common practice in the area to infiltrate storm water. The closest drainage feature is Portage Creek, a tributary to the Stillaguamish River. Portage Creek lies approximately 5,000 feet north of the site and is likely the principal discharge point for the groundwater comprising the outwash aquifer. Springs, mapped in the Portage Creek valley wall by Newcomb (1952), evidence this discharge.

Site Hydrogeologic Units

Although the site data indicate the subsurface materials are generally consistent with the regional description of the Marysville sand outwash unit, there are at least three distinct layers with differing material types identified. These include Fill Material, an upper native Gravelly Sand unit, and a deeper Fine Sand unit. Internal to these units are interbedded coarse- and fine-grained layers; however, it appears that the most consistency in these units occurs beneath the main treatment area, with more variability occurring to the north and south. Cross sections depicting our interpretation of these layers across the site are presented on Figures 6, 7, and 8. Figure 5 shows the location of the cross sections.

Fill Material

Several distinct bodies of fill material are present in areas of the site. These fills are distinguished based on historical aerial photos, known site activities, and artifacts observed in the drilling sample data. The fills appear to have been placed in areas of the site formerly excavated, most likely for gravel mining. The woodwaste landfill west of the Main Treatment Area is a documented example. In borings SB-5 and SB-6, drilled to investigate a pit observed in a 1967 aerial photo, wood chips and other organic debris were encountered to a depth of approximately 12 to 13 feet. Other areas of known backfilling include the location of the former "tar" material excavated during installation of the kilns in the 1970s, and backfill for the butt tanks, which are estimated to be about 15 feet below ground surface.

The fill is typically a silty to slightly silty, gravelly to slightly gravelly Sand. Wood chips and organics are common. In two locations—SB-7 between 2 and 6 feet, and SB-8 between 4 to 7 feet—charcoal bits were observed. In most other areas, the upper few feet of soil were generally more silty than the deeper native outwash. The upper 1 to 2 feet of the facility operation areas are tightly compacted from routine regrading and resurfacing.

Upper Gravelly Sand Unit

The uppermost native unit is most commonly a Gravelly Sand, but ranges from gray to brown-gray, from slightly silty to non-silty and from slightly gravelly to very gravelly. This unit typically occurs within 1 or 2 feet of ground surface to a depth 15 to 25 feet, but was observed as deep as 30 feet in boring BT-S on the south side of the former butt tank (See Figure 8). To the north of Parcel A (in MW-2 and HCMW-7) this unit is interbedded with slightly silty to non-silty, fine to medium Sand layers.

Lower Fine Sand Unit

Finer sands underlie the Gravelly Sand. This unit is typically a slightly silty to non-silty, fine to medium or medium to fine Sand. Discontinuous layers of fine- and coarse-grained materials are present within this unit. In the southern site area (Parcel B) at BSX-4, 13 feet of a silty clay were encountered. The clay was soft to very soft and moderately plastic (EMCON, 1989). In the northern portion of the site, sandy gravel and very gravelly sand were logged in MW-3 and SB-4, respectively, at depths below 40 feet.

Groundwater Occurrence

Groundwater is encountered at depths between 10 and 40 feet depending on time of year and location on the property. Groundwater elevations are higher on the south and east sides of the property (as shallow as 7 to 15 feet in depth) and deeper on the north and west property areas (ranging between 30 and 45 feet in depth). Groundwater elevations fluctuate about 5 to 10 feet between the wet and dry seasons and as much as 15 to 18 feet between wet and dry years (Table 2). The seasonal pattern of recharge was indicated by hydrographs of several of the existing wells presented on Figure 6 of the Work Plan.

Groundwater was encountered during drilling of the new monitoring wells (HCMW-5, HCMW-6, and HCMW-7) at approximately the same depth as was measured when the wells were completed, indicating an unconfined or water table aquifer. Figures 6 through 8 show the range in water table elevation between the wettest and driest periods recorded for the site, as well as the water levels measured on October 25, 1999, for this investigation. In general, groundwater occurs within the upper Gravelly Sand unit in the south and east sides of the site, at least during the wet season, and almost always within the finer sand unit in the north and west site portions of the site.

Groundwater Flow

The groundwater flow patterns for a wet season (April 1997) and a dry season (October 1999) are illustrated on Figure 9. The data collected in October 1999, including the three new wells, show a strong influence from the east. While groundwater is recharged on site by direct infiltration, it is apparent that inflow also occurs from the upland area to the east. Groundwater generally flows to the northwest, although there is a more westerly flow on the east side of the site that curves around to the northwest beneath the main treatment area. It is believed that the water ultimately discharges into Portage Creek.

There are several local anomalies in the groundwater flow patterns worth noting as they may influence contaminant transport:

- Hydraulic gradients vary across the site. Higher hydraulic gradients exist to the east of HCMW-5 and MW-1, while flatter gradients occur to the northwest, suggesting higher permeability materials to the northwest. In October 1999, the hydraulic gradients in the southeast site were between 0.03 to 0.035 ft/ft, while gradients between 0.01 and 0.006 ft/ft occurred between HCMW-5 and MW-3, and downgradient of MW-3, respectively.

- A steeper drop in hydraulic head between MW-1 and MW-3 than between HCMW-5 and MW-3 (which are further apart) causes a nearly east to west flow pattern in the area around the butt tank. In addition, the potential gradient between groundwater at MW-1 and HCMW-5 (the water level elevation in MW-1 was 74.4 feet and the water level elevation in HCMW-5 was 71.3 feet) may even suggest a local preferential southwest flow pattern in the area around the butt tank area.
- During the wet season, groundwater in the southeastern portion of the site, flows within the upper Gravelly Sand unit (See Figure 6). During this period it is likely that the groundwater flows at higher rates in this area.

Estimates of the groundwater flow rate are made based on measured hydraulic conductivity and hydraulic gradient data. Table 3 below presents the hydraulic conductivity data collected by previous investigators, and supplemented with interpretation of grain size analyses collected during this investigation.

Table 3 - Hydraulic Conductivity Data

Location Tested	**Material Description**	**Type of Test**	**Hydraulic Conductivity in feet/day (cm/sec)**
MW-1 [1]	Fine Sand, trace of silt	Slug rod test	4 to 6 (2×10^{-3})
MW-3 [1]	Screened in both sandy Gravel and fine Sand	Slug rod test	100 to 150 (4×10^{-2})
BXS-2 [1]	Fine to medium Sand	Bailed slug test	2 to 6 (1.4×10^{-3})
BXS-4 [1]	Silty Sand; with gravel; decrease in silt with depth	Bailed slug test	0.2 to 1 (2×10^{-4})
SB-2, composite 17.5 to 19 and 22.5 to 24 feet	Medium to fine Sand	Hazen's: D_{10}^2	76 (2.6×10^{-2})
MW-5, 30 to 31.5 feet	Slightly silty, medium Sand	Hazen's: D_{10}^2	21 (7.5×10^{-3})
SB-4, 12.5 to 14 feet	Gravelly Sand	Hazen's: D_{10}^2	143 (5×10^{-2})
SB-5, 32.5 to 34 feet	Silty, fine Sand	Hazen's: D_{10}^2	4 (1×10^{-3})

Note: [1] Data from Woodward-Clyde, 1990.

The hydraulic conductivity data show consistency with typical values for the material properties identified in each of the wells; 2 to 20 feet per day is the estimated range for hydraulic conductivity in the Fine Sand layer, within which most of the groundwater flows beneath the main treatment area. However, using MW-3 and SB-4 data, hydraulic conductivities may be as high as 100 to 150 feet per day in the coarser, gravelly sand layers.

Groundwater flow rates can be estimated using the hydraulic conductivity and gradient data discussed above for the different units. Using the October 1999 gradient data and an assumed porosity of 0.3, flow rates in the fine sand unit in the southeast would range between 0.2 and 2 feet/day. In the northeast site area, the lower gradients suggest flow occurs primarily within coarser sand and gravelly sand layers. Using a permeability range of 20 to 150 ft/ day as an average and the lower gradients, flow rates in the northwest site area are estimated to most likely range between 0.4 and 5 ft/day.

During the wet season in the southeast site area, groundwater flow rates as high as 8 ft/day are estimated using an assumed hydraulic conductivity of 150 ft/day and the April 1997 gradient of 0.017 ft/ft.

A comparison of lag times between peak precipitation and peak groundwater elevations for the wells completed beneath Parcel A indicates that it takes several months for precipitation to infiltrate the ground surface, migrate through the unsaturated zone, and reach the water table (Hart Crowser Work Plan, 1999, Figure 6).

NATURE AND EXTENT OF CONTAMINATION

The results of soil, groundwater, and surface water quality testing are presented in this section. First, screening levels are developed to evaluate and identify chemicals of concern. Then, a discussion of the chemicals identified above screening levels and the nature and extent of the exceedences are presented in the section on the Occurrence of Chemicals of Concern. Finally, a Summary of the Contaminant Concerns identified is presented.

A summary of the specific chemical data collected at the site since 1998 is presented in Tables B-1 through B-5 in Appendix B. Additional data are available in the site database and in the tables presented in the Work Plan.

Screening Levels for Chemicals of Concern

The Work Plan identified the preliminary chemicals of concern as PCP (based on detection in soil, surface water, and groundwater) and dioxins (based on detection in surface water). Our investigation focused on these chemicals. In addition, selected samples were analyzed for petroleum hydrocarbon compounds (TPH) as they are used with PCP in the treating process. Selected samples were also analyzed for polycyclic aromatic hydrocarbons (PAHs) as there were reports of historical use of creosote for wood treating.

Screening levels were developed for each compound for each potentially significant exposure pathway using the Proposed Amendments, Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC (Ecology, November 1999), scheduled to be implemented in June of 2000. The screening levels used are presented in Tables 8, 9, 10, and 11 with a summary of the concentration range detected, the maximum concentration detected, and the frequency of exceedences of the screening levels. Derivation of the screening levels is discussed in the section.

Note that we use the term dioxins to refer to polychlorinated dioxins and furans. Unless otherwise noted, the term 'dioxin concentration' refers to the 2,3,7,8-TCDD equivalents concentration, which is the sum of 17 dioxin and furan compound concentrations that have been adjusted using Toxicity Equivalency Factors (TEFs).

Groundwater Evaluation Criteria

The aquifer located beneath the Baxter site is considered by Ecology to be a potential drinking water source. Therefore, MTCA Method B groundwater cleanup levels, which are based on a drinking water exposure scenario, were used as screening levels for PCP, dioxins, and PAHs. Petroleum hydrocarbons were screened against the proposed Method A Industrial groundwater cleanup levels.

Soil Quality Evaluation Criteria

Soil data are screened relative to MTCA criteria developed for direct contact risks and for protection of groundwater. Screening levels for PCP, dioxins, and PAHs were based on Method B and C standard and modified cleanup levels in accordance with the November 1999 draft MTCA cleanup regulation. Petroleum concentrations detected in soils were screened against the proposed MTCA Method A cleanup levels. Procedures used to establish Method B and C cleanup levels for each of the potential exposure pathways outlined in the draft regulation are discussed below.

Direct Contact with Soils

The site is currently used for industrial activities and lies within an area zoned Industrial by the City of Arlington. Therefore, MTCA Method C industrial direct contact cleanup levels were used to evaluate the direct contact exposure pathway for soils.

Groundwater Protection

Both surface and subsurface soils were screened against Modified Method B cleanup levels for protection of groundwater. Modified Method B cleanup levels rely on site-specific data to determine appropriate soil concentrations for groundwater protection. We used several methods outlined in the draft MTCA cleanup regulation including the modified three-phase partitioning model, leaching tests, and empirical data. The resulting screening levels are presented in Table 5, along with the cleanup levels calculated using Ecology's default Method B K_{oc} value for comparison.

Development of these screening levels is based on evaluation of the leachability of a chemical from the soil. The leachability depends most strongly on two parameters: how strongly the chemical sorbs to the organic fraction of soil (typically given by the organic carbon partition coefficient, K_{oc}), and the organic matter content in the soil. Because surface soils, unsaturated zone soils, and saturated zone soils exhibit varying organic carbon contents and dilution potential, we calculated separate groundwater protection cleanup levels for each of these units. For the purpose of this analysis, soils sampled from depths less than 4 feet are considered to be surface soils since they generally had higher organic carbon contents (roughly 1% versus 0.1%) than soils sampled at greater depths. K_{oc}s for PCP and dioxin were estimated as described below.

PCP K_{oc} in Surface Soil. The organic carbon partition coefficient (K_{oc}) for PCP in surface soils was estimated using Synthetic Precipitation Leaching Procedure (SPLP) data, which provide a conservative estimation of PCP concentrations that could leach from soil by rainfall. Figure 10 provides the SPLP results for six site surface soil samples that contained relatively high concentrations of PCP. As can be seen in the graph (and as is typical for many chemicals), the sorption isotherm from the SPLP data was not linear over the entire range of concentrations tested. To account for this condition, we determined K_{oc} values based on the magnitude of PCP concentration in the soil. For PCP concentrations in soil greater than 10 mg/kg, a K_{oc} of 1,200 mL/g was determined. For PCP concentrations in soil less than 10 mg/kg, a K_{oc} of 14,000 mL/g was determined.

PCP K_{oc} in Subsurface Soil. The K_{oc} for PCP in subsurface soils was calculated based on PCP concentrations in soil and groundwater collected from the same depth interval within a boring. The ratio of the chemical concentration in soil to that in water at the same depth interval provides an empirical method for measurement of the partitioning of the chemical of concern from soil to water. The data used are summarized in Table 4. Using the measured organic content of the subsurface soils (0.08%), the K_{oc}s were calculated to be 12,200 mL/g. As can be seen in Table 5, this K_{oc} value compares well with the K_{oc} value computed using the SPLP isotherm for the low PCP concentrations.

Dioxins. Screening levels for dioxins were developed in a similar fashion to those for PCP except that literature values for K_{oc} were used (EPA, 1994). Table 6 presents a summary of the reported K_{oc} for each of the dioxin and furan congeners. As can be seen in the table, congeners have markedly different absorptive properties. In particular note that the congeners detected at the site generally have much higher K_{oc}s and, therefore, are much more strongly sorbed to site soils than the more toxic and less chlorinated congeners such as 2,3,7,8-TCDD, not detected at the site.

To develop an appropriate groundwater protection cleanup level for dioxins that accounts for both the lower toxicity and higher hydrophobicity of the detected congeners, we calculated a weighted K_{oc} (6.9×10^7 mL/g) based on the contribution of each congener to the total dioxin concentration, as shown in Table 6. The weighted K_{oc} was determined using the average relative percentages of the various congeners detected in the site surface soils. As with PCP, distinct groundwater protection screening levels were calculated for surface and subsurface soils based on the varying organic content of these soils and dilution potential, using the Modified Method B approach. The resulting groundwater protection cleanup levels are presented in Table 7.

PAHs. For cPAHs in subsurface soils, we used the proposed standard Method B groundwater protection level of 2 mg/kg, which is calculated using the three-phase partitioning model. Since surface soils have an order of magnitude higher fractional organic carbon content of 1.1%, we used the Modified Method B approach to set the screening level for groundwater protection at 22 mg/kg for surface soils. These screening levels conservatively assume that all of the cPAHs have the same toxicity as benzo[a]pyrene.

Soil to Air

No volatile constituents, as defined in Section 173-340-200 of the proposed MTCA cleanup regulation, have been identified as constituents of potential concern at the site. Therefore, the soil to air pathway was not further evaluated.

Occurrence of Chemicals of Concern

This section discusses data that exceed the direct contact and/or groundwater protection screening levels. The nature and extent of the chemical occurrence are also described, and an assessment of the potential source of the contaminant is made. The discussion is first organized by medium, and then by the particular chemical being considered.

A statistical summary of the occurrence of the chemicals of concern detected at the site is provided in Tables 8, 9, 10 and 11 for surface soils, subsurface soils, surface water, and groundwater, respectively. These tables summarize the data collected (since 1988) for the chemicals of concern, and provide a statistical tabulation of the data relative to the screening levels developed as described above.

Surface Soils

Surface soils are differentiated from subsurface soils because of their higher silt and organic content. Surface soil data include four samples obtained by Ecology in 1992, 12 samples (SS-series shallow and deep) collected for this investigation, and the 2.5-foot samples collected in the borings drilled for this investigation. A summary of the surface soil exceedences relative to regulatory criteria is presented in Table 8. The specific chemical results of surface soil and subsurface soil data are provided in Table B-1 and Table B-4 (dioxins only) in Appendix B.

PCP

PCP was detected in surface soils in the Main Treatment Area and the Treated Pole Storage Yard at concentrations ranging from 0.03 to 110 mg/kg. Detected concentrations of PCP in surface soil were all well below the direct contact screening level of 1,094 mg/kg (Table 8). A map showing the distribution of PCP detections in surface soils is provided on Figure 14.

As discussed above, site-specific SPLP and organic carbon data were used to estimate a groundwater protection cleanup level for surface soils of 3.1 mg/kg. PCP was detected above this screening level in 17 of 23 surface soil samples. The highest detected concentrations were in the shallow sample from SS-3 (90 mg/kg) located near the railroad loading area in the treated wood storage area, and the 2.5-foot-deep sample from boring SB-5 (110 mg/kg) located just east of the drip pads. Exclusive of these data, and older data collected by Ecology in 1992, the average surface soil PCP concentration level is 5 mg/kg. The log-normal average concentration of surface soil data is 2.4 mg/kg, which is below the groundwater protection levels.

PCP concentrations in the deeper surface samples (0.8-inch depth) were generally an order of magnitude lower than in shallow surface samples (0.2-inch depth). For example, in samples SS-1 and SS-5 (located next to drains 24 and 23) over an order of magnitude decrease in PCP concentrations (6 to 0.15 mg/kg and 9.3 to 0.096 mg/kg) was observed with a 6 inch increase in depth. In a study on soil surrounding PCP-treated telephone poles (EPRI, 1997), PCP concentrations were observed to decline rapidly with increasing distance from the treated poles. The data collected in this Remedial Investigation corroborate the findings of that study. These data suggest a limited potential for subsurface leaching of PCP from surface soils.

Although PCP was detected in surface soils in the treatment area and the treated pole storage yard, substantially lower PCP concentrations were located off site, in the down-wind direction. SS-6-S and SS-6-D indicated PCP concentrations of 0.02 and 0.015 mg/kg, respectively. This is substantially lower than the high of 90 mg/kg detected at the closest on-site sample location (SS-3) to location SS-6. In addition, PCP was detected at low concentrations (0.033 to 0.16 mg/kg) in surface soil samples from borings SB-2 and HCMW-5 in the south part of Parcel A. These explorations are located close to the untreated log yard and away from the handling of treated logs (see Figure 5). These data indicate that transport of site constituents outside of the Main Treatment Area and Treated Pole Storage Yard is minimal.

The consistent pattern of PCP occurrence at similar concentrations throughout both the Main Treatment Area and the Treated Wood Storage Area suggest a low level, relatively ubiquitous source of PCP within these areas. An AKART analysis (AGI, 1997) identified a former potential source of PCP in surface soils to be vapor deposition from the cooling tower. While this may have contributed to PCP detected in site soils in the past, a carbon treatment system has recently been installed to minimize cooling tower impacts.

TPH

Diesel-range petroleum, of which the PCP carrier oil is a component, was detected at relatively low concentrations (60J to 1400 mg/kg) in four of five surface soil samples analyzed. TPH as lube oil was detected in three of these samples (SS-1S at 630, SS-1D at 60J and SS-2S at 190 mg/kg), which is most likely associated with industrial machinery operations. TPH detected in sample SS-2D (1,400 mg/kg) was identified as Non-PHC as Diesel (the signature is similar to the aromatic oil, but has a wider range and is heavier). The detected concentrations of petroleum compounds were below groundwater protection screening criteria for TPH.

PAHs

A previous investigation (Ecology, 1992) found PAH concentrations in surface soil to be below screening criteria for both direct contact and groundwater protection. Since PAHs have also not been detected above screening criteria in either groundwater or surface water, nor are they in products currently used at the site, surface soil samples obtained for this RI were not analyzed for PAHs.

Dioxin

Dioxins were detected in surface soils at concentrations between 1 and 8 ug/kg, which are above the MTCA Method C direct contact criterion of 0.875 ug/kg for industrial soils. Figure 15 presents the location of surface soil samples analyzed for dioxin and the resulting concentrations detected. Although the data exceed MTCA screening level for direct contact with dioxin, the EPA typically uses a cleanup level of 1 ug/kg for residential soils and a cleanup level of between 5 and 20 ug/kg for commercial/industrial soils (EPA, 1997). Note that the site dioxin data fall within or below the range that EPA has set as protective of human health and the environment at commercial/industrial sites.

The dioxin congeners detected at the site in surface soils are less toxic and more hydrophobic than the 2,3,7,8-TCDD congener. Table 6 presents the average concentration of each of the dioxin/furan congeners detected. Because of the extremely high hydrophobicity of the detected compounds, dioxins were detected below the screening criterion for groundwater protection.

Subsurface Soils

Subsurface soils include those below 4 feet in depth for the purpose of this discussion. Table 9 presents the statistical summary of the chemical detections in subsurface soil relative to regulatory criteria. The complete database of soil data is provided in Appendix B, Table B-1 and Table B-4 (dioxins only).

PCP

PCP was detected in the subsurface at relatively high concentrations in two areas where non-aqueous phase liquid (NAPL) was observed; adjacent to the butt tank investigated for closure, and beneath the eastern end of the former excavated pit. Otherwise, PCP was generally not detected, or was detected at or below groundwater protection screening criteria. PCP occurrences in unsaturated and saturated zone soils are presented on Figures 16 and 17, respectively. Cross Sections presented on Figures 11, 12, and 13 show the distribution of PCP data with depth.

The highest level of PCP in subsurface soil (560 mg/kg) was detected in SB-6 at a depth of 15 to 16.5 feet. SB-6 was located in what is presumed to have been a former gravel pit (observed in 1967 photos) that was later filled in. Residual product was observed directly beneath woodwaste material apparently used to fill the pit. Sheen was observed in the SB-6 soil samples from a depth of 15 feet to the total depth drilled, although the concentration of PCP just beneath the water table (32.5 to 34 feet) was significantly lower (0.78 mg/kg) than that of the 15-foot sample. The 1969 and 1970 photos indicate a stained soil area along the northern edge of the former pit (See Figure 2).

High concentrations of PCP were also detected in borings BT-S (40 mg/kg) and BT-W (1,400 mg/kg), located directly adjacent to the butt tank that was abandoned in 1990. During drilling of BT-W, residual product sheen was noted throughout the depth drilled, from the shallowest sample at 2.5 feet to the deepest sample collected just beneath the water table at 32 feet. In BT-S, sheen was observed in the 2.5-foot sample and in the samples from depths of 12.5 feet to the bottom of the boring at 34 feet.

Low concentrations of PCP detected elsewhere in subsurface soils likely result from the leaching of PCP to surface soils and subsequent adsorption of dissolved PCP by subsurface soils. In particular, note the consistency in PCP concentrations at boring SB-4, located adjacent to the drainage ditch that runs along the western boundary of the treated pole storage yard. This ditch receives most of the drainage from both the main treatment area (through Drains 13 and 14, piped directly to the ditch) and the western side of the Treated Pole Storage Yard. PCP was detected at low levels in SB-4 throughout its depth, at a generally consistent concentration of between 0.018 and 0.025 mg/kg (See Figure 11). This consistency suggests that the soil column may have reached its adsorption capacity with respect to the influent PCP concentrations in storm water. Also note the lack of PCP in the deeper soils at HCMW-6, located in the center of the treated pole storage yard. The HCMW-6 data suggest that PCP leachate migration via direct infiltration through that treated pole storage yard is not a significant source to groundwater.

TPH

Diesel-range petroleum was detected above the screening criteria in borings BT-S, BT-W, and SB-6, at the locations where residual product was observed. TPH was not detected in any other subsurface explorations. The highest concentration (56,000 mg/kg) was detected in boring BT-W at the water table. The TPH was identified as 'PHC as diesel' which is consistent with the signature of the PCP carrier oil. TPH concentrations near the base of the former butt tank (estimated to be 15 feet deep) ranged between non-detect and 4,900 mg/kg in BT-S and BT-W, respectively. TPH concentrations near the water table ranged between 2,900 and 56,000 mg/kg for BT-S and BT-W, respectively.

The highest TPH concentration detected in boring SB-6 was 17,000 mg/kg, detected at a depth of 15 feet, just below the fill layer. The TPH concentration just below the water table was much lower (170 mg/kg). The TPH detected in boring SB-6 was identified as 'Diesel.' The difference in identification of the TPH between boring SB-6 and the butt tank ('Diesel' versus 'PHC as Diesel') may indicate that the oil in SB-6 originated from an older spill that occurred at a time when a different carrier oil was used.

Dioxins

Dioxins were detected in boring SB-6 above screening criteria. Dioxin concentrations in SB-6 ranged from 7,092 ng/kg at a depth of 15 to 16.5 feet (just below the fill material) to 79 ng/kg at a depth of 32.5 to 34 feet. These concentrations correlate with the magnitude of PCP and TPH concentrations detected at the same locations in this boring. The specific dioxin congeners detected are consistent with those detected in other media on the site. The suite of congeners detected is also consistent with those found as a by-product in PCP.

PAHs

Total cPAHs were detected in the soil samples analyzed from boring SB-6. Sample S-6 (15 to 16.5 feet), in which NAPL was observed, contained total cPAHs (30.9) above the screening level of 2 mg/kg. Total cPAHs in the sample near the water table were below screening criteria. PAHs are not present in the current treating solution, indicating that the oil observed in SB-6 may be a former carrier oil no longer used at the site.

Surface Water

Surface water is sampled quarterly at several site catch basins by J.H. Baxter as part of on-going NPDES monitoring. These samples are analyzed for chlorinated phenols, TSS, PAHs, and TPH. In addition, several samples collected in 1997 and 1998 were analyzed for dioxins. A statistical summary of the surface water sampling results relative to regulatory criteria is provided in Table 9. A summary of the data collected since 1998 are presented in Appendix B, Tables B-2 and B-5 (dioxins only).

PCP

Ecology and EPA have identified surface water as a possible source of PCP to the groundwater system. Review of quarterly storm water data demonstrates greatly fluctuating PCP concentrations, with PCP typically highest in drains 23 and 24 on the western side of the treated wood storage and main treatment area, with average PCP concentrations of 410 and 363 ug/L in these locations. Figure 18 presents a summary map of the detected range and average concentrations of PCP detected in storm water at each of the site drains.

The storm water samples are generally very turbid, with average suspended solids (TSS) concentrations ranging between 380 and 880 mg/L. Because of the high turbidity of the samples and the hydrophobicity of PCP, the detected PCP concentrations are unlikely to represent true dissolved PCP concentrations. Estimates of the dissolved PCP concentration were made using the TSS data from drains 23 and 24.

Figure 19 presents linear correlations between PCP and TSS detected in samples from drains 23 and 24 for samples containing less than 1,000 mg/L of TSS. The y-intercept of these correlations, approximately 100 to 200 ug/L, provides an estimate of an average true dissolved PCP concentration.

Another estimate of the true dissolved PCP concentration in surface water can be made using the surface soil and SPLP data. For this estimate the lognormal average surface soil concentration of 2.4 mg/kg is adjusted to the surface soil organic content. To determine a conservative estimate of the amount of PCP bound to organics we used the lowest organic content measured (0.49%) at SS-2 near Drain 13/14. Figure 10 was then used to estimate the leachable concentration of PCP using the organic carbon normalized PCP concentration. An estimated dissolved concentration of approximately 40 ug/L was determined using this method.

Finally, we reviewed the filtered storm water data collected by AGI in 1997 (AGI, 1997) to further evaluate the amount of dissolved PCP likely to be in the storm water. These data included the collection of storm water samples from Drains 13/14, 23, 24, and 25 using 0.45 micron filters on 2/14/97 and #40 Whatman filters on 5/29/97. PCP was detected at concentrations from 0.6 to 2.5 ug/L using the 0.45 micron filter, and from 0.8 to 120 ug/L PCP using the Whatman filter. These data show a range similar to that calculated using the site chemistry data.

Concentrations of PCP in surface water appear most likely to be the result of leaching from surface soils and treated poles, and the inclusion of PCP-containing solids in surface water samples. Dissolution of the treatment solution from process operations into surface water does not appear to be a likely source of PCP in storm water, since oil was not observed in the treatment area or treated pole storage yard, and oil is generally not detected in storm water samples.

Dioxins

Similar to PCP, dioxin concentrations in surface water samples vary widely (33 to 11,146 pg/L). Considering the strongly hydrophobic nature of these compounds, it is likely that these data are even less representative of true dissolved dioxin concentrations. In filtered samples collected in 1998, detected dioxin concentrations were over an order of magnitude less than those in the unfiltered samples, indicating that most of the dioxins in surface water are likely associated with particulates.

TPH

Oil and grease are typically not detected in site storm water samples.

PAHs

PAHs are generally not detected or are detected below 3 ug/L in site storm water samples.

Groundwater

A substantial database of groundwater quality data exists for the site because of sampling being conducted as a part of NPDES requirements and landfill closure monitoring. As shown in the statistical summary table (Table 11) for groundwater, over 64 samples have been obtained from site wells, and 161 samples have been collected for PCP analysis. These data have indicated a PCP plume around the MW-3 area. Three new wells (HCMW-5 through HCMW-7) were installed for this investigation to attempt to further bound the PCP plume. A summary of the groundwater data collected for this study and relevant data collected since 1998 under the NPDES program are presented in Tables B-3 and B-5 (dioxins only) in Appendix B.

PCP

PCP has been detected in groundwater above the cleanup level of 1 ug/L 92 times since sampling for PCP began in 1990. However, the detections have only been consistent in three wells: MW-3, BXS-1, and MW-2. The highest PCP concentrations are detected in wells MW-3 (average of 220 ug/L) and BXS-1 (average of 45 ug/L) which are located downgradient of the Main Treatment Area. Lower concentrations of PCP (less than 10 ug/L) have been detected in samples from well MW-2, located in the northwest corner of the Treated Pole Storage Yard. PCP has not been detected above cleanup levels in samples from wells (MW-4 and BXS-4) located in the untreated pole storage area; from wells (BXS-2 and BXS-3) located along the western boundary of the former woodwaste landfill; or from well MW-1 located on the upgradient side of the Main Treatment Area. A summary of the October 1999 groundwater data is presented on Figure 20.

The three new wells (HCMW-5, HCMW-6, and HCMW-7) installed as part of this investigation did not detect PCP during two sampling events. These wells were sampled initially in October 1999, and again in January 2000, in conjunction with the quarterly NPDES monitoring of the other site wells. HCMW-5 was located downgradient of catch basins 25 and 26 to assess storm water in this area as a potential source to the groundwater. HCMW-5 was also located in the area of the reported "tar" excavation. HCMW-6 was located in the middle of the treated pole storage yard to assess subsurface leaching of surface soils by infiltrating rainfall. HCMW-7 is located in the right of way for 188th Street NE, approximately 300 feet from MW-3, in the downgradient groundwater flow direction. That PCP was not detected in any of these wells on either sampling date provides valuable data on the extent of the PCP plume and potential sources of the detected PCP.

In addition to groundwater sampling from the new wells, groundwater grab samples were also obtained during drilling from several soil borings and analyzed for PCP as part of this investigation. These data are also presented on Figure 20. Unfortunately, the grab samples were highly turbid and may not represent true dissolved concentrations. To minimize turbidity interferences, the samples were allowed to settle in the lab, and the supernatant was analyzed for both TSS and PCP. Low PCP concentrations (less than 2 ug/L) were detected in both the untreated log storage yard by catch basin 25 (SB-2) and the treated pole storage yard downgradient of catch basin 23 (SB-4). These data suggest limited input of PCP to groundwater from a storm water source. In addition, that PCP was not detected in either well HCMW-5 (immediately downgradient of storm drain 25) or well HCMW-6 (in the treated pole storage yard) further suggests a limited influence of storm water infiltration on groundwater PCP concentrations.

Groundwater PCP concentrations detected in grab samples within the main treatment area were higher (4 to 58,000 ug/L). The highest concentrations (58,000 and 22,000 ug/L) were detected from highly turbid (22,700 and 8,650 mg/L TSS) grab samples from borings BT-S and BT-W around the former butt treating tank, in which NAPL was observed. Based on soil concentrations above the water table beneath the butt tank, and the seasonal variation of the water table, there is likely a smear zone of LNAPL in this location. When the water table is highest, the greatest volume of groundwater is in contact with the LNAPL and the greatest potential for PCP dissolution occurs. This would account for the large seasonal variation in PCP concentration observed at MW-3. Both wells (BXS-1 and MW-3) in which moderate to high PCP concentrations have been detected are located in the downgradient direction of the observed LNAPL occurrences.

PCP has been either not detected or detected at very low concentrations in MW-1, which is only 50 feet from the butt tank and the observed LNAPL. The most recent groundwater elevation data (including the newly installed HCMW-5 and HCMW-6) indicate that MW-1 may be cross-gradient from the butt tank location rather than downgradient because the flow direction is almost due west in this location. Although it seems unusual that higher PCP concentrations have not been detected in this well, there are several possible explanations. First, it appears that the fine sand layer slopes to the southwest. In this case, the product source may have migrated preferentially within the unsaturated upper Gravelly Sand layer to a southwesterly location away from MW-1. In addition, the flatter gradient between HCMW-5 and MW-3 indicates that a higher permeability material occurs southwest of the butt tank, suggesting preferential flow in this direction.

Dioxins

Dioxins were analyzed for in groundwater samples collected in October 1999 and again in January 2000 from the three wells (BXS-1, MW-3, and MW-2) in which PCP have been regularly detected. Dioxin concentrations detected in both samples from MW-2 and the October sample from MW-3 exceeded the groundwater screening level of 0.6 pg/L. Wells were sampled in October 1999 using a bailer, and in January 2000 using dedicated low-flow bladder pumps. In October 1999, dioxin was detected in MW-3 at 10.7 pg/L and in MW-2 at 1,056 pg/L. Conversely, in January 2000 sampling, dioxin was detected at 0.15 in MW-3 and in MW-2 at 2.5 pg/L. Dioxin concentrations were below detection limits in BXS-1 during both samplings events.

Although dioxin concentrations detected at MW-2 were above screening levels, given the strong association of dioxin compounds with suspended solids, the January 2000 dioxin concentration detected at MW-2 may still be associated with suspended solids. The low-flow sampling pumps produced samples containing suspended solids below the detection limit of 4 mg/L. Table 12 presents an analysis that shows it would only take 1 mg/L (one-quarter the detection limit) to produce a dioxin concentration of 2.5 pg/L. The analysis in Table 12 uses the October 1999 turbidity and dioxin concentration data to predict the soil dioxin concentration in MW-2. Using these data and the K_{oc} equilibrium data for dioxins, a dissolved dioxin concentration of 0.17 pg/L in groundwater is predicted. Assuming the TSS concentration was 1 mg/L (one quarter the detection limit), a dioxin concentration of 2.3 pg/L is predicted for groundwater. The actual measured dioxin concentration was 2.5 pg/L.

The dioxin detected in MW-2 may be related to the occurrence of PCP in this area. The dioxin congeners detected are consistent with those detected elsewhere on the site in association with PCP occurrence.

TPH

TPH-D was detected above the screening level (0.5 mg/L) in the groundwater grab samples obtained from the butt tank borings BT-S and BT-W (at 590 and 1,500 mg/L, respectively). LNAPL was observed in these samples and the samples were highly turbid (22,700 and 8,650 mg/L TSS). The TPH was identified in the diesel range, consistent with the aromatic PCP carrier oil.

Away from the former butt tank source area, only low or non-detectable concentrations of TPH-D (less than 0.1 mg/L) were identified. Gasoline-range petroleum and BTEX were generally not detected in any groundwater samples after low concentrations of gasoline-range petroleum were quantified in the BT-S and BT-W grab samples. Review of the chromatograms indicated that these detections were merely the low end of the diesel-range petroleum detected at high concentrations in the same samples.

PAHs

PAHs have consistently not been detected in site groundwater during quarterly NPDES monitoring.

Chemical Co-Occurrence

The occurrence of PCP, diesel-range petroleum (TPH-D), and dioxin on the J.H. Baxter site appear to be associated with each other. In general, the data show strong co-occurrence of these chemicals at source areas, with less correlation further removed from the source. Occurrence patterns away from the source, however, can be explained by differential migration patterns that generally match the expected behavior of the chemicals of concern. This characteristic can be seen using the correlation curves presented on Figures 21 and 22.

The co-occurrence of PCP and TPH-D is presented on Figure 21. The upper 4% and 8% curve identifies a good correlation between PCP and TPH-D, particularly for the highest concentrations of PCP. This is consistent with field data that indicated residual carrier oil was observed in samples later found to contain high PCP concentrations. Wood treating solutions typically contain between 4% and 8% PCP dissolved in a diesel-range aromatic oil (EPA, 1992). For the data collected at the site, the correlation indicates a 2.5% PCP/oil solution when NAPL is present. This is relatively consistent with typical treatment solution chemistry, considering that the PCP may be preferentially leaching out of the aromatic oil. The lower percentage of PCP suggests an older source.

At lower PCP concentrations (below 10 mg/kg), the correlation between PCP and TPH-D is less valid. As can be seen in the lower curve on Figure 21, the predicted TPH-D concentration is lower than the actually measured. In addition, the correlation does not include several samples with detectable PCP but no detectable TPH. This is because at the lower PCP concentrations, the correlation predicts TPH-D concentrations below the method detection limit.

Low concentrations of dioxins are present as a by-product of PCP production. The typical treating solution contains 0.1% dioxins (EPA, 1992). A correlation between occurrences of PCP and dioxins in surface soils is shown on Figure 22. For this correlation, the total dioxin concentration is used instead of the TEF equivalent concentration to allow a comparison to the treating solution, in which the dioxin concentration is reported by weight. Dioxin occurrences were higher in surface soils relative to PCP concentrations than is typically found in the treating solution. This is not surprising given the greater recalcitrance of dioxin compounds to degradation. In addition, the dioxin, congeners, and relative concentrations of these congeners detected in surface soil samples are consistent with each other and with the treating solution.

In groundwater, differential migration properties can explain the occurrence of PCP in wells where TPH-D has not been detected. Although PCP is consistently found in MW-3, TPH-D has not been detected in this well, which is downgradient of the LNAPL source. This is likely because the TPH is less mobile and/or more readily biodegraded in transport downgradient. Very low concentrations of TPH-D were detected, however, in the highly turbid groundwater grab samples at SB-2, SB-4, and SB-8 (0.07J, 0.089J, and 0.08J mg/L, respectively). The TPH-D was identified as Non-PHC as diesel, which is generally consistent with the identification of the carrier oil.

The PAHs detected in samples from boring SB-6 are likely a component of the PCP/oil mixture found in the same samples. The carrier oil found in boring SB-6 was identified as 'Diesel,' whereas the carrier oil found underneath the former butt-treating tank was identified as "PHC as Diesel." The product spilled from the butt tank may be different than the oil(s) used at the time of discharge to the SB-6 area. Although PAHs are not currently present in the treatment solution, they may have been present in a solution formerly used at the site.

Summary of Contaminant Concerns

The primary environmental concern at the Baxter site is protection of groundwater from PCP contamination. Although TPH-D, dioxins, and PAHs were also detected in subsurface LNAPL above groundwater protection screening criteria, these compounds have generally not been detected in site groundwater above MTCA Method B cleanup levels. These chemicals generally co-occur with the PCP, but are more persistent to the source area.

We identified two potential sources of PCP in site groundwater:

- **Dissolution of Subsurface LNAPL.** LNAPL occurs in the unsaturated zone and at the water table in the butt tank and former pit areas. Because the carrier oil is lighter than water, the product will tend to float on the water table. Groundwater level fluctuations up to 14 feet have been recorded in the area of the LNAPL occurrence indicating a "smear zone" of PCP and petroleum over this depth zone (approximately 20 to 33 feet in depth); and

- **Leaching of Surface Soils.** Surface soil leaching may occur from precipitation directly infiltrating the ground or by storm water infiltrating through catch basin drain fields and site drainage ditches.

The estimated mass of diesel-range petroleum and PCP in site soil and groundwater is presented in Table 13. This estimate accounts for a 50-foot by 50-foot area around the butt tank, surface soils, and the area of groundwater contamination. The area assessed around the butt tank was sufficiently large to account for the area of NAPL observed around SB-6. The majority of PCP and petroleum occurring at the site are in the NAPL observed beneath the former butt-treating tank and in surface soils. Of the two main sources (subsurface NAPL and surface soils), PCP present in the NAPL is likely to be more readily transported to groundwater because of the higher PCP concentrations, because the NAPL is in direct contact with the groundwater, and because the subsurface soils have a lower organic content than the surface soils.

FATE AND TRANSPORT OF PENTACHLOROPHENOL

The MULTIMED (Multimedia Exposure Assessment) Model developed by EPA was used to evaluate the fate and transport of PCP originating from the potential sources identified above. The model simulates transport through both unsaturated and saturated soils. The Baxter site is appropriate for this model because it consists of a relatively simple physical system; however, the model results should be viewed as approximate due to the natural variation of model parameters. In particular, the heterogeneity of the saturated zone soils (ranging from fine sand to sandy gravel), the temporal differences in seasonal recharge and groundwater flow gradients, and the effect of these water changes on the flow patterns are not accounted for. A conceptual drawing of the MULTIMED model applied to the Baxter site is provided on Figure 23.

Since wood treating operations have been present at the site since the 1960s and reported spills occurred more than 10 years ago, a steady state model was used. Changes in sources from degradation or changed operation practices are not accounted for. A description of the model, including assumptions, estimated parameters, and a sensitivity analysis, is provided in Appendix C.

Relative Contribution of Potential Sources to Groundwater

Using the MULTIMED model, we estimated the relative magnitude of the contribution of each source to groundwater PCP concentrations. The scenarios modeled included a NAPL source, area-wide surface water infiltration, and drainfield-focused storm water infiltration. We compared the model-predicted concentrations and average measured concentrations at several site wells. The predicted model results for a hypothetical well, MW-H, located at the site boundary downgradient of storm drain 23 were also obtained. The results of modeling with and without biodegradation are presented in Table 13.

According to the model results, the source most strongly contributing to detected concentrations of PCP in groundwater at MW-3 is the LNAPL source beneath the butt tank and in the SB-6 area. The estimated contribution of precipitation leaching to PCP detected at MW-3, whether through storm water infiltration at the drains or direct surface water infiltration, is only a small percentage of the total. Modeling without biodegradation results in PCP concentrations that are significantly higher than those observed in the field. Therefore, it is apparent that biodegradation of PCP is a significant attenuation factor. Possibly assisting the attenuation of PCP is the co-occurrence of the diesel carrier oil, which as a petroleum product is readily biodegraded in the aerobic conditions observed at this site. The enhanced biological activity from oil degradation would likely aid PCP biodegradation. TPH degradation may also create a local anaerobic environment that allows for reductive dechlorination of PCP.

The fact that neither PCP nor the diesel carrier oil has ever been detected at MW-1 is puzzling given its proximity to the NAPL source. MW-1 is only 50 feet away from the old butt tank, and in at least a cross-gradient, if not a partially downgradient, groundwater flow direction. This suggests that in this area groundwater may flow in a more westerly or west-southwesterly direction than indicated by the existing data. There appears to be more permeable sand and gravelly sand layers within the fine sand near and north of MW-3 (See Figures 6 and 8) which may act as a drain, providing a preferential flow path for groundwater containing PCP. MW-1 is screened entirely within the fine sand layer. The disparity in PCP concentrations detected at MW-1 and MW-3 may also result from NAPL occurrence in the area of SB-6.

The groundwater flow conditions support the potential that the majority of PCP is released into groundwater during the wet season when groundwater levels are high and moving through the LNAPL smear zone. Review of the MW-3 monitoring data over the last few years (See Figure 24) indicates that the highest concentrations typically occur in the fall months (e.g., 870 ug/L in October 1999), approximately 6 months after the high groundwater levels that typically occurs in April. Using the average groundwater flow rate of 2 ft/day, the travel time from the butt tank area to MW-3 would be about six months. Likewise, low concentrations are seen in MW-3 in the spring, roughly six months following the groundwater low. Although the PCP data in the spring could be lower because of dilution from recharge, this would also suggest less of a surface water or storm water infiltration source for PCP.

Low concentrations of PCP detected in MW-2 may be the result of storm water infiltration. Review of the groundwater elevation contour map for October 1999

(Figure 20) suggests that MW-2 is mostly cross gradient of the main plume area at MW-3. MW-2 is also not directly downgradient of the LNAPL source areas, and the low detection of PCP in the SB-4 grab sample suggests a limit in this direction to the plume identified in MW-3. Given the lack of PCP detection in HCMW-6, the close proximity of MW-2 to the treated storage area drainage ditch, and the PCP concentration predicted by the fate and transport modeling, it appears that the PCP in MW-2 may be due to storm water infiltration.

In summary, it appears that the PCP in groundwater is largely the result of groundwater flowing through the LNAPL beneath the butt tank. Isolated occurrences of NAPL in subsurface soils beneath the main treatment area (such as observed at SB-6) may also contribute. Modeling of the site conditions, and the empirical data collected during this investigation, suggest that the main contributor to groundwater PCP concentrations is the NAPL source; however, surface water leaching may be a secondary source resulting in low groundwater PCP concentrations that are slightly above the MTCA Method B cleanup level on the site.

Risk Associated with PCP in Groundwater

Groundwater PCP concentrations in monitoring wells near the site boundary, particularly MW-3, currently exceed the MTCA Method B cleanup level. Since Ecology considers area groundwater to be a potential drinking water source, the PCP potentially migrating off site in groundwater represents a potential human health risk. None of the area users, however, are located close to the site in the downgradient direction. In addition, PCP was not detected in groundwater at well HCMW-7, located approximately 300 feet downgradient from the site. Since no wells are located within the estimated impacted area, and fate and transport modeling indicates the observed levels would attenuate prior to reaching any existing wells, there is no current threat to human health.

The groundwater modeling indicated a minor potential that low PCP concentrations could reach HCMW-7. It is important to point out the conservatism build into the modeling. The biodegradation factor used is much lower that has been estimated at other PCP sites (Battelle, 1997), and also is lower than the site-specific biodegradation rate estimated using the decline in PCP concentration between MW-3 and SB-4. In addition, direct surface water infiltration was estimated to occur at a constant rate of 0.3 m/yr and to leach 40 mg/L PCP from soil across the entire Parcel A area. As discussed above, the empirical evidence suggests this greatly overestimates the input of PCP to groundwater.

SUMMARY OF REMEDIAL OBJECTIVES

The data indicate that the LNAPL and local surface soil leaching are likely contributing to PCP in the groundwater beneath the site. Remediation of these concerns should affect remediation of other chemicals of concern present above regulatory screening levels. The areas of focus for remedial action include:

- Preventing dissolution of soil from near the butt tank and at SB-6, which contains PCP and dioxins above groundwater protection screening criteria, and TPH-D above Method A cleanup levels;
- Preventing leaching of surface soils in the treatment area and treated pole storage yard, which contain PCP and dioxins above groundwater protection screening criteria; and
- Reducing PCP concentrations in groundwater downgradient of MW-3, which contains PCP above Method B cleanup levels. This could be addressed by remediating the potential sources discussed above.

LIMITATIONS

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of J.H. Baxter for specific application to the referenced property. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the undersigned.

We trust that this report meets your needs.

HART CROWSER, INC.

LORI J. HERMAN
Principal

JEREMY J. PORTER
Staff Remediation Engineer

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Table 1 - Water Supply Use

Well Location	Owner	Use	Approx. Surface Elev. in Feet (1)	Well Depth in Feet	Depth to Water in Feet (2)	Water Level Elev. in Feet	Screened Interval in Feet	Notes	Info. Source
T31N R5E									
Section 10	The Petal Patch Flower Shop, 20404 67th Ave. NE	Unknown	-	-	-	-	-		2
Section 14	Nikleson, 6803 188th St NE	Domestic	-	-	-	-	-		3
Section 14	Mr. Willett, 'Cozy Heating', 20221 67th Ave. NE	Unknown	116	-	15	91	-	not in use	2
Section 15	Thomco	Domestic	-	-	-	-	-		2,3
Section 15	Arlington Cemetary Association	Irrigation	119	77	43	76	73-77	irrigation	2
Section 15	Mr. E. Experdal, 5822 Cemetary Rd.	Domestic	120	65	69	51	-		2,3
Section 15	Mr. B. Hoggarth, 6225 204th Place NE	Domestic	110	69	52	58	-		2,3
Section 15	D.H. Thompson, 6210 204th Place NE	Domestic	120	85	50	70	80-85	16A1 on Figure 3	1,3
Section 15	Mr. Gray, 6115 204th Place NE	Domestic	110	69	52	58	60-69		2,3
Section 15	Kim Hudnall, 5530 Cemetary Rd	Domestic	117	-	52	65	-		2
Section 16	Mr. Hans Bohn	Domestic	-	-	-	-	-	not mapped	2
Section 21	City of Arlington, Arlington Airport	Municipal	-	-	-	-	-		4
Section 22	Mr. James, 18110 67th Ave. NE	Domestic	158	23	10	148	-	property to be redeveloped	2,3
Section 22	Mr. Jones, 17722 1/2 67th Ave. NE	Domestic	140	-	11	129	-		2
Section 23	Unknown, 6804 188th St NE	Domestic	-	-	-	-	-		3
Section 23	Unknown, 18727 67th Ave NE	Domestic	-	-	-	-	-	may soon switch to city water	3

Information Sources

1) Washington State Water Well Reports
2) 1988 Sweet-Edwards/EMCON Beneficial Use Survey (EMCON, 1989)
3) Hart Crowser Field Well Inventory (October 1999 and January 2000)
4) City of Arlington

Notes

- Indicates no data available or unknown

(1) Elevations are relative to Mean Sea Level. Most of the well elevations are determined from topographic maps and are only approximate.

(2) Water levels reported on the original well log or obtained during a well inventory (EMCON, 1989).

Table 2 - Summary of Water Elevation Data

	Depth to Water in Feet Below Top of Casing										
Monitoring Well	**BXS-1**	**BXS-2**	**BXS-3**	**BXS-4**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**HCMW-5**	**HCMW-6**	**HC-MW-7**
Sampling Date											
8/1/90	35.80	34.80	31.60	15.60	26.50	38.50	36.20	(2)			
8/1/91	34.94	33.79	30.71	15.31	27.08	37.99	35.14	(2)			
10/1/91	NM	NM	32.97	NM	NM	NM	37.45	(2)			
3/1/92	35.16	34.72	31.06	10.06	21.50	40.56	(1)	(2)			
8/1/92	39.92	38.85	35.77	17.61	32.97	44.83	(1)	(2)			
3/1/93	40.70	40.22	37.31	16.17	28.58	45.54	(1)	(2)			
6/1/93	40.61	70.02	NM	NM	NM	45.52	(1)	(2)			
9/1/93	42.35	41.64	NM	NM	33.40	47.20	(1)	(2)			
12/1/93	43.57	42.93	NM	NM	NM	NM	(1)	(2)			
8/15/94	42.85	41.93	39.79	19.06	33.45	47.74	43.70	(2)			
11/30/94	44.91	43.65	41.86	NM	26.54	NM	43.16	14.74			
2/16/95	40.17	39.31	36.64	13.91	23.31	45.29	42.37	13.30			
4/27/95	38.40	37.59	34.23	12.84	23.28	43.59	40.79	11.36			
8/1/95	40.39	39.40	36.28	17.59	30.13	45.37	43.08	15.00			
10/10/95	41.46	40.66	38.18	15.61	28.46	46.56	44.17	12.27			
1/11/96	38.28	37.78	34.43	12.19	22.95	43.57	40.60	9.79			
4/18/96	31.20	35.20	31.53	31.78	26.79	41.35	38.88	11.70			
7/18/96	36.66	35.76	31.99	15.94	28.25	41.74	38.78	13.82			
9/25/96	38.81	37.85	34.35	14.85	29.57	43.76	41.95	12.10			
1/14/97	33.52	32.83	29.26	8.14	19.68	38.93	35.60	7.01			
4/9/97	28.23	27.82	23.22	10.14	22.28	33.35	30.88	10.67			
8/6/97	30.99	29.96	25.29	13.65	24.50	36.19	33.79	13.00			
10/6/97	33.27	32.13	28.29	13.73	27.02	38.53	36.15	11.87			
1/15/98	33.19	34.94	28.22	10.94	23.25	38.78	35.99	9.23			
4/15/98	30.92	29.88	25.78	11.45	23.61	36.35	33.95	10.67			
7/15/98	33.21	32.04	28.04	14.47	27.25	38.55	36.01	12.85			
10/6/98	36.63	35.47	31.59	16.43	31.51	41.89	39.57	13.95			
1/12/99	36.05	35.14	31.57	12.18	23.75	41.88	38.18	10.15			
4/13/99	31.79	30.81	26.61	11.40	23.06	47.32	34.45	10.82			
7/21/99	32.26	31.06	26.96	12.78	24.54	37.80	35.02	12.05			
10/4/99	34.87	33.73	29.55	15.65	29.14	40.24	37.82	13.81			
10/25/99	35.76	35.54	30.57	15.47	30.00	41.01	38.80	13.19	29.31	39.17	40.68

	Water Table Elevation in Feet										
Monitoring Well	**BXS-1**	**BXS-2**	**BXS-3**	**BXS-4**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**HCMW-5**	**HCMW-6**	**HC-MW-7**
Top of Casing Reference Elevations	**99.59**	**99.77**	**98.99**	**100.34**	**104.4**	**102.86**	**103.04**	**101.97**	**100.63**	**103.25**	**101.68**
Sampling Date											
8/1/1990	63.79	64.97	67.39	84.74	77.90	64.36	66.84	(2)			
8/1/1991	64.65	65.98	68.28	85.03	77.32	64.87	67.90	(2)			
10/1/1991	NM	NM	66.02	NM	NM	NM	65.59	(2)			
3/1/1992	64.43	65.05	67.93	90.28	82.90	62.30	(1)	(2)			
8/1/1992	59.67	60.92	63.22	82.73	71.43	58.03	(1)	(2)			
3/1/1993	58.89	59.55	61.68	84.17	75.82	57.32	(1)	(2)			
6/1/1993	58.98	(1)	NM	NM	NM	57.34	(1)	(2)			
9/1/1993	57.24	58.13	NM	NM	71.00	55.66	(1)	(2)			
12/1/1993	56.02	56.84	NM	NM	NM	NM	(1)	(2)			
8/15/1994	56.74	57.84	59.20	81.28	70.95	55.12	56.80	(2)			
11/30/1994	54.68	56.12	57.13	NM	77.86	NM	59.88	87.23			
2/16/1995	59.42	60.46	62.35	86.43	81.09	57.57	60.67	88.67			
4/27/1995	61.19	62.18	64.76	87.50	81.12	59.27	62.25	90.61			
8/1/1995	59.20	60.37	62.71	82.75	74.27	57.49	59.96	86.97			
10/10/1995	58.13	59.11	60.81	84.73	75.94	56.30	58.87	89.70			
1/11/1996	61.31	61.99	64.56	88.15	81.45	59.29	62.44	92.18			
4/18/1996	68.39	64.57	67.46	(3)	77.61	61.51	64.16	90.27			
7/18/1996	62.93	64.01	67.00	84.40	76.15	61.12	64.26	88.15			
9/25/1996	60.78	61.92	64.64	85.49	74.83	59.10	61.09	89.87			
1/14/1997	66.07	66.94	69.73	92.20	84.72	63.93	67.44	94.96			
4/9/1997	71.36	71.95	75.77	90.20	82.12	69.51	72.16	91.30			
8/6/1997	68.60	69.81	73.70	86.69	79.90	66.67	69.25	88.97			
10/6/1997	66.32	67.64	70.70	86.61	77.38	64.33	66.89	90.10			
1/15/1998	66.40	64.83	70.77	89.40	81.15	64.08	67.05	92.74			
4/15/1998	68.67	69.89	73.21	88.89	80.79	66.51	69.09	91.30			
7/15/98	66.38	67.73	70.95	85.87	77.15	64.31	67.03	89.12			
10/6/98	62.96	64.30	67.40	83.91	72.89	60.97	63.47	88.02			
1/12/99	63.54	64.63	67.42	88.16	80.65	60.98	64.86	91.82			
4/13/99	67.80	68.96	72.38	88.94	81.34	(3)	68.59	91.15			
7/21/99	67.33	68.71	72.03	87.56	79.86	65.06	68.02	89.92			
10/4/99	64.72	66.04	69.44	84.69	75.26	62.62	65.22	88.16			
10/25/1999	63.83	64.23	68.42	84.87	74.40	61.85	64.24	88.78	71.32	64.08	61.00

Notes:
(1) Data are not reported.
(2) MW-4 not installed until 1994.
(3) Reported elevation inconsistent with water elevation history.

Table 4 - PCP Partition Coefficient Estimation Based on Soil and Groundwater Concentrations in Soil Borings

Soil Boring	PCP Concentration in Groundwater in mg/L	PCP Concentration in Soil at the Watertable in mg/kg	Partitioning Coefficient (K_d)
SB-2	0.0006	0.69	1,150
SB-3	0.021	0.02	0.95
SB-4	0.0012	0.023	19
SB-5	0.047	0.005	0.11
SB-8	0.0048	0.19	40
Geometric Mean K_d in mL/g			**9.8**
Geometric Mean K_{oc}[1] in mL/g			**12,200**

Note:

[1] Based on measured soil organic carbon content of 0.08%.

702602\RI modeling.xls- Kd-S GW ratio

Table 5 - Development of a Groundwater Protection Cleanup Level for PCP

Soil Region	Average Soil pH	K_{oc} in mL/g	Fractional Organic Carbon Content of Soil	K_d in mL/g	Groundwater Cleanup Level in mg/L	Dilution Factor	Soil Cleanup Level in mg/kg
Method B - Washington State Department of Ecology Default Values of K_{oc} [1]							
Surface	6.4	877	0.011	9.647	0.001	20	0.20
Unsaturated Zone	6.4	877	0.001	0.877	0.001	20	0.022
Saturated Zone	7.6	429	0.0008	0.3432	0.001	1	0.00063
Modified Method B - K_{oc} Determined from Soil and Groundwater PCP Concentrations [2]							
Surface	6.4	12,200	0.011	134.2	0.001	20	2.7
Unsaturated Zone	6.4	12,200	0.001	12.2	0.001	20	**0.25**
Saturated Zone	7.6	12,200	0.0008	9.76	0.001	1	**0.010**
Modified Method B - K_{oc} determined using SPLP Data (Valid for PCP Concentrations Less than 10 mg/kg) [3]							
Surface	6.4	14,000	0.011	154	0.001	20	**3.1**
Unsaturated Zone	6.4	14,000	0.001	14	0.001	20	0.28
Saturated Zone	7.6	14,000	0.0008	11.2	0.001	1	0.011

Literature Values (EPRI, 1997)

Site Parameters	K_d in mL/g
All Sites	0.3 to 900
Sites with a pH and Organic Content of Studied Site	0.8 to 39

Notes:

Bolded values used to screen site soil data.

[1] Proposed MTCA Amendments, Washington State Department of Ecology, 1999.

[2] See Table 2 for development of K_{oc}

[3] See Figure 10 and text for derivation of K_{oc} from SPLP data

Table 6 - Determining Weighted Average K_{oc} for Dioxin

Congener	K_{oc} (1) in mL/g	Toxicity Equivalency Factor (TEF) (2)	Average Concentration in ng/kg (3)	Fraction of Total	Weighted K_{oc} in mL/g
2,3,7,8-TCDD	2,700,000	1	Not Detected	0	0
1,2,3,7,8 PeCDD	2,700,000	0.5	551	0.0003	870
1,2,3,4,7,8-HxCDD	38,000,000	0.1	1,745	0.0010	38,775
1,2,3,6,7,8-HxCDD	12,000,000	0.1	4,892	0.0029	34,336
1,2,3,7,8,9-HxCDD	12,000,000	0.1	3,582	0.0021	25,144
1,2,3,4,6,7,8-HpCDD	98,000,000	0.01	126,391	0.074	7,244,689
OCDD	24,000,000	0.001	1,350,024	0.79	18,950,865
2,3,7,8-TCDF	2,100,000	0.1	Not Detected	0	0
1,2,3,7,8-PeCDF	3,800,000	0.05	Not Detected	0	0
2,3,4,7,8-PeCDF	5,100,000	0.5	Not Detected	0	0
1,2,3,4,7,8-HxCDF	12,000,000	0.1	12,902	0.0075	90,554
1,2,3,6,7,8-HxCDF	12,000,000	0.1	Not Detected	0	0
1,2,3,7,8,9-HxCDF	12,000,000	0.1	Not Detected	0	0
2,3,4,6,7,8-HxCDF	12,000,000	0.1	Not Detected	0	0
1,2,3,4,6,7,8-HpCDF	49,000,000	0.01	21,906	0.013	627,820
1,2,3,4,7,8,9-HpCDF	49,000,000	0.01	2,007	0.0012	57,532
OCDF	390,000,000	0.001	185,715	0.11	42,363,058
Totals:			**1,709,715**	**1.0**	**69,400,000**

Note:

(1) Dioxin congener K_{OC}s from EPA, 1994.

(2) Included for reference. Not used in calculating weighted K_{oc}.

(3) Determined from five surface soil samples analyzed for dioxins.

702602\RI modeling.xls-Dioxin Koc

Table 7 - Development of a Groundwater Protection Cleanup Level for Dioxins

Soil Region	K_{oc} in mL/g	Fractional Organic Carbon Content of Soil	K_d in mL/g	Groundwater Cleanup Level in mg/L	Dilution Factor	Soil Cleanup Level in ng/kg
Modified Method B - Using a Weighted Average K_{oc} Based on Detected Site Concentrations of Individual Congeners [1]						
Surface	69,400,000	0.011	763,400	5.83E-10	20	**8,901**
Unsaturated Zone	69,400,000	0.001	69,400	5.83E-10	20	**809**
Saturated Zone	69,400,000	0.0008	55,520	5.83E-10	1	**32.4**
Background Concentration						6 to 8

Note:

[1] See Table 6 for development of the weighted average K_{OC}.

Table 8 - Statistical Summary of Analytical Results for Surface Soil Samples

Analyte	Detection Frequency	Range	Maximum Detection	Location of Maximum Detect.	Direct Contact (a)	Exceedence Frequency	Protection of GW	Exceedence Frequency
Nonchlorinated Semivolatiles in mg/kg								
Acenaphthene	1/4	.046 J to .9 U	0.046 J	40-3/25/92	210000	0/4		
Anthracene	3/4	.375 to .9 U	0.87	40-3/25/92	1050000	0/4		
Benzo(a)anthracene	2/4	.39 U to 2.6	2.6	40-3/25/92	17.98	0/4		
Benzo(a)anthracene	2/4	.39 U to 2.6	2.6 J	42-3/25/92	17.98	0/4		
Benzo(a)pyrene	2/4	.39 U to 2.3 J	2.3 J	40-3/25/92	17.98	0/4		
Benzo(b)fluoranthene	4/4	.18 J to 8.2 J	8.2 J	40-3/25/92	17.98	0/4		
Chrysene	4/4	.17 J to 2.6	2.6	40-3/25/92	17.98	0/4		
Dibenz(a,h)anthracene	2/4	.16 J to 1.2 J	1.2 J	40-3/25/92				
Fluoranthene	4/4	.16 J to 9.2	9.2	40-3/25/92	140000	0/4		
Fluorene	1/4	.11 J to .9 U	0.11 J	40-3/25/92	140000	0/4		
Pyrene	4/4	.26 J to 13 J	13 J	42-3/25/92	105000	0/4		
Total cPAHs	4/4	.35 to 16.9	16.9	40-3/25/92			22 (c)	0/4
Chlorinated Phenols in mg/kg								
2,4,6-Trichlorophenol	0/19	.005 U to 5 U	N/A					
Pentachlorophenol	23/23	.015 to 1900 J	1900 J	42-3/25/92	1094	1/23	3.1 (c)	17/23
Total Tetrachlorophenols	5/19	.005 U to 10	10	SB-5 S-1	105000	0/19	530 (c)	0/19
Dioxins in ng/kg								
TEF Equivalent	5/5	1161 to 8248	8248	SS-3-S	875 (a)	5/5	8900 (c)	0/5
TPH in mg/kg								
Diesel	0/5	25 U to 25 U	N/A				2000 (b)	0/5
Heavy Fuel Oil	0/5	100 U to 100 U	N/A				2000 (b)	0/5
Jet Fuel as Jet A	0/5	25 U to 25 U	N/A				2000 (b)	0/5
Kerosene	0/5	25 U to 25 U	N/A				2000 (b)	0/5
Lube Oil	3/5	60 J to 630	630	SS-1-S			2000 (b)	0/5
Mineral Spirits	0/5	25 U to 25 U	N/A				2000 (b)	0/5
Non-PHC as Diesel	0/5	100 U to 100 U	N/A				2000 (b)	0/5
PHC as Diesel	1/5	100 U to 1400	1400	SS-2-D			2000 (b)	0/5

U = Not detected at indicated detection limit.

J = Estimated value.

(a) Using MTCA Method C Cleanup Level for Industrial Soils.

(b) Proposed MTCA Method A Cleanup Level.

(c) Modified MTCA Method B Cleanup Level.

Table 9 - Statistical Summary of Analytical Results for Subsurface Soil Samples

Analyte	Detection Frequency	Range	Maximum Detection	Location of Maximum Detec	Direct Contact (a)	Exceedence Frequency	Protection of GW	Exceedence Frequency
Nonchlorinated Semivolatiles in mg/kg								
Acenaphthene	2/10	.084 to 58	58	SB-6 S-6	210000	0/10		
Acenaphthylene	2/10	.003 J to 1.2	1.2	SB-6 S-6				
Anthracene	2/10	.087 to 31	31	SB-6 S-6	1050000	0/10		
Benzo(a)anthracene	2/10	.041 to 8.9	8.9	SB-6 S-6	17.98	0/10		
Benzo(a)pyrene	2/10	.017 to 3.7	3.7	SB-6 S-6	17.98	0/10		
Benzo(b)fluoranthene	2/10	.014 to 2.9	2.9	SB-6 S-6	17.98	0/10		
Benzo(g,h,i)perylene	2/10	.006 to 1.1	1.1	SB-6 S-6				
Benzo(k)fluoranthene	2/10	.017 to 4.1	4.1	SB-6 S-6	17.98	0/10		
Chrysene	2/10	.043 to 9.1	9.1	SB-6 S-6	17.98	0/10		
Dibenz(a,h)anthracene	1/10	.005 U to .6	0.6	SB-6 S-6				
Fluoranthene	2/10	.17 U to 51	51	SB-6 S-6	140000	0/10		
Fluorene	2/10	.14 to 68	68	SB-6 S-6	140000	0/10		
Indeno(1,2,3-cd)pyrene	2/10	.009 to 1.6	1.6	SB-6 S-6	17.98	0/10		
Naphthalene	2/10	.009 to 68	68	SB-6 S-6	140000	0/10		
Phenanthrene	2/10	.17 U to 150	150	SB-6 S-6				
Pyrene	3/10	.15 to 39	39	SB-6 S-6	105000	0/10		
Total cPAHs	2/10	.17 U to 30.9	30.9	SB-6 S-6			2 (e)	1/8
Chlorinated Phenols in mg/kg								
2,4,6-Trichlorophenol	0/25	.005 U to 50 U	N/A					
Pentachlorophenol	27/33	.001 J to 1400	1400	BT-W S-7	1094	1/33	.28/0.012(b)(d)	14/33
Total Tetrachlorophenols	5/25	.005 U to 40 J	40 J	BT-W S-7	105000	0/25	48 (e)	0/25
Dioxins in ng/kg								
TEF Equivalent	2/2	79 to 7092	7092	SB-6-S-6	875	1/2	809/32(b)(d)	2/2
TPH in mg/kg								
Diesel	3/10	20 J to 17000	17000	SB-6 S-6			2000 (c)	1/10
Heavy Fuel Oil	0/10	100 U to 100 U	N/A				2000 (c)	0/10
Jet Fuel as Jet A	0/10	25 U to 25 U	N/A				2000 (c)	0/10
Kerosene	0/10	25 U to 25 U	N/A				2000 (c)	0/10
Lube Oil	0/10	100 U to 100 U	N/A				2000 (c)	0/10
Mineral Spirits	0/10	25 U to 25 U	N/A				2000 (c)	0/10
Non-PHC as Diesel	0/10	100 U to 100 U	N/A				2000 (c)	0/10
PHC as Diesel	3/10	100 U to 56000	56000	BT-W S-7			2000 (c)	3/10

U = Not detected at indicated detection limit; J = Estimated value.

(a) MTCA Method C Cleanup Level for Industrial Soils.

(b) Modified MTCA Method B Cleanup Level.

(c) Proposed MTCA Method A Cleanup Level.

(d) Unsaturated/saturated zone.

(e) Standard MTCA Method B Cleanup Level.

Table 10 - Statistical Summary of Analytical Results for Storm Water Samples

Analyte	Detection Frequency	Range	Maximum Detection	Location of Maximum Detect.	Screening Level (a)	Exceedence Frequency
Dioxins in pg/L						
TEF Equivalent	13/13	.36 to 13568	13568	Drains 13/14	1.0	12/13
Nonchlorinated Semivolatiles in μg/L						
Acenaphthene	0/40	1 U to 10 U	N/A			
Acenaphthylene	0/40	1 U to 35 U	N/A			
Anthracene	0/40	.1 U to 1 U	N/A			
Benzo(a)anthracene	4/40	.1 U to 1 U	0.9	Drains 13/14		
Benzo(a)pyrene	10/40	.1 to 1.8	1.8	Drain 13		
Benzo(b)fluoranthene	9/40	.2 U to 2.5	2.5	Drain 13		
Benzo(g,h,i)perylene	5/40	.2 U to 2 U	0.8	Drains 13/14		
Benzo(k)fluoranthene	11/40	.1 to 1.2	1.2	Drain 13		
Chrysene	19/40	.1 to 2.6	2.6	Drain 13		
Dibenz(a,h)anthracene	1/40	.1 to 1 U	0.1	Drains 13/14		
Fluoranthene	3/40	.2 U to 11 U	5.1	Drains 13/14		
Fluorene	0/40	.2 U to 2 U	N/A			
Indeno(1,2,3-cd)pyrene	6/40	.1 U to 2 U	0.7	Drains 13/14		
Naphthalene	0/40	1 U to 10 U	N/A			
Phenanthrene	10/40	.1 to 5 U	2	Drains 13/14		
Pyrene	3/40	.2 to 30 U	6.8	Drains 13/14		
Total PAHs	10/75	.148 to 84.8 U	34.1	Drains 13/14		
Total cPAHs	1/5	.2 U to .9	0.9	Drains 13/14		
Chlorinated Phenols in μg/L						
2,4,6-Trichlorophenol	0/40	.5 U to 50 U	N/A			
Pentachlorophenol	130/130	.8 to 960	960	Drain 24	1.0	129/130
Total Tetrachlorophenols	28/40	.5 U to 50 U	15	Drain 24; Drains 13/14		
Conventionals in mg/L						
Total Suspended Solids	130/130	5 to 19900	19900	Untreat. Wood-3/1-5/31/95		
pH	130/130	6.01 to 8.82	8.82	Drain 25	6.5-8.5	3/130
TPH in mg/L						
Oil & Grease	100/127	1 to 16	16	Drain 25	10	4/127

U = Not detected at indicated detection limit.

2,3,7,8-TCDD TEF Equivalent was calculated using detected dioxin results multiplied by the corresponding Toxic Equivalency Factor.

(a) Based on NPDES permit requirements.

Table 11 - Statistical Summary of Analytical Results for Groundwater Samples

Sheet 1 of 2

Analyte	Detection Frequency	Range	Maximum Detection	Location of Maximum Detect.	GW Scr. Level	Exceedence Frequency
Dioxins in pg/L						
TEF Equivalent	6/6	.0745 to 1056	1056	MW-2	0.6 (d)	3/6
Nonchlorinated Semivolatiles in µg/L						
Acenaphthene	0/71	1 U to 10 U	N/A			
Acenaphthylene	1/71	1 to 10 U	1	BXS-3		
Anthracene	0/71	.1 U to 1 U	N/A			
Benzo(a)anthracene	0/71	.1 U to 1 U	N/A			
Benzo(a)pyrene	0/71	.1 U to 1 U	N/A			
Benzo(b)fluoranthene	3/71	.2 U to 2 U	0.8	BXS-4		
Benzo(g,h,i)perylene	0/71	.2 U to 2 U	N/A			
Benzo(k)fluoranthene	0/71	.1 U to 1 U	N/A			
Chrysene	0/71	.1 U to 1 U	N/A			
Dibenz(a,h)anthracene	0/71	.1 U to 1 U	N/A			
Fluoranthene	0/71	.2 U to 2 U	N/A			
Fluorene	1/71	.2 to 2 U	0.2	MW-3		
Indeno(1,2,3-cd)pyrene	0/71	.1 U to 1 U	N/A			
Naphthalene	1/71	1 U to 10 U	1.7	MW-3		
Phenanthrene	1/71	.1 to 1 U	0.1	BXS-4		
Pyrene	0/71	.2 U to 2 U	N/A			
Total cPAHs	3/71	.2 U to 2 U	0.8	BXS-4	0.1 (a)	3/71
Chlorinated Phenols in µg/L						
2,4,6-Trichlorophenol	0/82	.2 U to 500 U	N/A		7.95 (d)	0/80
2,4-Dichlorophenol	0/72	.2 U to .2 U	N/A		48 (d)	0/72
2,4-Dimethylphenol	0/72	.2 U to .2 U	N/A		320 (d)	0/72
2,4-Dinitrophenol	0/72	.5 U to .5 U	N/A		32 (d)	0/72
2-Chlorophenol	0/72	.2 U to .2 U	N/A		80 (d)	0/72
2-Nitrophenol	0/72	.2 U to .2 U	N/A			
4,6-Dinitro-2-methylphenol	0/72	.5 U to .5 U	N/A			
4-Chloro-3-methylphenol	0/72	.2 U to .2 U	N/A			

Table 11 - Statistical Summary of Analytical Results for Groundwater Samples

Analyte	Detection Frequency	Range	Maximum Detection	Location of Maximum Detect.	GW Scr. Level	Exceedence Frequency
4-Nitrophenol	0/72	.5 U to .5 U	N/A			
Pentachlorophenol	106/169	.1 to 58000	58000	BT-S-GW	1 (d)	88/163
Phenol	0/72	.2 U to .2 U	N/A		9600 (d)	0/72
Total Phenols (b)	3/4	.2 to 300	300	BXS-4		
Total Tetrachlorophenols	4/10	.1 J to 2600	2600	BT-S-GW	480 (c)	2/10
Volatiles in µg/L						
Benzene	0/6	.5 U to 5 U	N/A		5 (e)	0/6
Ethylbenzene	0/6	1 U to 10 U	N/A		700 (e)	0/6
Toluene	0/6	1 U to 10 U	N/A		1000 (e)	0/6
Total Xylenes	0/6	1 U to 10 U	N/A		1000 (e)	0/6
TPH in µg/L						
Diesel	2/9	250 U to 1500000 J	1500000 J	BT-W-GW	500 (e)	2/9
Gasoline	0/6	250 U to 500 U	N/A		500 (e)	0/6
Heavy Fuel Oil	0/9	500 U to 500 U	N/A		500 (e)	0/9
Jet Fuel as Jet A	0/9	250 U to 250 U	N/A		500 (e)	0/9
Kerosene	0/9	250 U to 250 U	N/A		500 (e)	0/9
Lube Oil	0/9	500 U to 500 U	N/A		500 (e)	0/9
Mineral Spirits	0/9	250 U to 250 U	N/A		500 (e)	0/9
Non-PHC as Diesel	3/9	70 J to 500 U	89 J	SB-4 GW	500 (e)	0/9
Non-PHC as Gasoline	0/6	250 U to 500 U	N/A		500 (e)	0/6
PHC as Diesel	0/9	500 U to 500 U	N/A		500 (e)	0/9
PHC as Gasoline	2/6	250 U to 1000 J	1000 J	BT-W-GW	500 (e)	2/6

U = Not detected at indicated detection limit.

J = Estimated value.

(a) Based on Standard MTCA Method B carcinogenic PAHs as benzo(a)pyrene.

(b) Not including pentachlorophenol.

(c) MTCA Method B Cleanup level for 2,3,4,6-Tetrachlorophenol.

(d) MTCA Method B Drinking Water Cleanup Level.

(e) Proposed MTCA Method A Cleanup Level.

**Table 12 - Association of Dioxins Detected in Groundwater with Suspended Solids
(Detected Congeners Only)**

				Measured Concentrations			Predicted Concentrations			
Congener	K_{oc} in mL/g [1]	K_d in mL/g [2]	Toxicity Equivalency Factor (TEF)	TSS Concentration in mg/L [3]	Congener Concentration in pg/L [3]	TEF Equivalent Concentration in pg/L [3]	Soil Concentration at MW-2 in mg/kg [4]	Groundwater Concentration in pg/L [5]	TEF Equivalent Concentration in pg/L [5]	TEF Equivalent of Total Dioxin Concentration for a Sample Containing 1 mg/L TSS
1,2,3,7,8 PeCDD	2,700,000	2,160	0.5	504	103.0	51.5	0.0002	0.0946	0.0473	0.15
1,2,3,4,7,8-HxCDD	38,000,000	30,400	0.1	504	262.0	26.2	0.0005	0.0171	0.0017	0.05
1,2,3,6,7,8-HxCDD	12,000,000	9,600	0.1	504	781.0	78.1	0.0015	0.1614	0.0161	0.17
1,2,3,7,8,9-HxCDD	12,000,000	9,600	0.1	504	570.0	57.0	0.0011	0.1178	0.0118	0.12
1,2,3,4,6,7,8-HpCD	98,000,000	78,400	0.01	504	25497.00	255.0	0.0506	0.6453	0.0065	0.51
OCDD	24,000,000	19,200	0.001	504	228345.000	228.3	0.4531	23.5972	0.0236	0.48
1,2,3,4,7,8-HxCDF	12,000,000	9,600	0.1	504	3102.0	310.2	0.0062	0.6411	0.0641	0.68
1,2,3,4,6,7,8-HpCD	49,000,000	39,200	0.01	504	3294.00	32.9	0.0065	0.1667	0.0017	0.07
OCDF	390,000,000	312,000	0.001	504	17067.000	17.1	0.0339	0.1085	0.0001	0.03
Total Groundwater TEF Equivalent Concentration:						**1056.3**			**0.17**	**2.3**
							Actual Concentration Detected in January 2000:			**2.5**

Notes:

[1] K_{OC} from EPA (1994).

[2] Uses the average subsurface organic carbon content of 0.0008.

[3] Results of groundwater sampling in MW-2 for October 1999.

[4] Calculated assuming all dioxins detected in groundwater sample are associated with TSS.

[5] Calculated dissolved dioxin concentration assuming predicted soil concentrations and equilibrium between soil and groundwater.

Table 13 - Modeled Contribution of Potential Sources to PCP in Groundwater

	Source Contribution from Model in ug/L (No Biodegradation)				Source Contribution from Model in ug/L (Including Biodegradation [4])				
Receptor Well	NAPL Source	Storm Water Infiltration [1,6]	Surface Water Infiltration [6]	Total	NAPL Source	Storm Water Infiltration [1,6]	Surface Water Infiltration [6]	Total	Average Observed Concentration in ug/L
MW-2	12	0.03	25	**37**	0.13	3.2	11.0	**14**	**2.8**
MW-3	845	6.3	26	**877**	328	0.0003	17.0	**345**	**250**
BXS-1	346	0.7	23	**370**	26	0.02	2.9	**29**	**44**
HCMW-7	8.4	0.4	20	**29**	1.1	0.03	1.9	**3**	**<1**
MW-H[2,3]	274	20	25	**319**	19	14	11.0	**44**	**-**

Notes:

[1] Storm water contribution from drains 13/14 unless otherwise noted.

[2] Storm water contribution from drain 23.

[3] Hypothetical well at potential point of compliance, located on site boundary downgradient of storm drain 23.

[4] Biodegradation rate estimated by fitting decline in concentration between well MW-3 and well BXS-1.

[6] Storm water and surface water assumed to have an average concentration of 40 ug/L based on SPLP data.

Table 14 - Estimate of Mass of PCP and Diesel-Range Petroleum in Soil and Groundwater

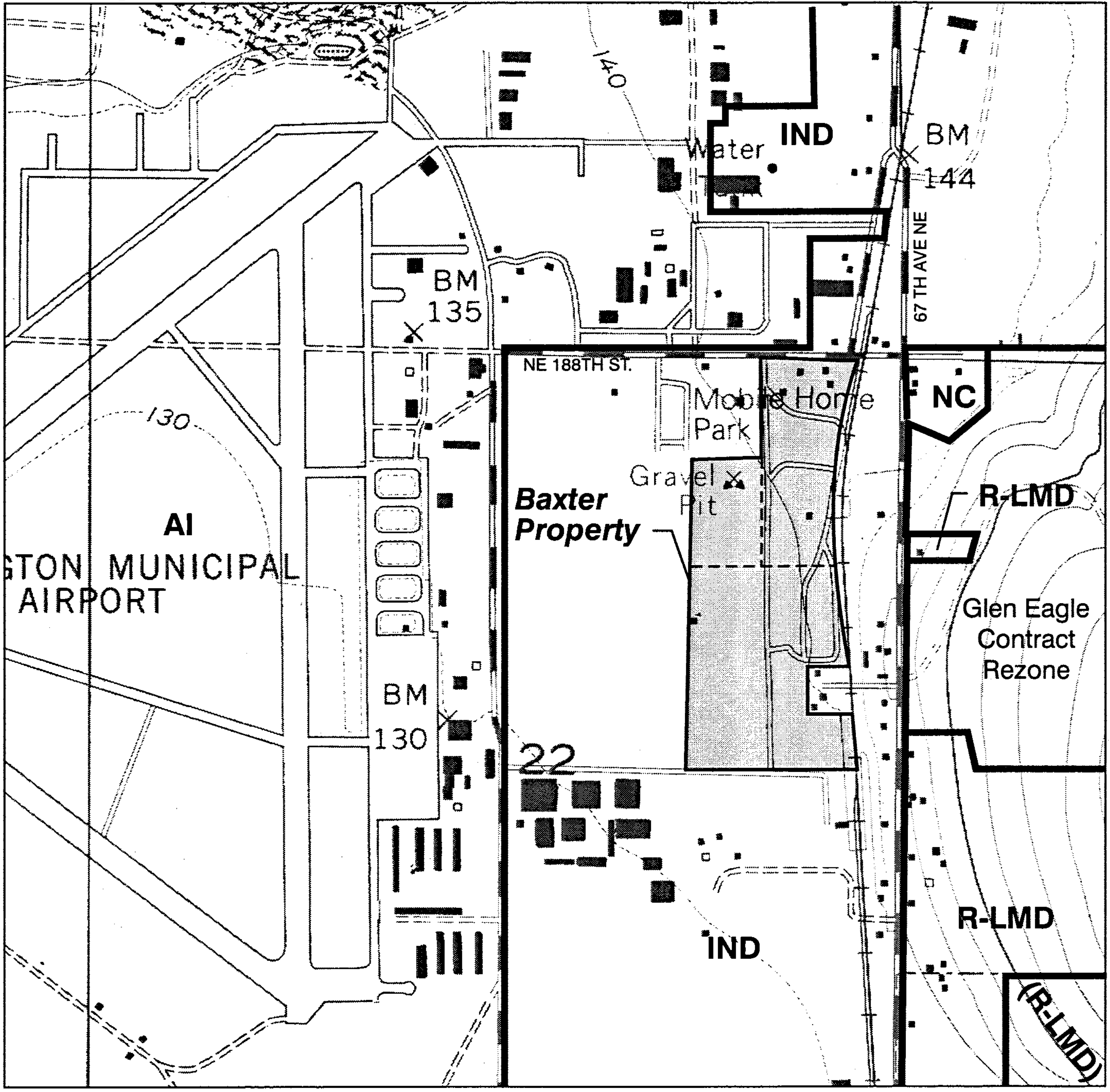
				Average Concentration [1]		Estimated Mass			
Location	Area in square meters	Depth in Meters	Volume in Cubic Meters	TPH-D	PCP	TPH-D in kg	Percent of Total TPH-D	PCP in kg	Percent of Total PCP
Soil				**Concentrations in mg/kg**					
Smear Zone Beneath Former Butt Treating Tank	225	3	675	29,500	720	31,860	38.3	778	44.9
Above Smear Zone Beneath Former Butt Treating Tank	225	7	1,575	2,460	56	6,199	7.5	141	8.2
Surface Soil - Treatment Area and Treated Log Yard [2]	49,500	1.5	74,250	296	5.6	35,165	42.3	665	38.5
Groundwater				**Concentrations in mg/L**					
Former Butt Treating Tank [3]	225	5	1,125	1,050	40	1,890	2.3	72	4.2
Treatment Area and Treated Log Yard, PCP Concentrations Above 0.1 mg/L	14,400	5	72,000	0.08	0.09	9	0.01	10	0.6
Total Mass:						**83,100**	**100**	**1,730**	**100**

Notes:

[1] Half the method detection limit used for non-detect samples.

[2] Average surface soil PCP concentration calculated excluding the two highest and two lowest detected concentrations.

Vicinity and Land Use Map



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Notes: 1. Base map prepared from USGS 7.5 minute quadrangle map of Arlington West, Washington, dated 1981.
2. Zoning boundaries from City of Arlington Map entitled "Official Zoning Designations," dated May 1999.

R-LMD	Residential Low to Moderate Density
NC	Neighborhood Commercial
AI	Airport Industrial
IND	Industrial
(R-LMD)	Proposed Arlington Zoning in U.G.A. Outside City Limits

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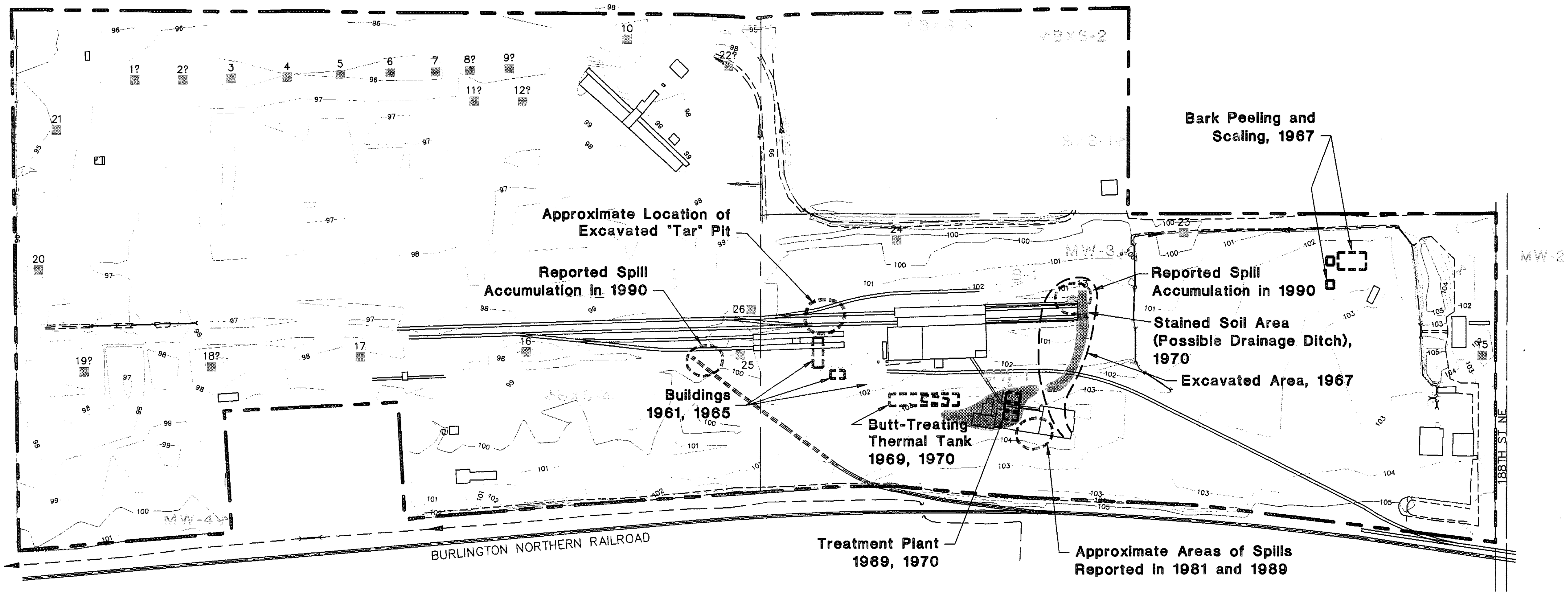
J-7026-02 *2/00*

Figure 1

Historical Features and Spill Location Map



— ◄ —	Drainage Ditch and Flow Direction (From ACI, 1998)
→←	Culvert
1? ▨	Catch Basin – ? Indicates Approximate Location
···105···	Ground Surface Elevation Contour in Feet Based on Baxter Plant Datum
— - - —	Approximate Property Parcel Boundary
━ ━ ━	Baxter Site Boundary
═══	Railroad
☐	Building or Structure

Exploration Location and Number

MW-1	Monitoring Well
B-1	Soil Boring
⌐- - - -¬	Previous Location of Building or Structure and Date of Aerial Photo in which Observed
◌	Date and Approximate Location of PCP Spill
●	Date and Area of Ground Discolored in Aerial Photos Suggesting Possible Staining

N

0 200 400
Scale in Feet

Note: Base map based on survey by Clark Leaman Surveying, January 1996.

XR-BASE.DWG

CVD 2/23/00 1=200 color.pc2
70260221

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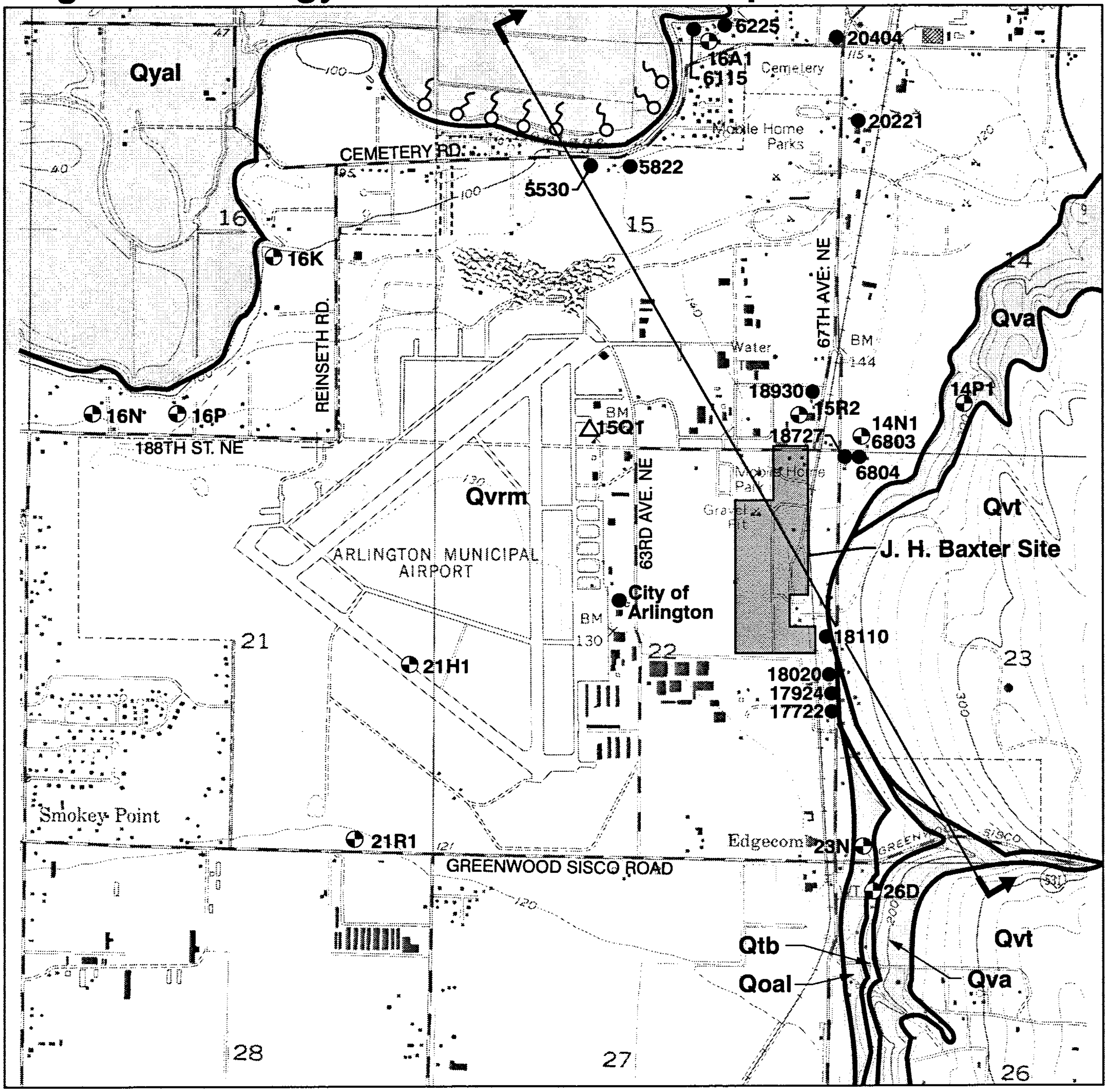
J-7026-02 2/0
Figure 2

Regional Geology and Well Location Map



702602\REGIONAL.CDR

Notes:
1. Base map prepared from USGS 7.5 minute quadrangle map of Arlington West, Washington, dated 1981. Township 31N, Range 5E.
2. See Figure 5 for definitions of geologic units.

0 2000 3000
Scale in Feet

N

16A1 ⊕ Well Log Available from Dept. of Ecology or Newcomb (1952)

6803 ● Field Located Well (Number Identifies Well Address)
No log available, see Table 1.

△**15Q1** Ecology Log for Anode Well

Regional Cross Section Location

Seep

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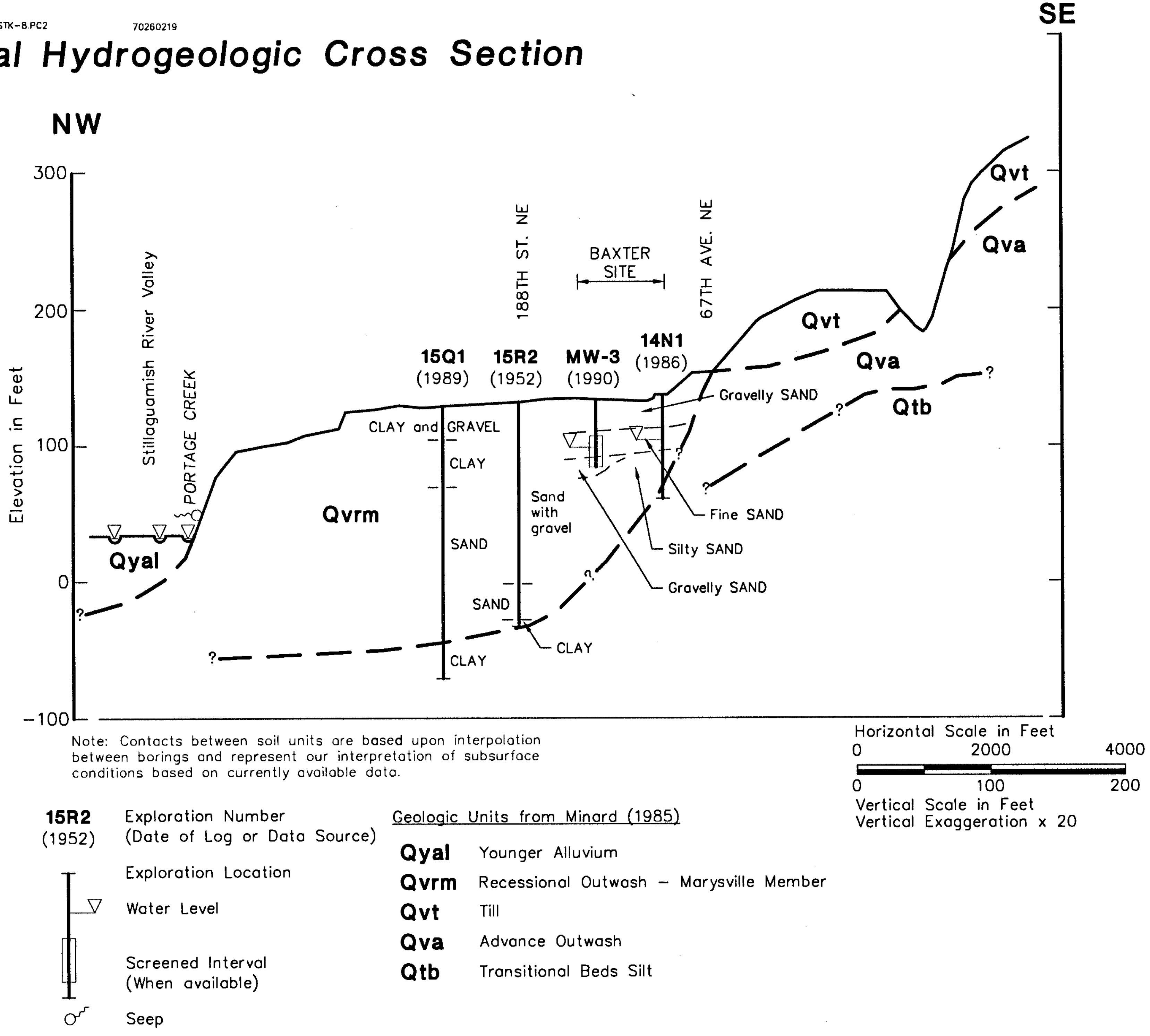
J-7026-02 ***2/00***

Figure 3

CVD 2/23/00 1=2000 WDSTK-8.PC2 70260219

Regional Hydrogeologic Cross Section



Note: Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.

15R2 (1952) Exploration Number (Date of Log or Data Source)

Exploration Location

Water Level

Screened Interval (When available)

Seep

Geologic Units from Minard (1985)

Qyal	Younger Alluvium
Qvrm	Recessional Outwash – Marysville Member
Qvt	Till
Qva	Advance Outwash
Qtb	Transitional Beds Silt

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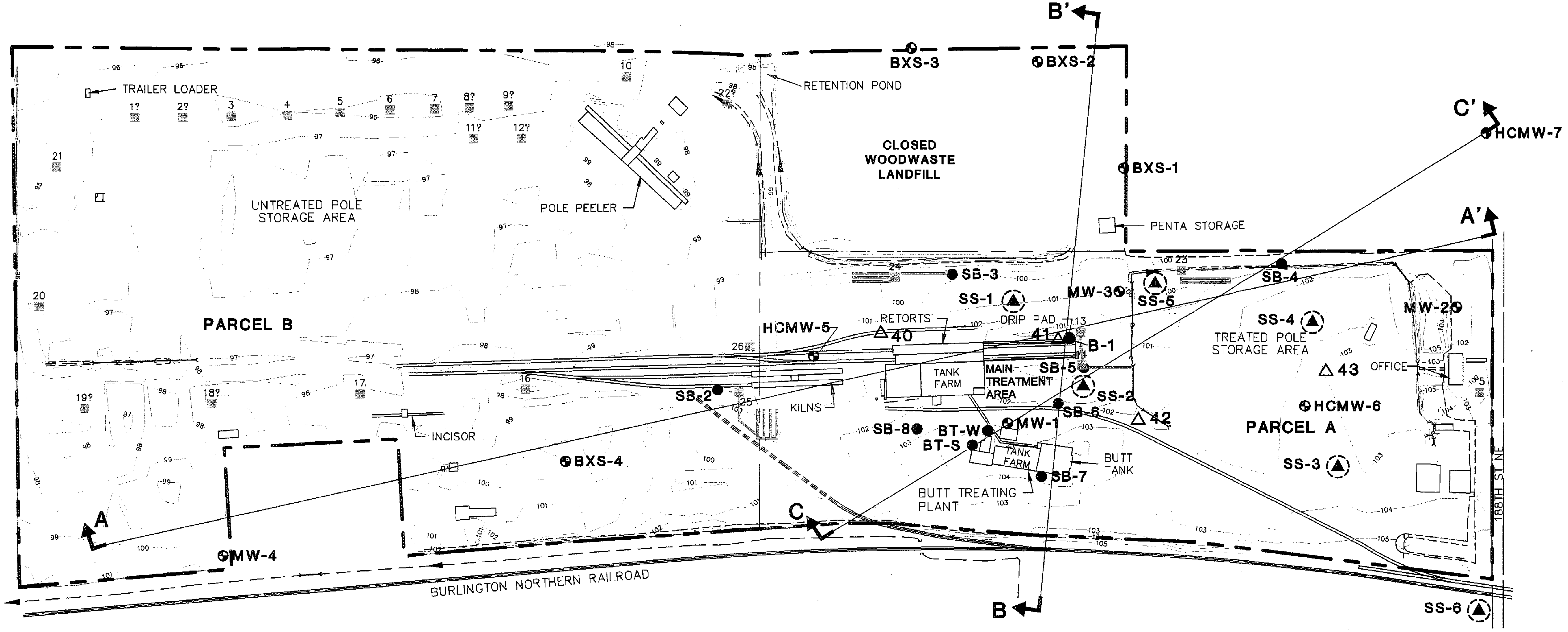
J-7026-02 2/00

Figure 4

Exploration Location Map



Drainage Ditch and Flow Direction (From ACI, 1998)

Culvert

1? Catch Basin and Drainfield – ? Indicates Approximate Location

105 Ground Surface Elevation Contour in Feet Based on Baxter Plant Datum

Approximate Property Parcel Boundary

Baxter Site Boundary

Railroad

Building or Structure

Exploration Location and Number

MW-4 Monitoring Well

B-1 Soil Boring

△ 42 Surface Soil Sample (Ecology, 1992)

SS-1 Composite Surface Soil Sample (Hart Crowser, 1999)

BB' Cross Section Location and Designation

N

0 200 400

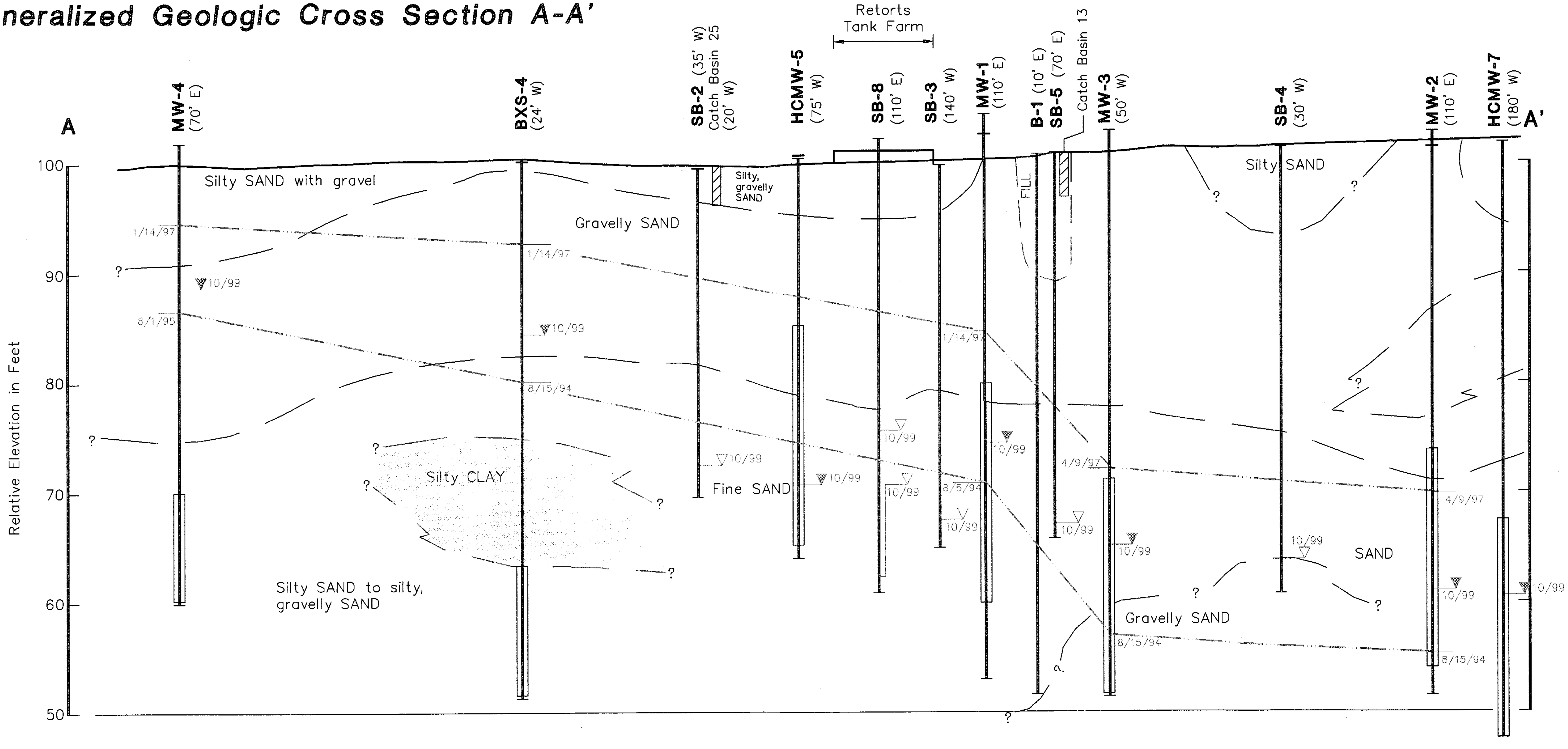
Scale in Feet

Note: Base map based on survey by Clark Leaman Surveying, January 1996.

CVD 2/17/00 1=200 color.pc2
70260206

HARTCROWSER
J-7026-02 2/00
Figure 5

Generalized Geologic Cross Section A-A'



MW-1 Exploration Number
(70' E) (Offset Distance and Direction)

Top of Casing
Ground Surface at Exploration Location
Exploration Location

1/14/97 Maximum Recorded Water Level (Observed at Date Specified)

▼ 10/99 Water Level Recorded October 1999

▽ 10/99 Water Level Recorded During Drilling

8/15/94 Minimum Recorded Water Level (Observed at Date Specified)

Screened Interval

13 ▨ Storm Water Drain Field Catch Basin Location and Number

Notes:
1. Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.
2. Reference Elevation Datum is 104.4 Feet at MW-1 Top of Casing.

Horizontal Scale in Feet
0 200 400

0 10 20
Vertical Scale in Feet
Vertical Exaggeration x 20

CVD 2/3/00 1=200 color.pc2
70260209

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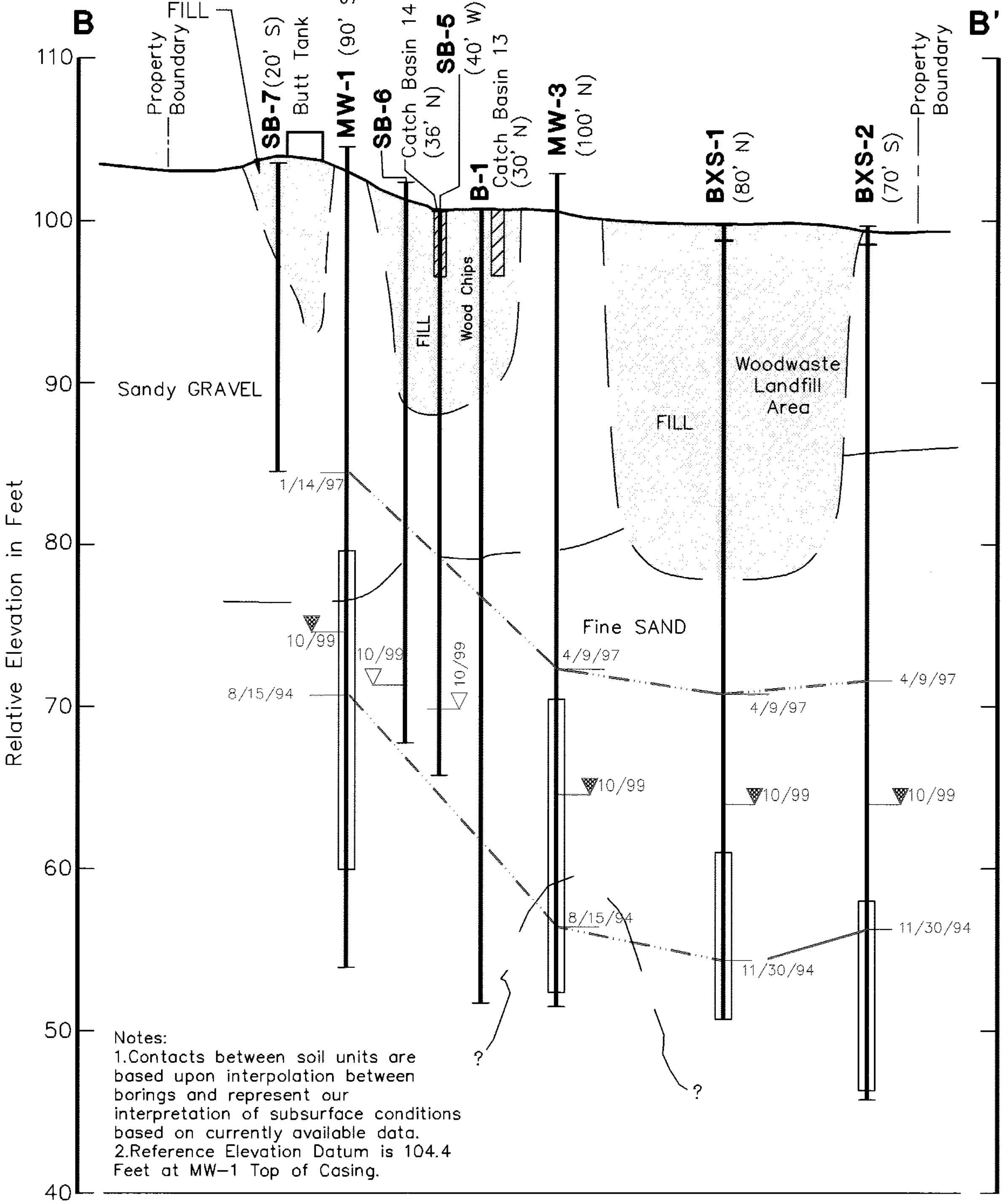
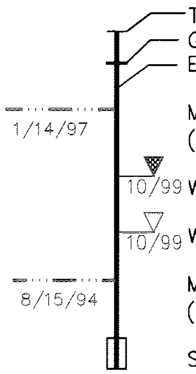
J-7026-02 **2/00**
Figure 6

Generalized Geologic Cross Section B-B'



Notes:
1. Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.
2. Reference Elevation Datum is 104.4 Feet at MW-1 Top of Casing.

MW-1 Exploration Number
(70' E) (Offset Distance and Direction)



Top of Casing
Ground Surface at Exploration Location
Exploration Location
Maximum Recorded Water Level (Observed on Date Specified)
Water Level Measured October 1999
Water Level Recorded during Drilling
Minimum Recorded Water Level (Observed on Date Specified)
Screened Interval

▨ Storm Water Drain Field Catch Basin Location and Number

Horizontal Scale in Feet
0 200 400
0 10 20
Vertical Scale in Feet
Vertical Exaggeration x 20

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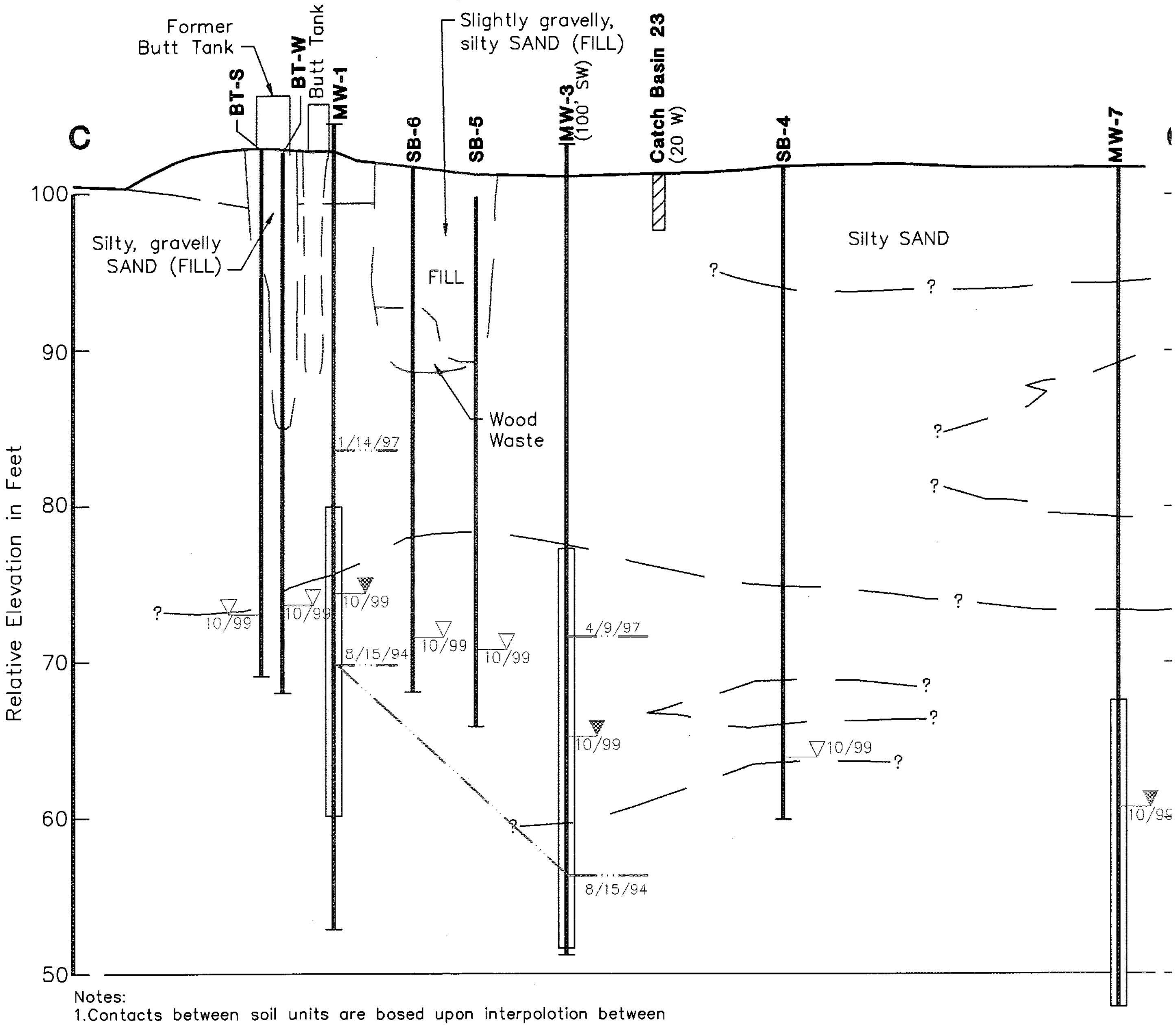
J-7026-02 2/00

Figure 7

CVD 2/18/00 1=200 color.pc2
70260211

Generalized Geologic Cross Section C-C'



Notes:
1.Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.
2.Reference Elevation Datum is 104.4 Feet at MW–1 Top of Casing.

Horizontal Scale in Feet
0 200 40

0 10 2
Vertical Scale in Feet
Vertical Exaggeration x 20

MW-1 Exploration Number
(70' E) (Offset Distance and Direction)

Top of Casing
Ground Surface at Exploration Location
Exploration Location

1/14/97 Maximum Recorded Water Level (Observed on Date Specified)

10/99 Water Level Measured October 1999

10/99 Water Level Recorded during Drilling

8/15/94 Minimum Recorded Water Level (Observed on Date Specified)

Screened Interval

▨ Storm Water Drain
Catch Basin
Location and Number

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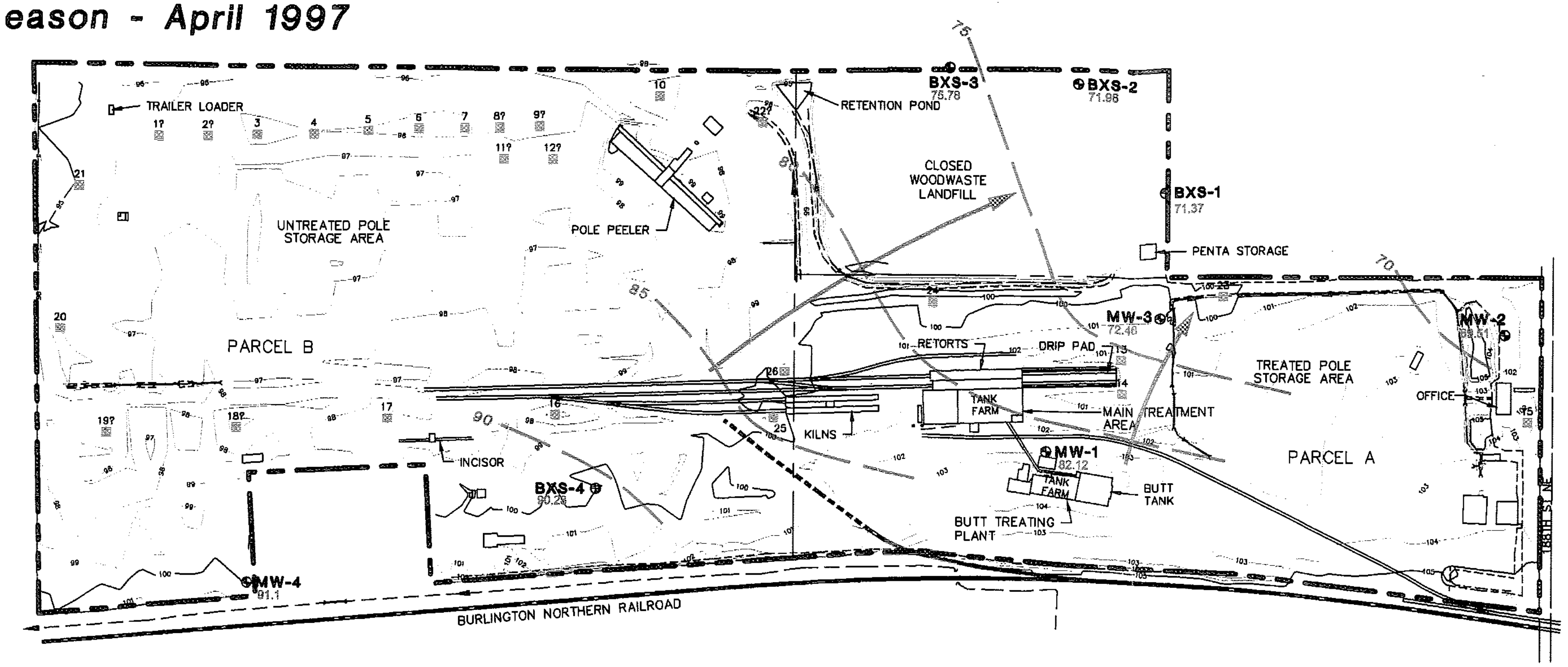
J-7026-02 2/00
Figure 8

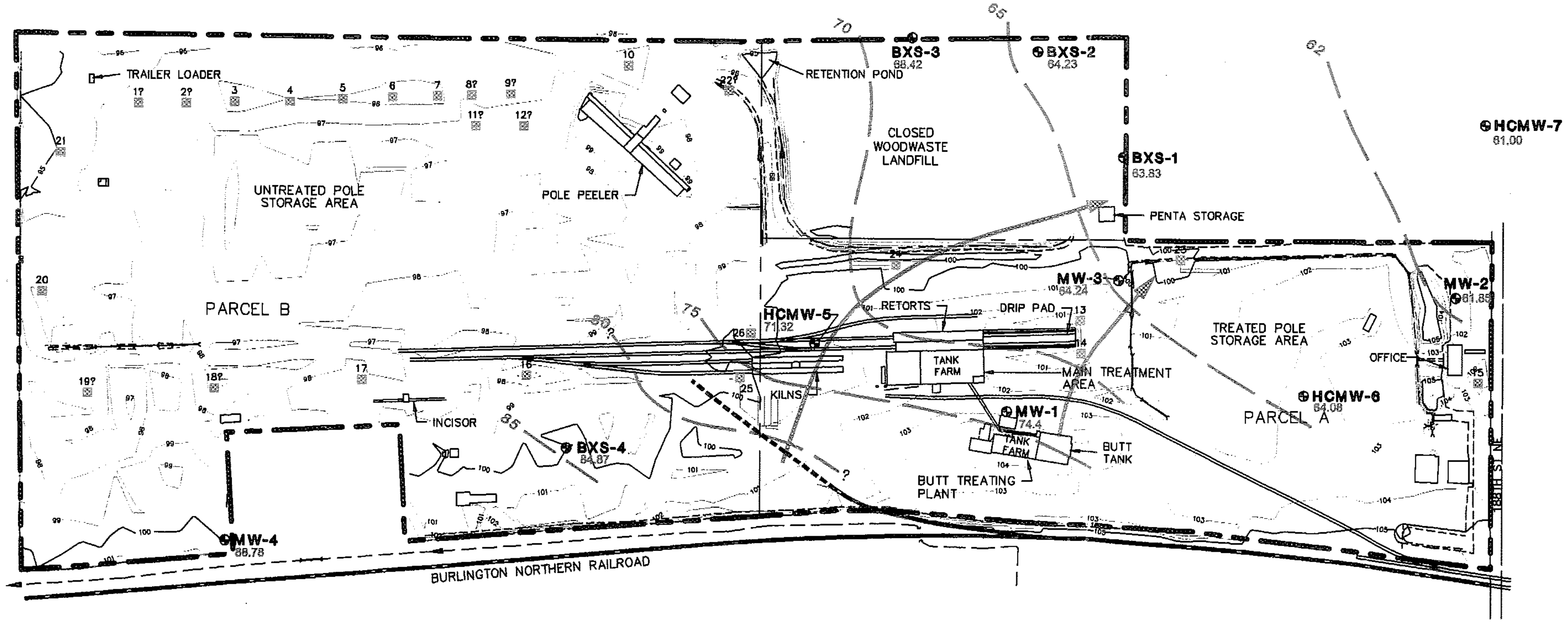
CVD 2/23/00 1=200 color.pc2
70260213

Groundwater Elevation Contour Maps

Wet Season - April 1997



Dry Season - October 1999



Exploration Location and Number

⊕MW-1	Monitoring Well
—70—	Groundwater Elevation Contour in Feet
82.12	Groundwater Elevation in Feet
⇦	Groundwater Flow Direction
—◄—	Drainage Ditch and Flow Direction (From ACI, 1998)
→→	Culvert
1? ▨	Catch Basin – ? Indicates Approximate Location
---103---	Ground Surface Elevation Contour in Feet Based on Baxter Plant Datum
— - —	Approximate Property Parcel Boundary
▬ ▬ ▬	Baxter Site Boundary
═	Railroad
☐	Building or Structure

Note: Base map based on survey by Clark Leaman Surveying, January 1996.

N

0 300 600

Scale in Feet

CVD 2/17/00 1=300 color.pc2
7026021B

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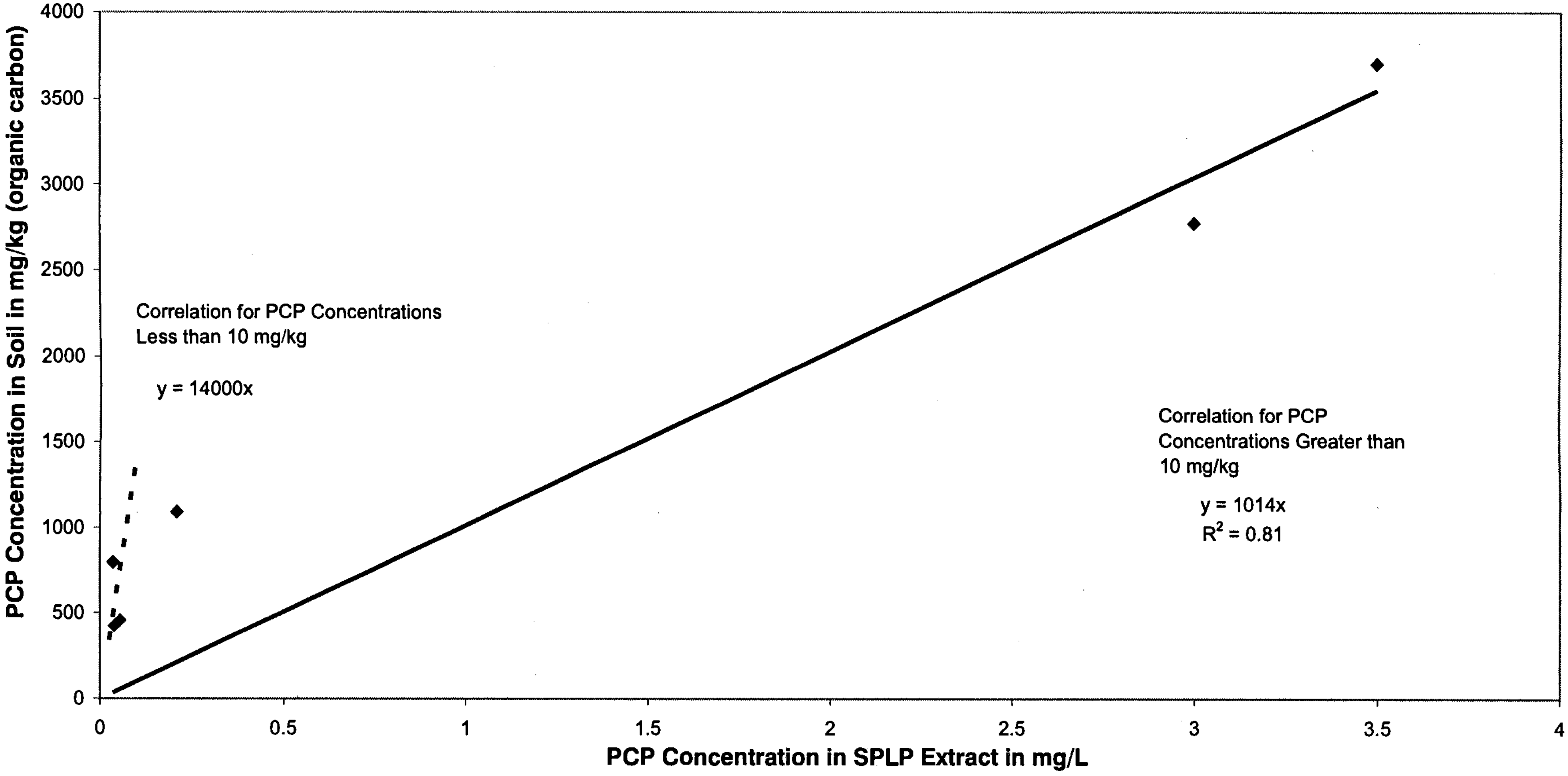
J-7026-02 2/0

Figure 9

Determining Site-Specific K_{oc} for PCP from SPLP Data



Sample	Total Organic Carbon in Percent	Soil PCP Concentration in mg/kg	Soil PCP Concentration in mg/kg (organic carbon)[1]	SPLP Leachate Concentration in ug/L
SS-1-S	1.59	6	456	54
SS-3-S	NM	90	2,778	3,000
SS-4-S	1.15	5.3	420	38
SS-5-S	NM	9.3	796	35
SS-3-D	NM	16	1,093	210
SB-5 S-1	NM	110	3,704	3500

Note: NM = Not Measured

[1] = Using the average measured organic carbon content of surface soils of 1.1%

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J-7026-02 2/00

Figure 10

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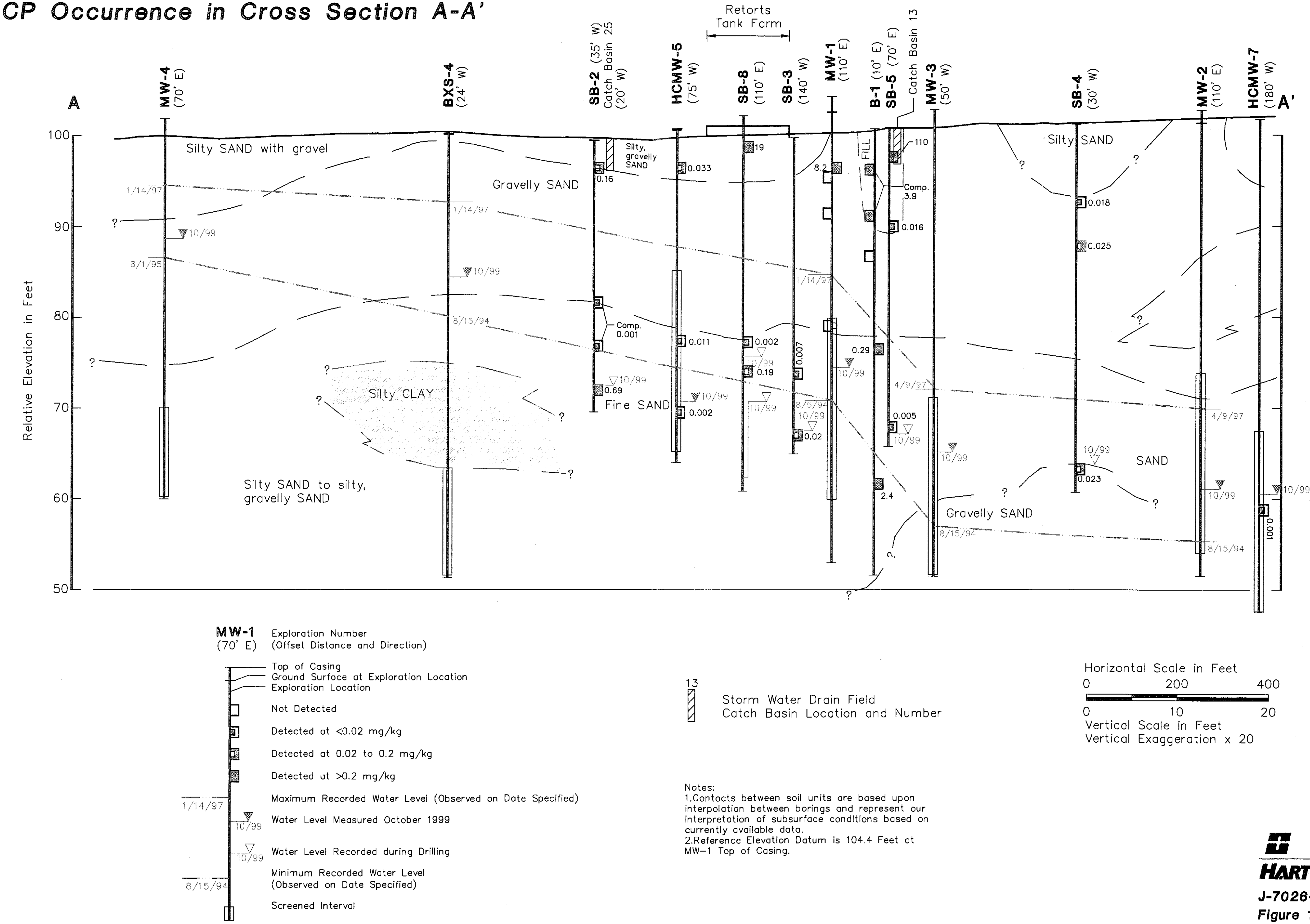
PCP Occurrence in Cross Section A-A'



Notes:
1.Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.
2.Reference Elevation Datum is 104.4 Feet at MW-1 Top of Casing.

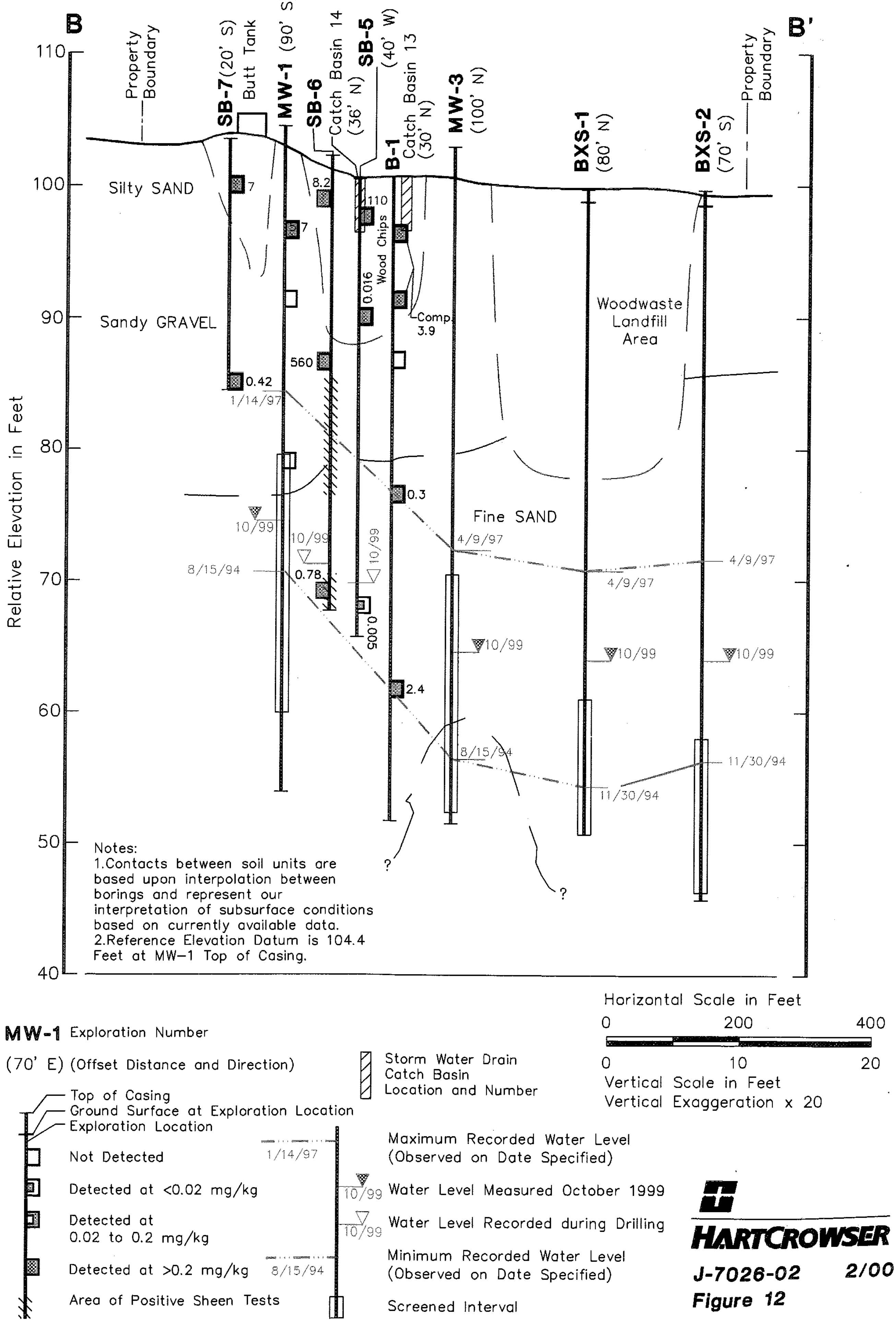
CVD 2/23/00 1=200 color.pc2
7026210

HARTCROWSER

J-7026-02 2/00

Figure 11

PCP Occurrence in Cross Section B-B'



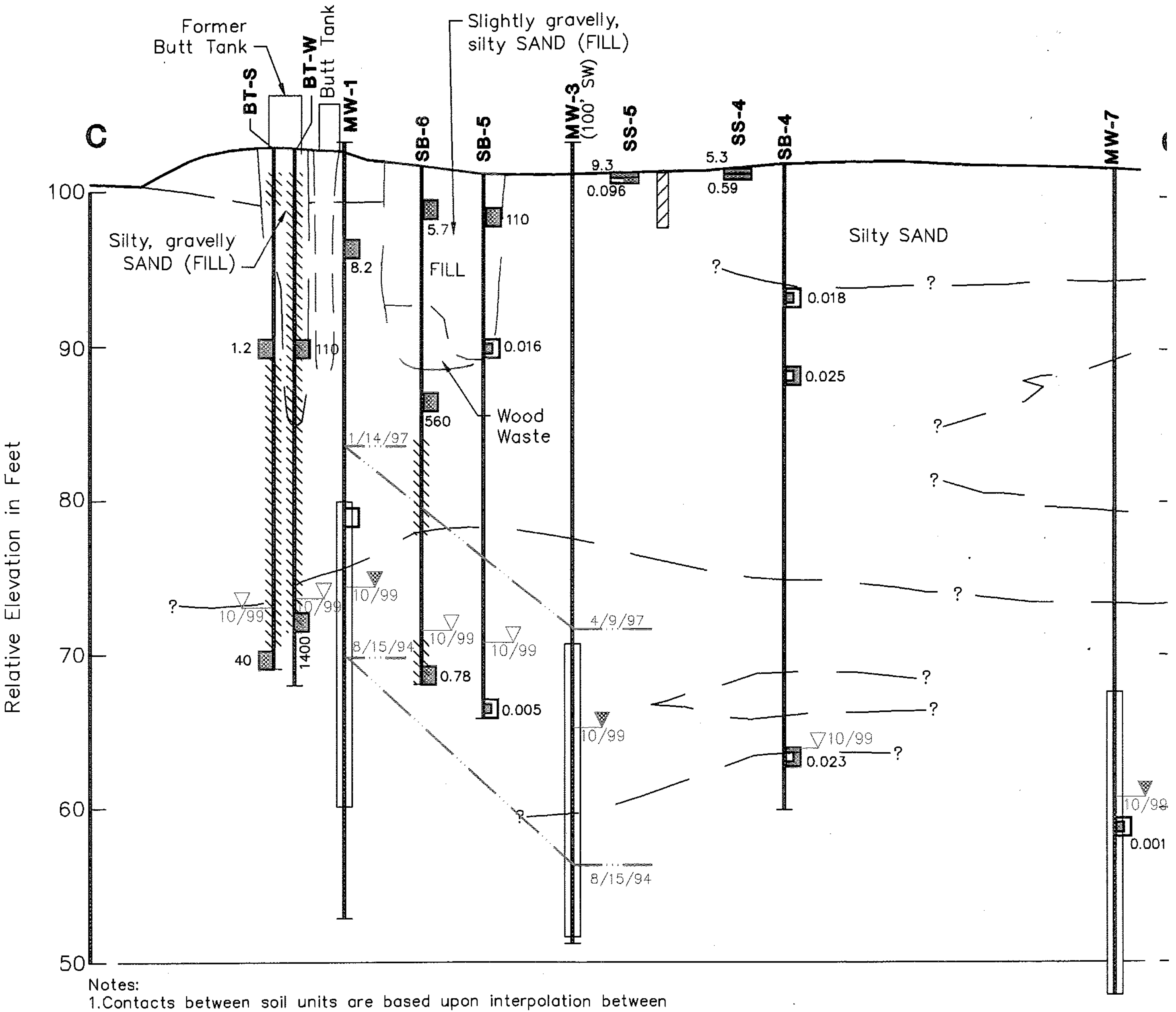
CVD 2/2/00 1=200 color.pc2
7026021 2

HARTCROWSER

J-7026-02 2/00

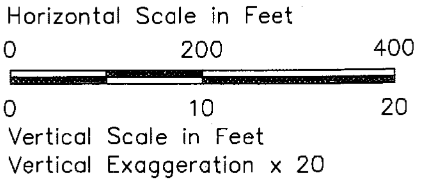
Figure 12

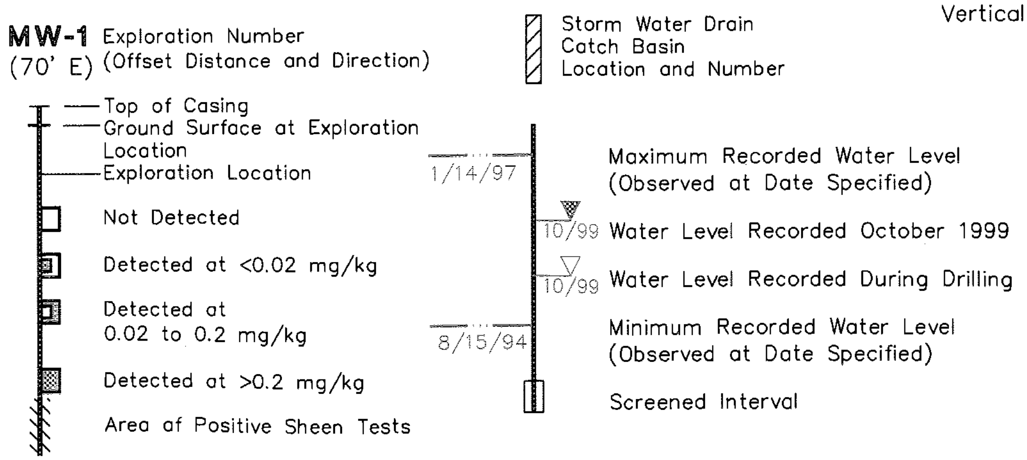
PCP Occurrence in Cross Section C-C'



Notes:

1. Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.
2. Reference Elevation Datum is 104.4 Feet at MW–1 Top of Casing.





CVD 2/23/00 1=200 color.pc2
70260214

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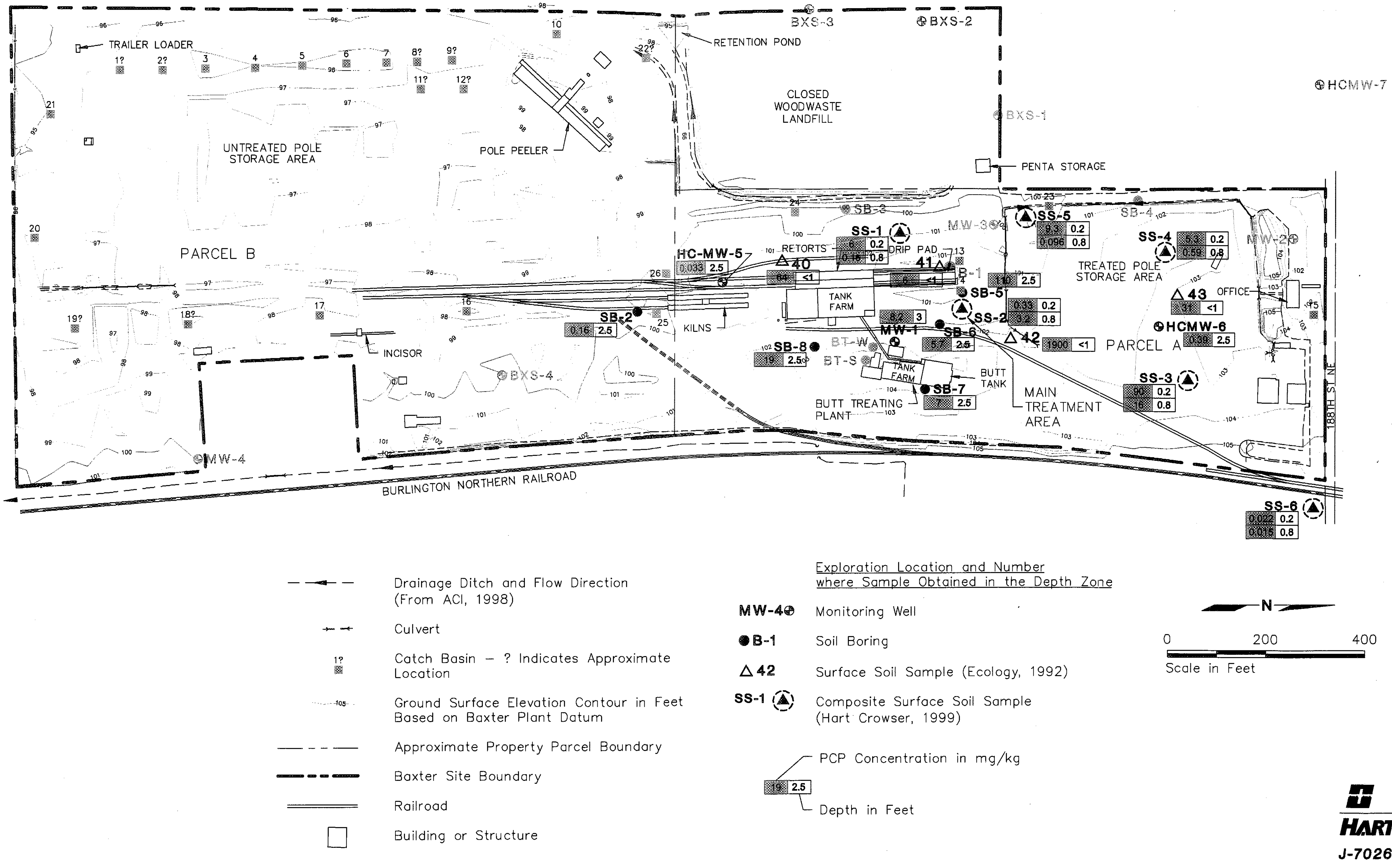
J-7026-02 2/00
Figure 13

Surface Soil PCP Concentrations
0- to 4-Foot Depth

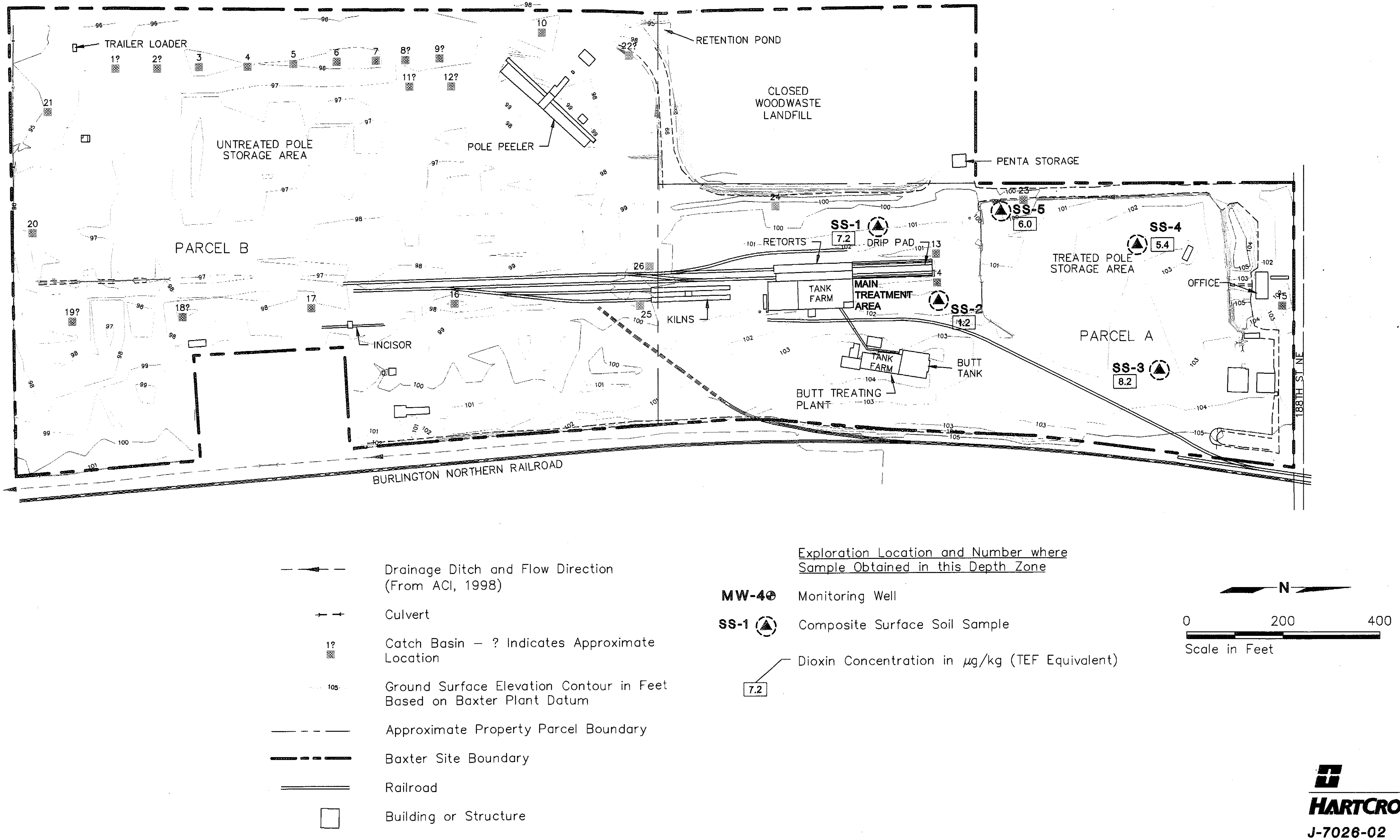


Note: Survey by Clark Leaman Surveying, January 1996).

CVD 2/23/00 1=200 color.pc2
70260217

HARTCROWSER
J-7026-02 2/0
Figure 14

Surface Soil Dioxin Concentrations
0- to 0.2-Foot Depth



Note: Base map based on survey by Clark Leaman Surveying, January 1996.

CVD 2/17/00 1=200 xref= Base02 color.pc2
70260220

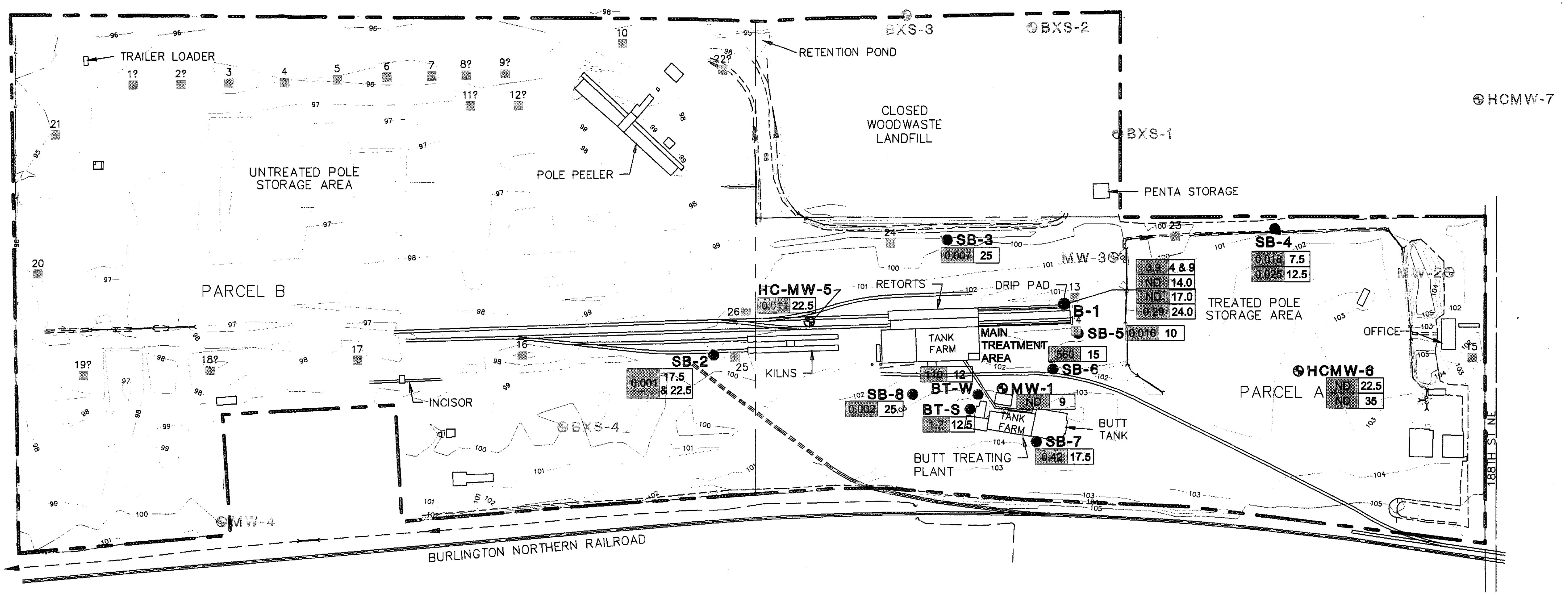
HARTCROWSE

J-7026-02 2/0

Figure 15

Subsurface Soil PCP Concentrations

Unsaturated Zone



Drainage Ditch and Flow Direction (From ACI, 1998)

Culvert

1? ▨ Catch Basin – ? Indicates Approximate Location

-105- Ground Surface Elevation Contour in Feet Based on Baxter Plant Datum

Approximate Property Parcel Boundary

Baxter Site Boundary

Railroad

☐ Building or Structure

Note: Base map based on survey by Clark Leaman Surveying, January 1996.

Exploration Location and Number where Sample Obtained in this Depth Zone

MW-4⊕ Monitoring Well

● **B-1** Soil Boring

110	12

PCP Concentration in mg/kg

Depth in Feet

N

0 200 400

Scale in Feet

HARTCROWSER

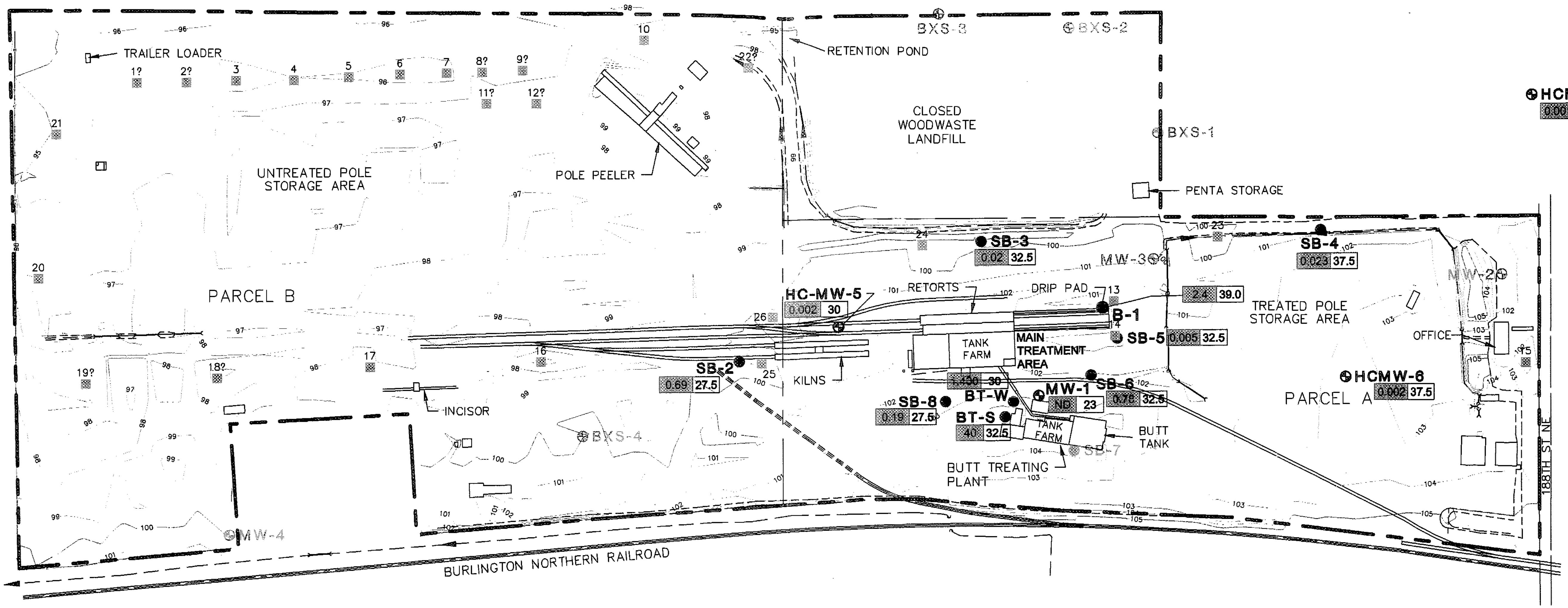
J-7026-02 2/00

Figure 16

CVD 2/23/00 1=200 color.pc2
70260215

Subsurface Soil PCP Concentrations

Saturated Zone



Drainage Ditch and Flow Direction (From ACI, 1998)

Culvert

1? ▨ Catch Basin – ? Indicates Approximate Location

105 Ground Surface Elevation Contour in Feet Based on Baxter Plant Datum

Approximate Property Parcel Boundary

Baxter Site Boundary

Railroad

☐ Building or Structure

Note: Base map based on survey by Clark Leaman Surveying, January 1996.

Exploration Location and Number where Sample Obtained in the Depth Zone

MW-4⊕ Monitoring Well

●B-1 Soil Boring

1,400 30

PCP Concentration in mg/kg

Depth in Feet

N

0 200 400

Scale in Feet

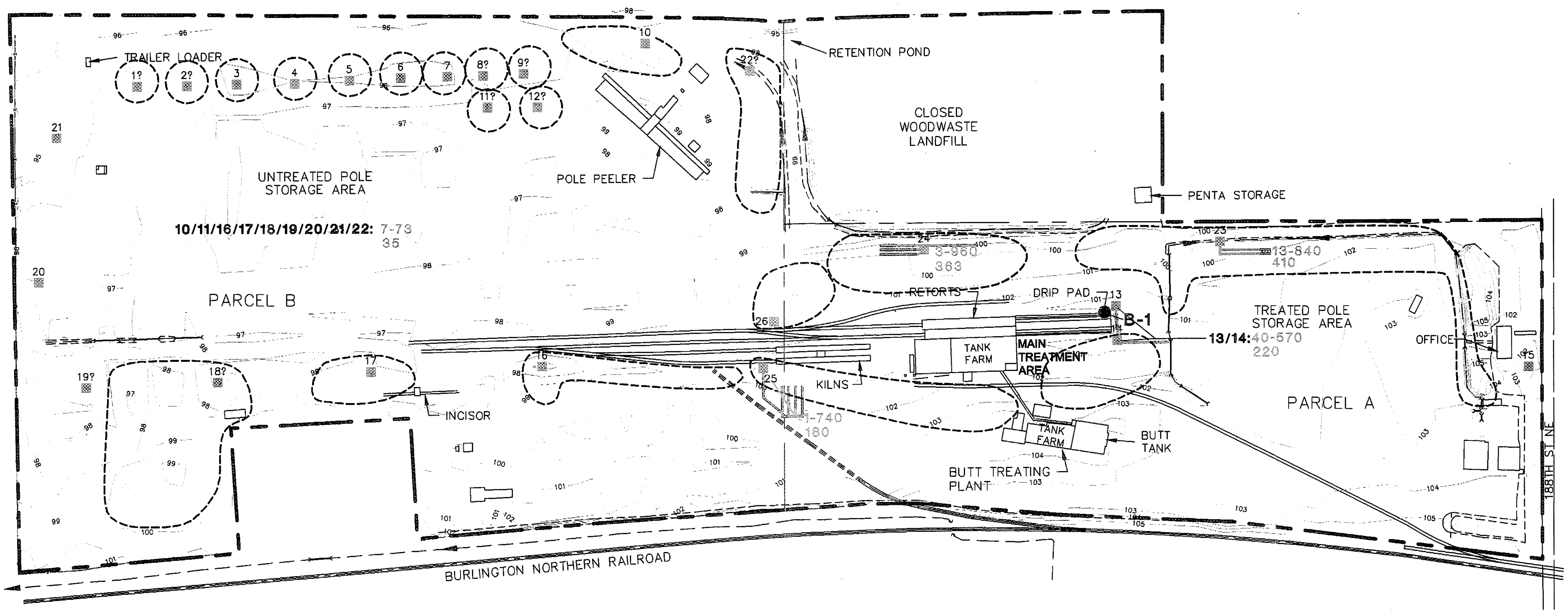
CVD 2/23/00 1=200 color.pc2
7026016

HARTCROWSER

J-7026-02 2/0

Figure 17

PCP Concentrations in Storm Water



Drainage Ditch and Flow Direction (From ACI, 1998)

Culvert

1? Catch Basin – ? Indicates Approximate Location

105 Ground Surface Elevation Contour in Feet Based on Baxter Plant Datum

Approximate Property Parcel Boundary

Baxter Site Boundary

Railroad

☐ Building or Structure

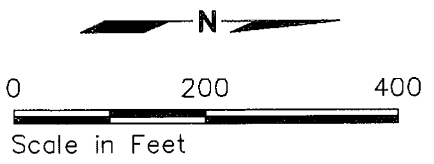
Note: Base map based on survey by Clark Leaman Surveying, January 1996.

Approximate Boundary of Storm Water Collection for the Enclosed Catch Basin (from WWC, 1990)

13/14: Storm Water Samples to be Analyzed were Composited from Drains 13 and 14

40-570 Range of Measured PCP Concentration in Storm Water in µg/L (1994 through 1999)

218 Mean PCP Concentration in Storm Water in µg/L



CVD 2/23/00 1=200 color.pc2
70260222

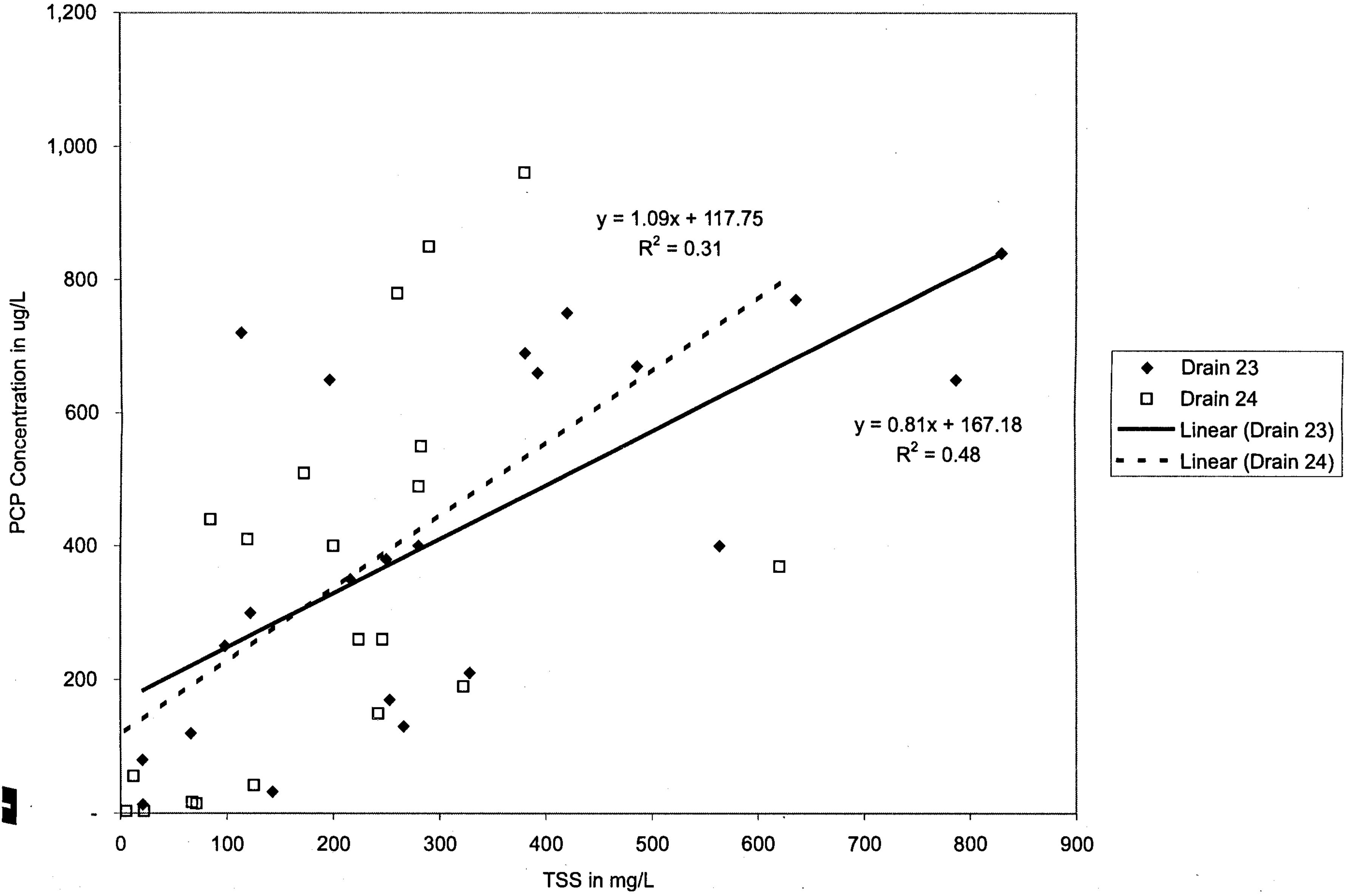
HARTCROWSE

J-7026-02 **2/0**

Figure 18

PCP Concentration Versus TSS in Surface Water

Drains 23 and 24

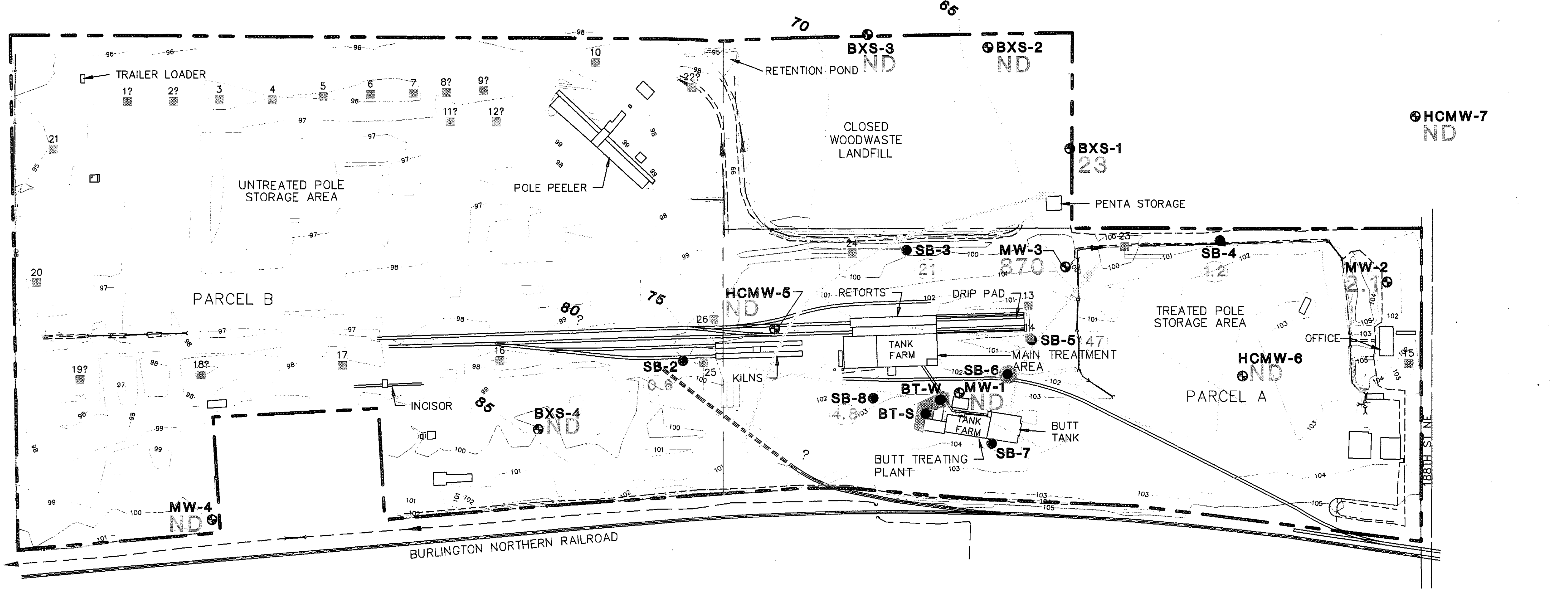


HARTCROWSER
J-7026-02 2/00
Figure 19

702602\702602C.CDR

PCP Concentration in Groundwater

October 1999



PCP Concetration in µg/L

0.6	Groundwater Sample from Monitoring Well (October 1999)
ND	Not Detected at Detection Limit of 0.5 µg/L
4.8	Groundwater Grab Sample taken during drilling. Analysis run on highly turbid sample. (See Appendix A)
▨	Area of LNAPL Occurrence

Drainage Ditch and Flow Direction (From ACI, 1998)

Culvert

1? Catch Basin – ? Indicates Approximate Location

105 Ground Surface Elevation Contour in Feet Based on Baxter Plant Datum

Approximate Property Parcel Boundary

Baxter Site Boundary

Railroad

☐ Building or Structure

Exploration Location and Number

MW-1	Monitoring Well
● **SB-1**	Soil Boring
65	Groundwater Elevation Contour in Feet (October 1999)
	Groundwater Flow Direction (October 1999)

N

0 200 400

Scale in Feet

Note: Base map based on survey by Clark Leaman Surveying, January 1996.

XR-BASE.DWG

CVD 2/17/00 1=200 color.pc2
70260208

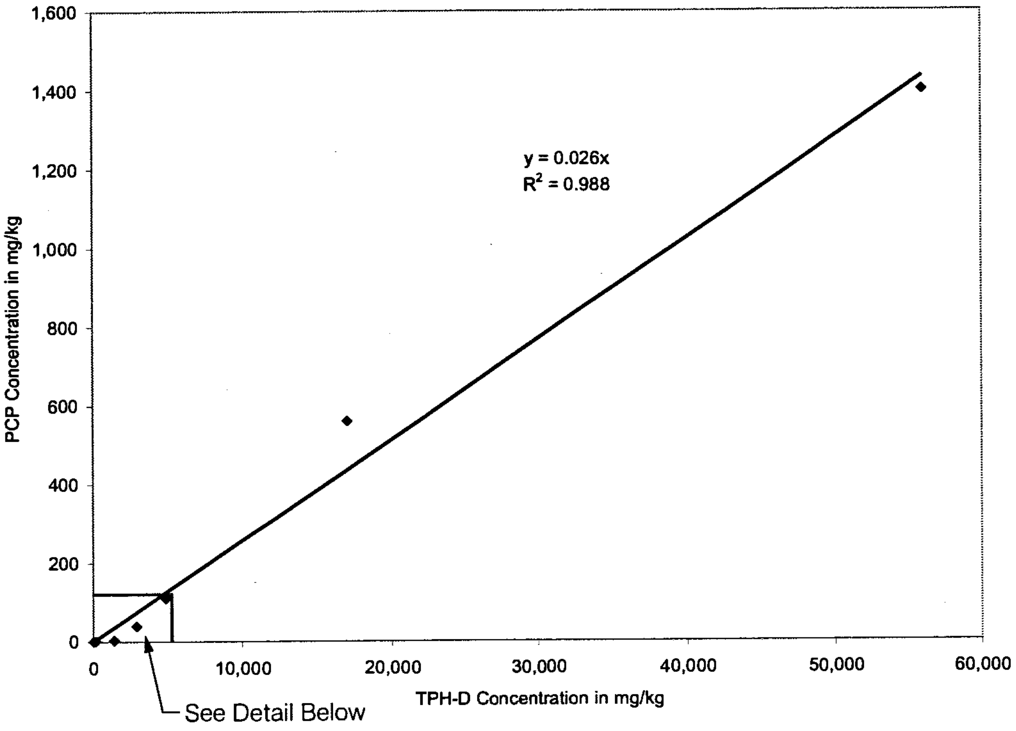
HARTCROWSER

J-7026-02 2/0

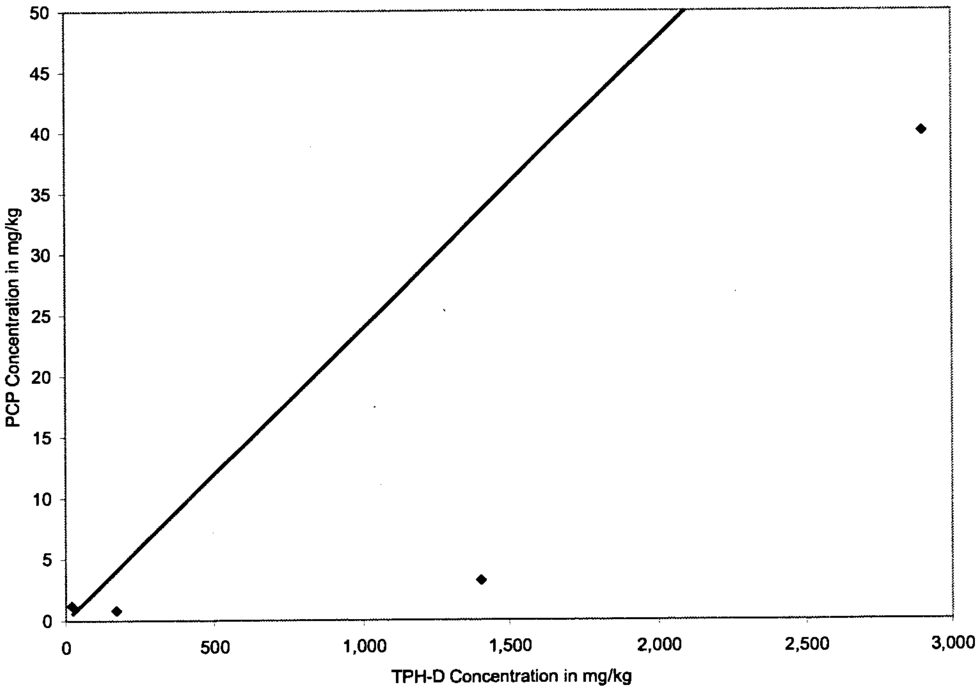
Figure 20

Co-Occurrence of PCP and TPH

Correlation of PCP and Diesel-Range Petroleum



Overprediction of PCP Concentration by TPH-D Correlation at Low Concentrations



HARTCROWSER

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Figure 21

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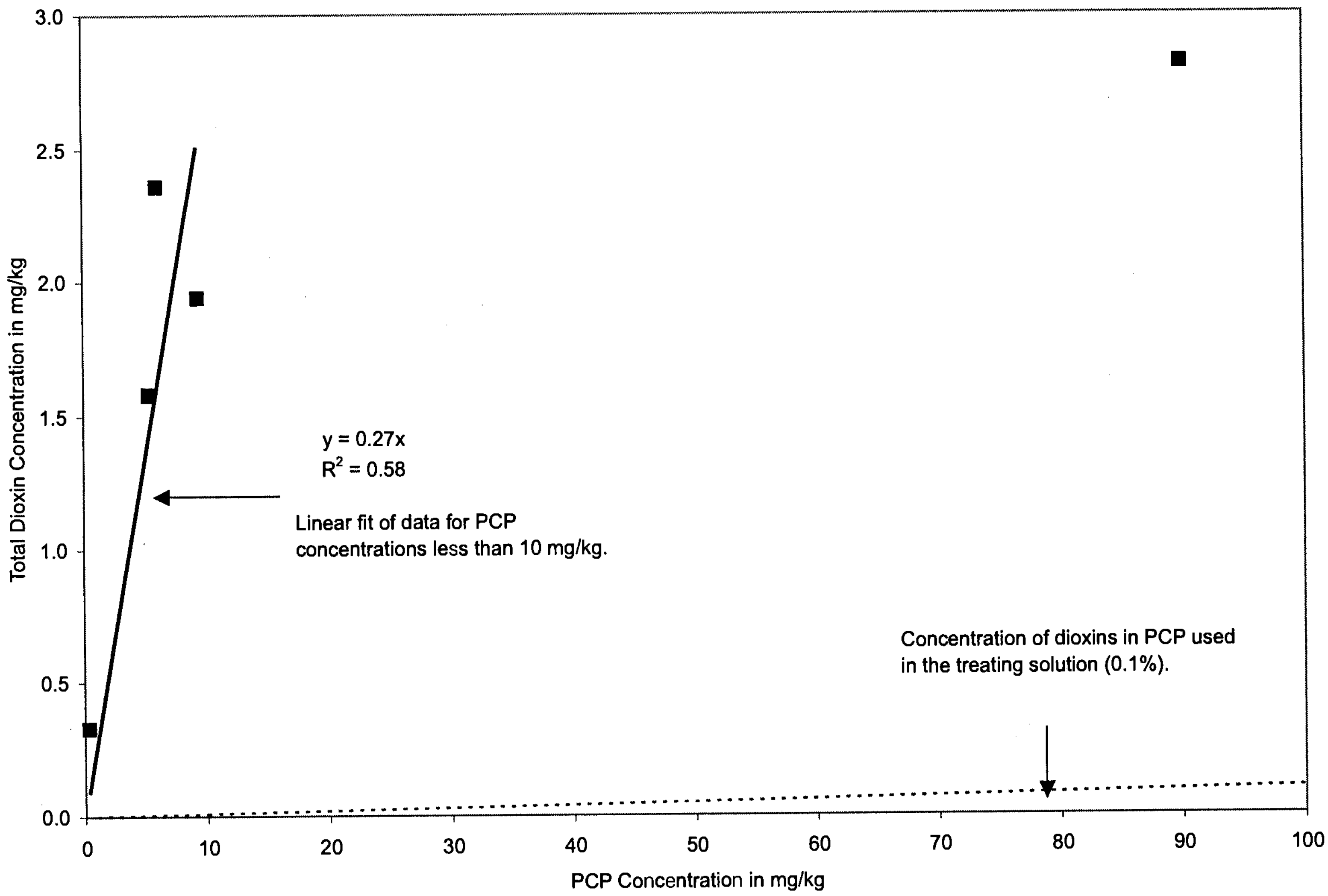
Co-Occurrence of Dioxin and PCP in Surface Soil Samples



Note: Dioxin concentrations reported as total congener concentrations and not TEF equivalent concentrations to provided comparison with treating solution concentration.

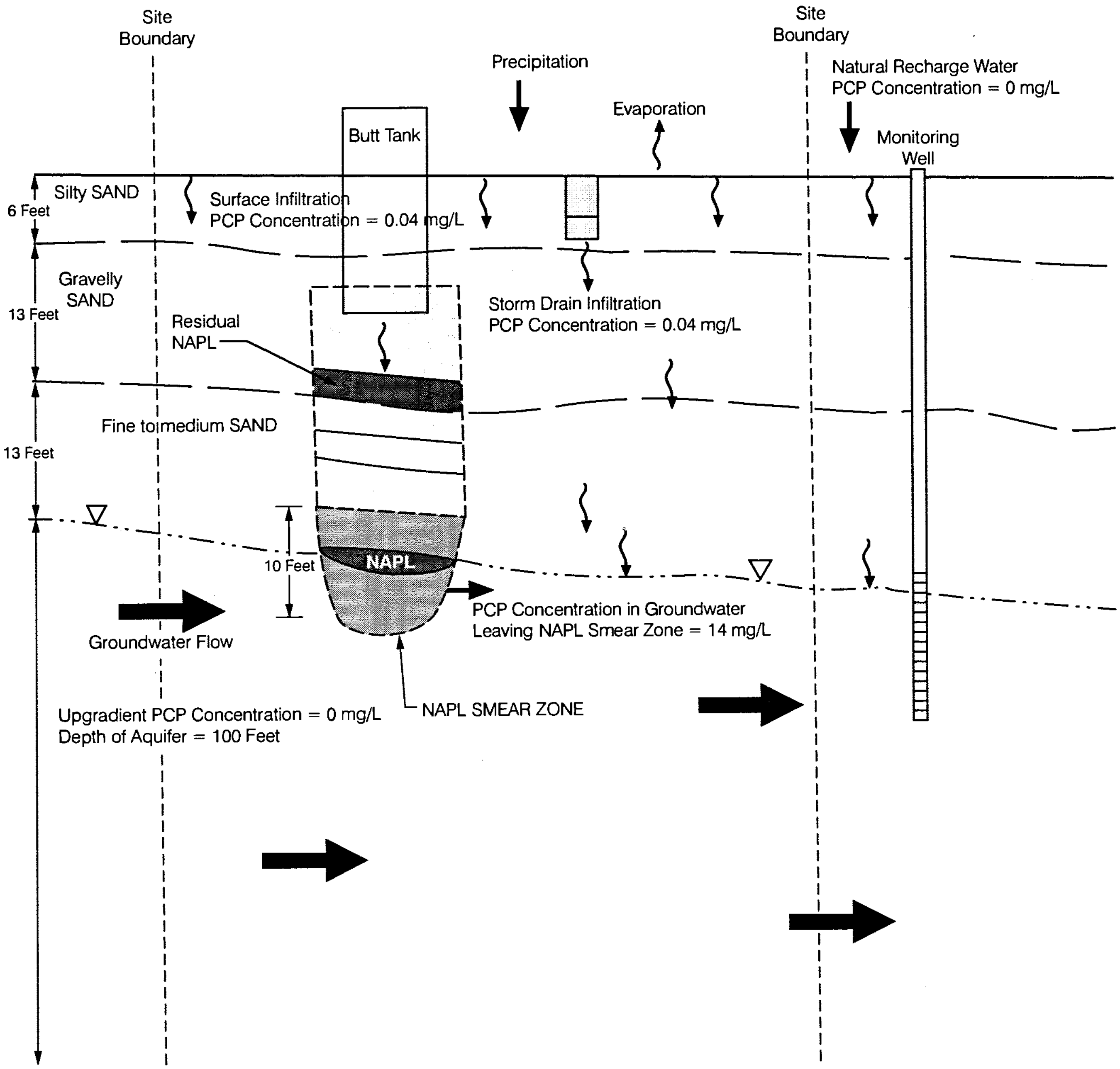
HARTCROWSER

J-7026-02 2/00

Figure 22

702602\702602D.CDR

Conceptual Model of PCP Migration



Not to Scale

702602\CONCEPT MODEL.CDR

HARTCROWSER

J-7026-02 **2/00**

Figure 23

Fluctuation in PCP Concentrations Detected at MW-3

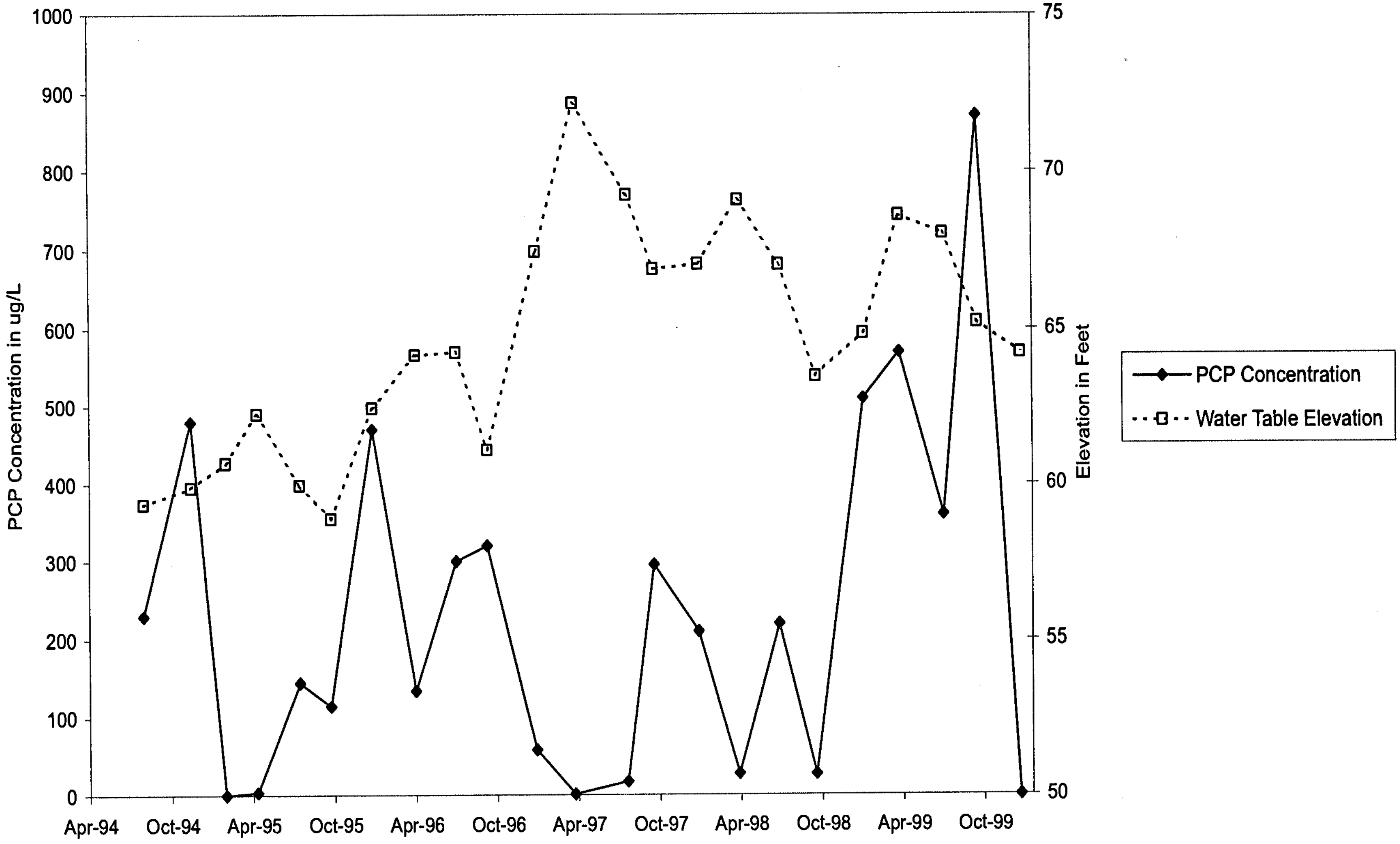


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Figure 24

702602\702602E.CDR

APPENDIX A
FIELD EXPLORATION DATA AND METHODS

APPENDIX A
FIELD EXPLORATION DATA AND METHODS

This appendix discusses exploration, sampling, and testing methods that were used to complete the work described in the J. H. Baxter Arlington Plant Final Work Plan for Remedial Investigation/Feasibility Study dated September 27, 1999. The majority of the field work was completed between October 1 and 23, 1999, by Hart Crowser, with the exception of some groundwater sampling conducted by Baxter on October 4 and 5, 1999, and January 11 and 12, 2000.

The exploration objectives and proposed sampling and analysis plan (SAP) were outlined in Table 6 of the Work Plan. A revised version of this table is provided as Table A-1 detailing the explorations and analyses actually performed.

Surface Soil Sampling

Twelve surface soil samples were collected on October 1, 7, and 8, 1999. Five-point composite shallow soil samples were collected at each of six locations, designated SS-1 through SS-6 (as shown on Figure 2), using the following general procedure:

- Digging approximately 2 inches deep at five locations within a 40-foot-square area using a hammer, chisel, and/or shovel;
- Collecting soil 2 to 3 inches below the surface with a stainless steel spoon;
- Homogenizing the samples from the five locations in a stainless steel bowl;
- Visually classifying the soil in general accordance with ASTM Method D 2488;
- Placing the sample in a laboratory-supplied clean glass 15-ounce jar;
- Placing the sample jar in a cooled ice chest; and
- Delivering the samples to CAS and SLO via normal chain of custody procedures.

A 3-point composite deeper surface soil sample at each of the same six locations was also obtained using the same procedure, except that a 4-inch-diameter hollow-stem auger drill rig was used to drill a 10- to 12-inch deep hole at three locations within the same 40-foot-square area. Soil was then collected with a stainless steel spoon at depths between 7 and 10 inches below the surface, homogenized, and placed in a 15-ounce glass sample jar.

Drilling and Soil Sampling

Drilling of boring and for monitoring well installations was performed between October 4 and 8, 1999, by Holt Drilling of Puyallup, Washington. Samples were collected and logged by Hart Crowser representatives Jeremy Porter (field engineer) and Dan Berta (field geologist). Twelve borings, designated SB-2 through SB-8, HCMW-5 through HCMW-7, BT-S, and BT-W, were advanced using a truck-mounted, 4-inch inside diameter, hollow-stem auger. Standard hollow-stem auger drilling techniques were used. Water was not added to the borehole. Borings BT-S and BT-W were added to the original scope of work to investigate possible releases from and to support closure of the former butt-treating tank, located just south of the current butt treatment plant (See Figure 5).

Subsurface Soil Sampling

Soil samples were collected at 2.5- or 5-foot-depth intervals using split-spoon sampling procedures. Soil samples were collected in general accordance with the Standard Penetration Test (SPT) procedure described in ASTM D 1587, except that an oversized split-spoon sampler and heavier hammer were used. A 3-inch-outside-diameter (Dames & Moore) split-spoon sampler was driven into the soil 18 inches beyond the end of the borehole by a 300-pound hammer dropping 30 inches onto the end of the drilling rod. The number of blows required to drive the sampler the final 12 inches provides a measure of the density of granular soils (sands and gravels) and consistency of finer grained cohesive soils (silts and clays).

The geology and stratigraphy of the boreholes were logged by the field geologist and field engineer, and the boring logs are presented on Figures A-2 through A-13. Soils were classified using ASTM D 2488 as depicted on Figure A-1. Figure A-1 also presents a key and legend to the symbols and abbreviations used on the logs.

For soil samples that were retained for chemical analysis, soil was collected from the sampler using a stainless steel spoon, homogenized in a stainless steel bowl, and placed in laboratory-supplied clean glass jars. The sample jars were then placed in a cooled ice chest. Gravel larger than 1/2 inch in diameter was excluded from samples retained for chemical analysis. Soil samples were delivered from the site to either Columbia Analytical Services, Inc. (CAS) or Southwest Laboratory of Oklahoma, Inc. (SLO) for chemical analysis.

Soil samples were screened for the presence of volatile organic vapors using a portable photoionization detector (PID). Soil from each sample was placed in a resealable plastic bag and left to sit for several minutes before monitoring the headspace with the PID. Soil samples with a noticeable sheen, odor, or other evidence of oil, along with several samples from material transition zones (e.g., at the gravelly sand to fine sand interface) were also tested for the presence of LNAPL by adding clean water to a 2-ounce glass jar containing a soil sample, shaking the sample, and noting the presence or absence of a sheen. Samples were selected for physical and chemical analysis as shown in Table A-1.

Soil Classification

The on-site field representatives visually classified the soil samples recovered from the borings in general accordance with ASTM D 2488 (Figure A-1), prepared a log of soils encountered in the exploration, and recorded pertinent observations regarding drilling conditions, types of soils encountered, and depth to water during drilling. Boring logs are presented on Figures A-2 through A-13. Soil descriptions include the following properties: density of sands and gravels or consistency of silts and clays (as determined from the Penetration Resistance), moisture, color, minor constituents, and major constituents. The presence of non-soil substances (e.g., debris, NAPLs) was also noted.

Grain Size Analyses

Grain size analyses were performed on four soil samples to verify material type and assist with estimating the hydraulic conductivity of the soils. The soil samples selected were SB-4 S-3, SB-5 S-13, SB-2 S-5/7, and HCMW-5 S-10. These represent soils that were identified in the field as ranging from fine sands to gravelly sands. The grain size analysis were run in general accordance with ASTM D 422 and the results are presented on Figures A-14 and A-15. The samples analyzed for grain size are indicated with a GS on the boring logs.

Sample and Cuttings Handling

Samples and cuttings from boreholes in which evidence of contamination was observed (positive sheen test, odor) were placed in 55-gallon drums for later disposal by Baxter. The drums were labeled with the date, boring identification number, and contents. Samples and cuttings from boreholes in which evidence of contamination was not observed were spread on the ground in the general vicinity of the boring.

Equipment Decontamination

Prior to drilling and between each boring, the drill rig, auger sections, and downhole equipment were steam cleaned. The steam cleaning water was collected and disposed of in the treatment plant secondary containment area.

Before each sample was collected, all downhole soil and groundwater sampling equipment was decontaminated by:

- Scrubbing with detergent solution (ALCONOX);
- Rinsing with tap water; and
- Rinsing with deionized water.

Borehole Abandonment

Boreholes which were not completed as monitoring wells were abandoned by pumping bentonite grout and/or bentonite chips as the auger was withdrawn, in accordance with Chapter 173-160 WAC. Boring locations and elevations were surveyed by Clark Leeman Land Surveying of Everett, Washington.

Groundwater Sampling

Groundwater Grab Samples

Groundwater grab samples were collected from borings BT-S, BT-W, SB-2, SB-3, SB-4, SB-5, and SB-8 before abandonment of the borehole. In borings SB-2 through SB-5 and SB-8, 2-inch-diameter PVC pipe a 10-foot-long section of 2-inch-diameter 20 slot PVC screen was lowered into the borehole. Groundwater from borings SB-2, SB-3, and SB-5 was collected with a 2-inch stainless steel bailer. Groundwater from borings SB-4 and SB-8 was collected with a 12 volt submersible electric pump with disposable polyethylene tubing. In borings BT-S and BT-W, samples were collected directly from the borehole with a 4-inch stainless steel bailer. Samples were analyzed as listed in Table A-1.

Because of the method of sampling, most groundwater grab samples were very turbid. High turbidity can result in artificially high constituent concentrations, particularly when the constituents are highly hydrophobic (such as PCP) and, therefore, strongly associated with the solid fraction. To decrease the contribution of PCP sorbed to soil, we asked the laboratory to allow the samples to settle and to analyze the supernatant for both TSS and PCP. Thus, two values for TSS are reported in Table B-3 for groundwater grab samples: the TSS concentration of the sample, and the TSS concentration of the supernatant after settling. The results from this method may still be skewed because of the additional contact time of the groundwater with the solids, if the two matrices were not in equilibrium when sampled.

Monitoring Well Installation and Sampling

Borings HCMW-5, HCMW-6, and HCMW-7 were completed as monitoring wells on October 5, 4, and 7, 1999, respectively. Well construction details are provided on Figures A-11, A-12, and A-13. The location and top of casing elevations for the monitoring wells were surveyed by Clark Leeman Land Surveying.

Groundwater samples from wells MW-1, HCMW-5, HCMW-6, and HCMW-7 were collected on October 22 and 25, 1999. In addition, water level measurements were made at on-site monitoring wells on October 25, 1999. Samples were collected from wells HCMW-5 through HCMW-7 using the following basic procedures:

- Noting the general conditions of the well;
- Measuring water levels in the well and calculating the volume of water within the well casing;
- Thoroughly decontaminating the sampling pump and wires using alconox, hot water, and DI water;
- Purging three casing volumes of water from the well using an electric submersible Grundfos pump with disposable polyethylene tubing. During purging, field parameters (pH, temperature, conductivity, and dissolved oxygen) were monitored. The groundwater sample was collected when these parameters stabilized. Purging and sampling rates were kept below 0.1 liter per minute to minimize turbidity. Since no sheen or odor was observed, purge water was disposed of on the ground in the vicinity of the well;
- Sample vials for volatile organic analysis (VOA) were slowly filled with water, capped, inverted, and tapped to check for remaining air bubbles;
- Once filled, each bottle was capped and placed into coolers with Blue-Ice; and
- At the end of each sampling day, the samples were delivered to CAS and SLO using standard chain of custody procedures.

Well MW-1 was purged and sampled following the procedures above but using a 2-inch disposable bailer rather than the Grundfos submersible pump. Prior to purging the well, a clear Oil Recovery Systems bailer was slowly lowered into the well to obtain a 'cut' of the water table surface. This sample was inspected for sheen. No sheen was identified.

Additional Groundwater Sampling Performed by Baxter

In addition to the regular groundwater sampling performed by Baxter as part of the quarterly NPDES program, samples from the on-site monitoring wells that are part of the program were analyzed for TSS, and samples from monitoring wells MW-2, MW-3, and BXS-1 were analyzed for dioxins by SLO. Analytical results of these sampling events are included in Appendix B. A bailer was used to sample these wells in October 1999 resulting in samples containing high turbidity. Dedicated, low-flow sampling bladder pumps were installed in wells MW-2, MW-3, and BXS-1 prior to the January 2000 sampling event, and samples obtained with these pumps were much less turbid.

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Table A-1 - Summary of Explorations and Samples Analyzed

Exploration Location	Depth of Exploration in Feet	Depth of Sample in Feet	Soil Testing	Groundwater Testing	Objective
BT-S	34	12.5 to 14.0	PCP, NWTPH-Dx		Investigate Area Beneath Former Butt-Treating Tank
		32.5 to 34.0	PCP, NWTPH-Dx	PCP, TSS, NWTPH-G/BTEX, NWTPH-Dx	
BT-W	35	12.0 to 13.5	PCP, NWTPH-Dx		Investigate Area Beneath Former Butt-Treating Tank
		30.5 to 31.5	PCP, NWTPH-Dx	PCP, TSS, NWTPH-G/BTEX, NWTPH-Dx	
HCMW-5	31.5	2.5 to 4.0	PCP, NWTPH-Dx		Investigate area where tar-like material was excavated in 1981, evaluate upgradient extent of PCP plume, determine impact of storm drains 24, 25 and 26 on groundwater quality, look for evidence of residual from 1990 spill, evaluate area of stained soil
		22.5 to 24.0	PCP		
		30.0 to 31.5	PCP, NWTPH-Dx	PCP, TSS	
HCMW-6	39	2.5 to 4.0	PCP	PCP,TSS	Define groundwater flow direction, eastern extent of PCP plume, soil column quality, and water quality under treated pole storage area, sample surface soils
		22.5 to 24.0	PCP, TOC		
		35.0 to 36.5	PCP		
		37.5 to 39.0	PCP, TOC	PCP, TSS	
HCMW-7	55	42.5 to 44.0	PCP	PCP, TSS	Define northern extent of PCP plume, provide empirical data on PCP attenuation, evaluate off-site groundwater risks
SB-2	29	2.5 to 4.0	PCP		Assess subsurface impact of 1990 PCP spill, look for LNAPL
		17.5 to 24.0 (Composite)	PCP, TOC		
		27.5 to 29.0	PCP	PCP, TSS, NWTPH-G/BTEX, NWTPH-Dx	
SB-3	34	25.0 to 26.5	PCP		Evaluate the impact of storm drain 24 on groundwater quality, define southwest PCP plume boundary, evaluate source to BSX-1
		32.5 to 34.0	PCP, TOC	PCP, TSS	
SB-4	39	7.5 to 9.0	PCP		Evaluate soils with depth beneath drainage ditch to assess storm water impact on soil sorption
		12.5 to 14.0	PCP		
		37.5 to 39.0	PCP, NWTPH-Dx	PCP, TSS, NWTPH-G/BTEX, NWTPH-Dx	
SB-5	34	2.5 to 4.0	PCP		Investigate backfill of excavated area for wastes, assess impact of treatment operations on subsurface soil, determine source of PCP appearing in MW-3.
		10.0 to 11.5	PCP		
		32.5 to 34.0	PCP, TOC	PCP, TSS	
SB-6	34	2.5 to 4.0	PCP		Investigate backfill of excavated area for wastes, assess impact of treatment operations on subsurface soil
		15.0 to 16.5	PCP, NWTPH-Dx, PAHs, Dioxins		
		32.5 to 34.0	PCP, NWTPH-Dx, PAHs, Dioxins		
SB-7	19	2.5 to 4.0	PCP		Investigate area of previous butt tank overflow spills
		17.5 to 19.0	PCP		
SB-8	29	2.5 to 4.0	PCP		Investigate area of previous butt treatment tank
		25.0 to 26.5	PCP		
		27.5 to 29.0	PCP, NWTPH-Dx	PCP, TSS, NWTPH-G/BTEX, NWTPH-Dx	
SS-1	-	0.0 to 0.2	PCP, pH, NWTPH-Dx, SPLP, dioxin, TOC	-	Assess impact of treatment operations on nearby soils, assess leachability and surface contamination within catch basin for storm drain 24.
		0.6 to 1.0	PCP, NWTPH-Dx	-	
SS-2	-	0.0 to 0.2	PCP, pH, dioxin, NWTPH-Dx, TOC	-	Assess impact of treatment operations on nearby soils, and assess leachability
		0.6 to 1.0	PCP, SPLP, NWTPH-Dx	-	
SS-3	-	0.0 to 0.2	PCP, SPLP, Dioxin	-	Assess surface soil contamination and leachability in the treated pole storage area away from treatment operations and surface runoff
		0.6 to 1.0	PCP	-	
SS-4	-	0.0 to 0.2	PCP, Dioxin, TOC	-	Assess surface soil contamination and leachability in the treated pole storage area away from treatment operations and surface runoff.
		0.6 to 1.0	PCP	-	
SS-5	-	0.0 to 0.2	PCP, pH, SPLP, Dioxin	-	Assess surface soil contamination in the treated pole storage area within catch basin for storm drain 23.
		0.6 to 1.0	PCP	-	
SS-6	-	0.0 to 0.2	PCP	-	Assess impact of airborne dusts and volatilization from treatment processes on surrounding soils.
		0.6 to 1.0	PCP	-	

702602\TableA-1.xls - rationale

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual–manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptable moisture
Damp	Some perceptable moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptable moisture, probably above optimum

Minor Constituents

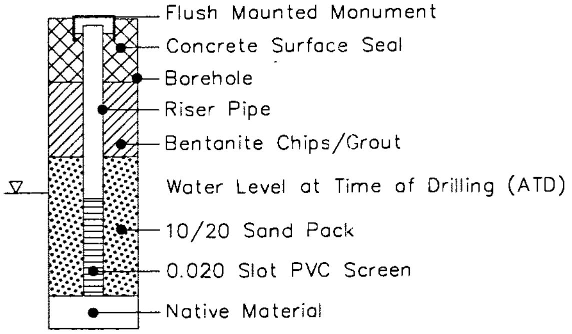
	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Sampling Test Symbols

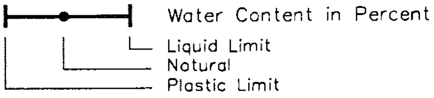
BORING SAMPLES		TEST PIT SAMPLES	
☒	Split Spoon	☒	Grab (Jar)
⧅	Shelby Tube	⧅	Shelby Tube
▥	Cuttings	⧄	Bag
◫	Core Run		
*	No Sample Recovery		
P	Tube Pushed, Not Driven		

Groundwater Observations



Test Symbols

GS	Grain Size Classification
CN	Consolidation
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained
QU	Unconfined Compression
DS	Direct Shear
K	Permeabilty
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
PID	Photoionization Reading
CA	Chemical Analysis



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FLUSH

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J-7026-02 2/00

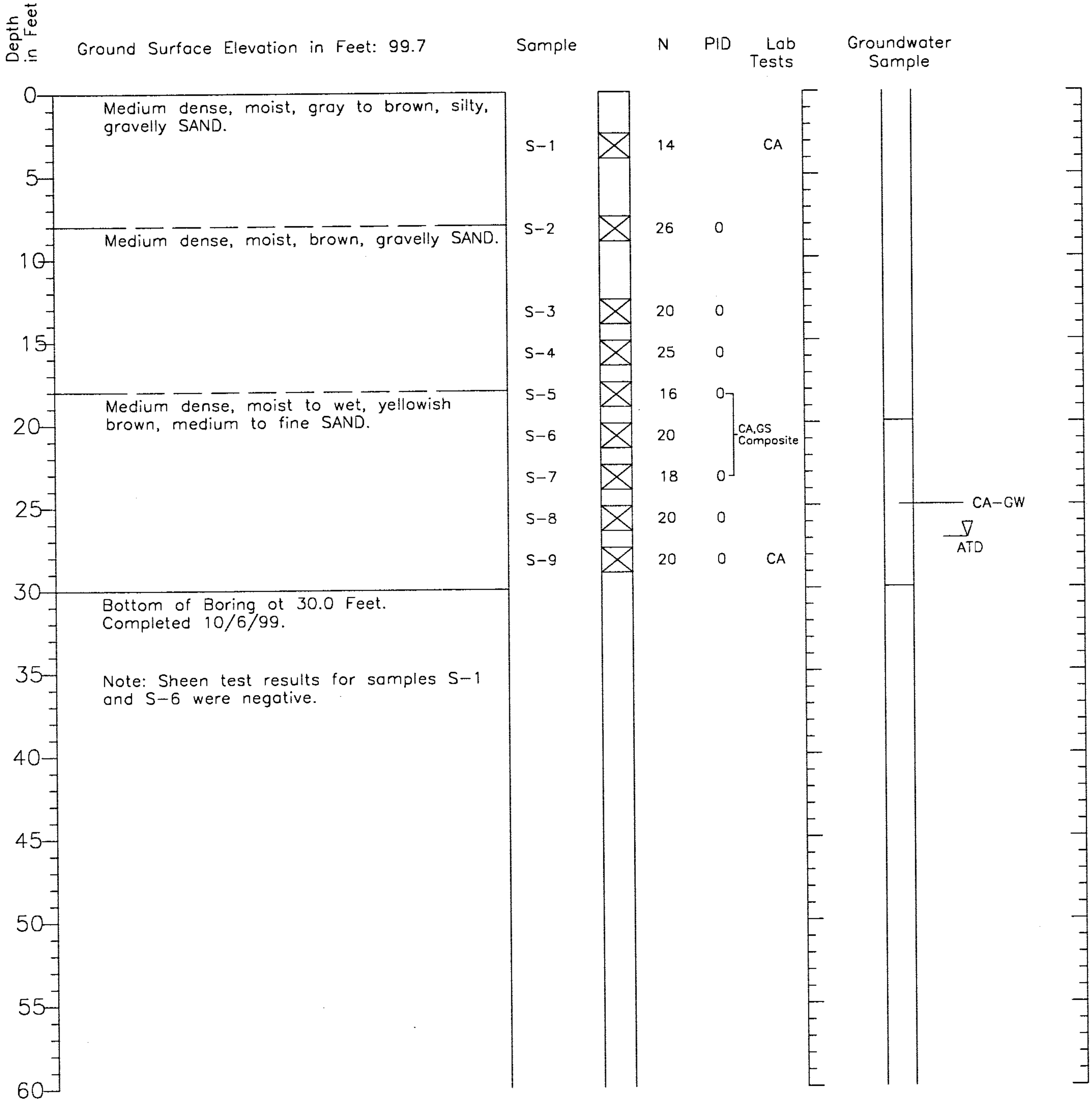
Figure A-1

Boring Log SB-2

Geologic Log

Monitoring Well Design

Ground Surface Elevation in Feet: 99.7



Medium dense, moist, gray to brown, silty, gravelly SAND.

Medium dense, moist, brown, gravelly SAND.

Medium dense, moist to wet, yellowish brown, medium to fine SAND.

Bottom of Boring at 30.0 Feet.
Completed 10/6/99.

Note: Sheen test results for samples S-1 and S-6 were negative.

Sample	N	PID	Lab Tests
S-1	14		CA
S-2	26	0	
S-3	20	0	
S-4	25	0	
S-5	16	0	CA,GS Composite
S-6	20		
S-7	18	0	
S-8	20	0	
S-9	20	0	CA

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HEM 2/4/00 1=1
702602 Logs wdstck

HARTCROWSER

J-7026-02 2/00

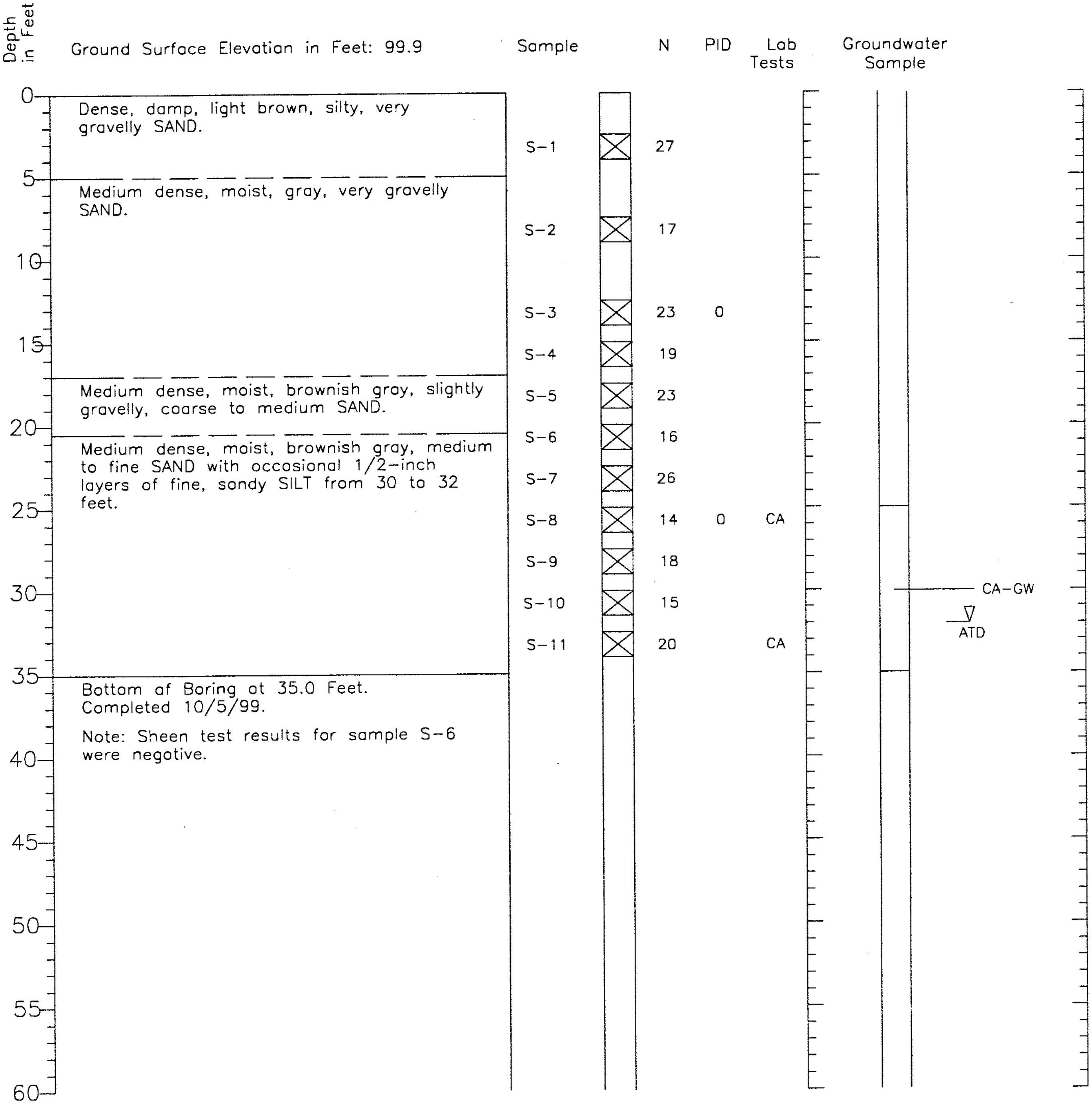
Figure A-2

Boring Log SB-3

Geologic Log

Backfilled Boring

Ground Surface Elevation in Feet: 99.9



Dense, damp, light brown, silty, very gravelly SAND.

Medium dense, moist, gray, very gravelly SAND.

Medium dense, moist, brownish gray, slightly gravelly, coarse to medium SAND.

Medium dense, moist, brownish gray, medium to fine SAND with occosional 1/2-inch layers of fine, sondy SILT from 30 to 32 feet.

Bottom of Boring ot 35.0 Feet.
Completed 10/5/99.

Note: Sheen test results for sample S-6 were negotive.

Sample	N	PID	Lab Tests
S-1	27		
S-2	17		
S-3	23	0	
S-4	19		
S-5	23		
S-6	16		
S-7	26		
S-8	14	0	CA
S-9	18		
S-10	15		
S-11	20		CA

1. Refer to Figure A-1 for explonotion of descriptions ond symbols.
2. Soil descriptions ond stratum lines are interpretive and octual changes moy be graduol.
3. Ground woter level, if indicoted, is ot time of drilling (ATD) or for dote specified. Level moy vory with time.

HEM 2/4/00 1=1
702602 Logs wdstck

HARTCROWSER

J-7026-02 2/00

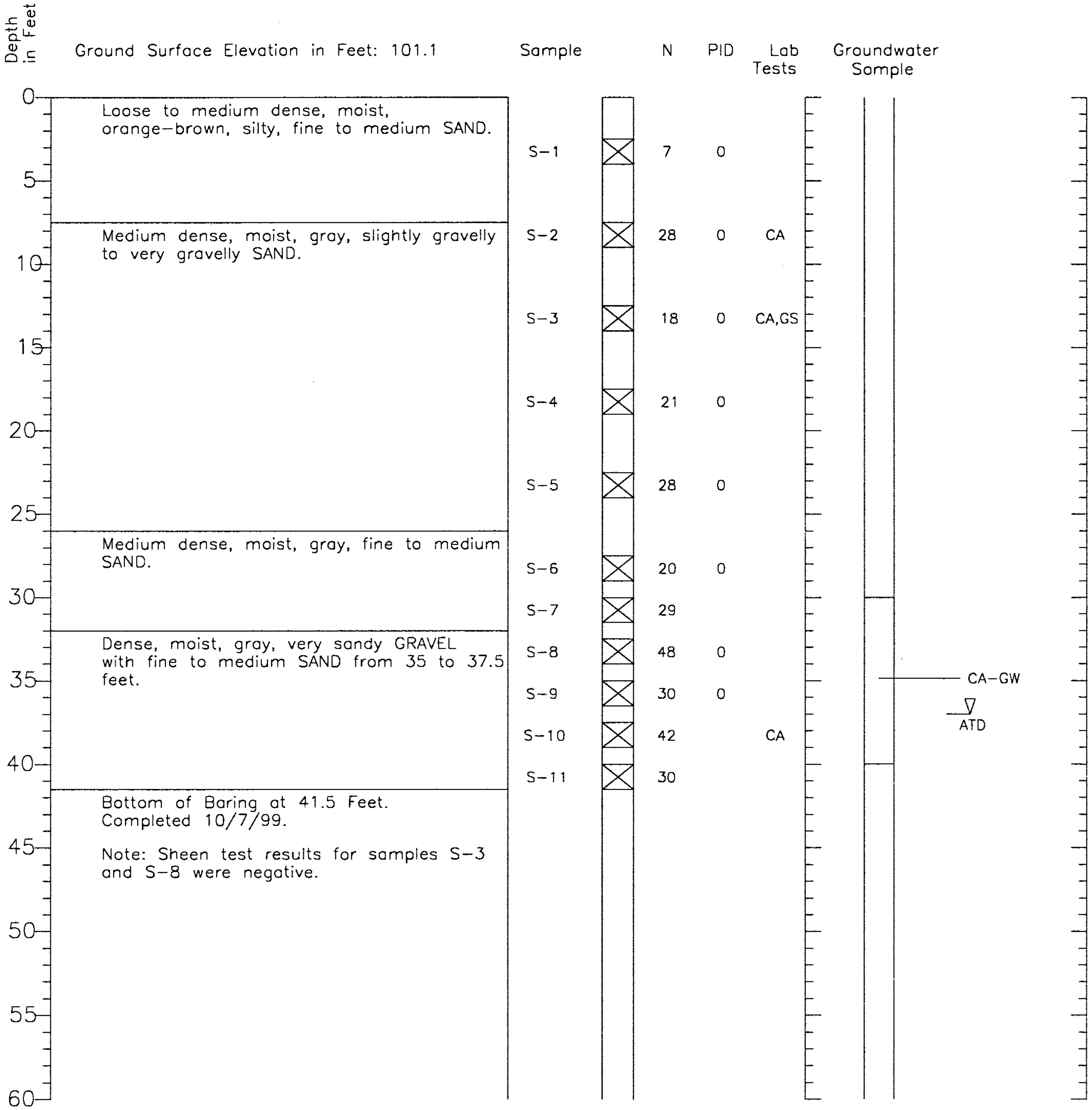
Figure A-3

Boring Log SB-4

Geologic Log

Backfilled Boring

Ground Surface Elevation in Feet: 101.1



Loose to medium dense, moist, orange-brown, silty, fine to medium SAND.

Medium dense, moist, gray, slightly gravelly to very gravelly SAND.

Medium dense, moist, gray, fine to medium SAND.

Dense, moist, gray, very sandy GRAVEL with fine to medium SAND from 35 to 37.5 feet.

Bottom of Boring at 41.5 Feet. Completed 10/7/99.

Note: Sheen test results for samples S-3 and S-8 were negative.

Sample	N	PID	Lab Tests
S-1	7	0	
S-2	28	0	CA
S-3	18	0	CA,GS
S-4	21	0	
S-5	28	0	
S-6	20	0	
S-7	29		
S-8	48	0	
S-9	30	0	
S-10	42		CA
S-11	30		

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-7026-02 2/00

Figure A-4

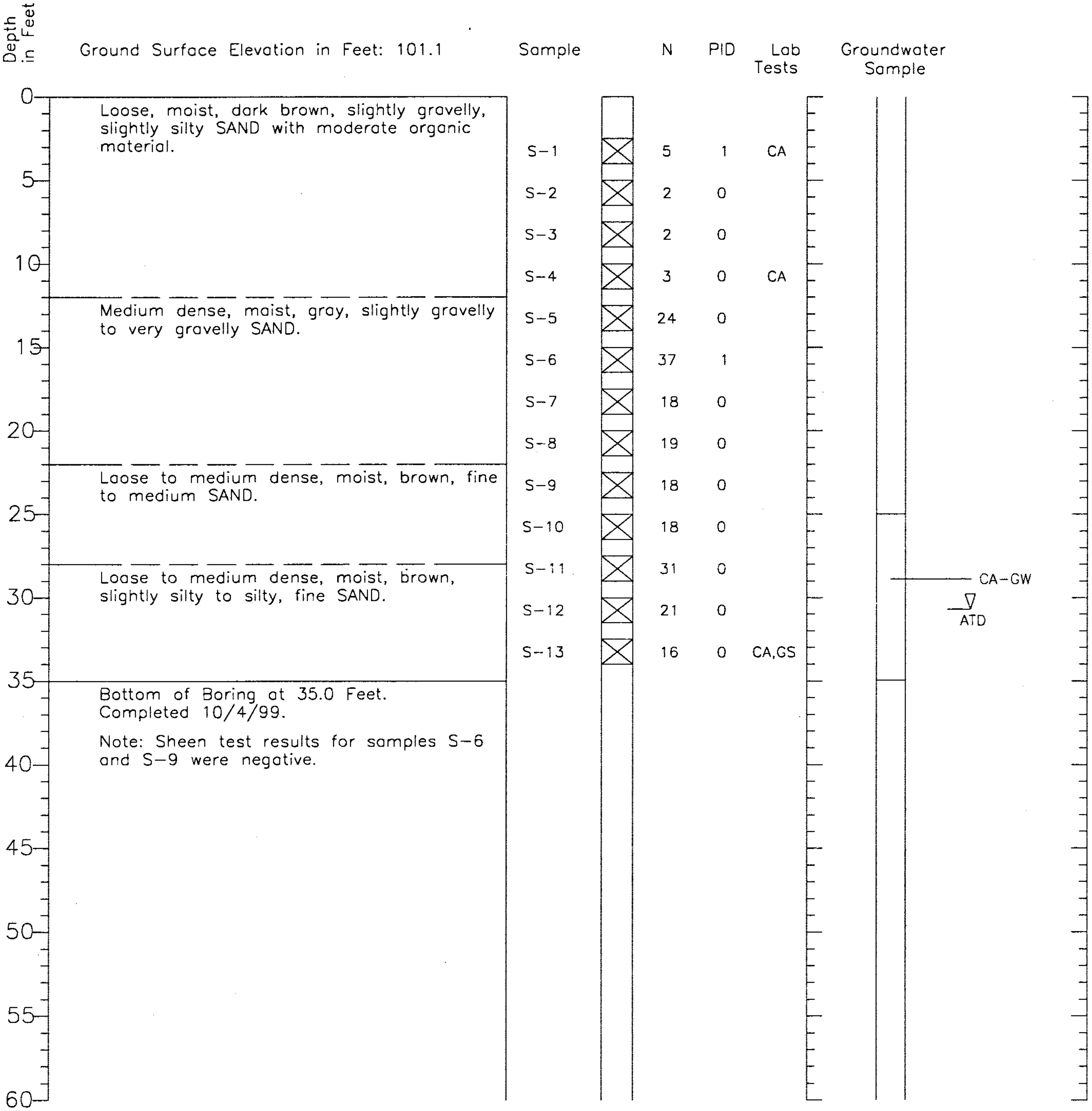
HEM 2/4/00 1=1

702602 Logs wdstck

Boring Log SB-5

Geologic Log

Backfilled Boring



Ground Surface Elevation in Feet: 101.1

Loose, moist, dark brown, slightly gravelly, slightly silty SAND with moderate organic material.

Medium dense, moist, gray, slightly gravelly to very gravelly SAND.

Loose to medium dense, moist, brown, fine to medium SAND.

Loose to medium dense, moist, brown, slightly silty to silty, fine SAND.

Bottom of Boring at 35.0 Feet.
Completed 10/4/99.

Note: Sheen test results for samples S-6 and S-9 were negative.

Sample	N	PID	Lab Tests
S-1	5	1	CA
S-2	2	0	
S-3	2	0	
S-4	3	0	CA
S-5	24	0	
S-6	37	1	
S-7	18	0	
S-8	19	0	
S-9	18	0	
S-10	18	0	
S-11	31	0	
S-12	21	0	
S-13	16	0	CA,GS

Groundwater Sample

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HEM 2/4/00 1=1
702602 Logs wdstck

HARTCROWSER

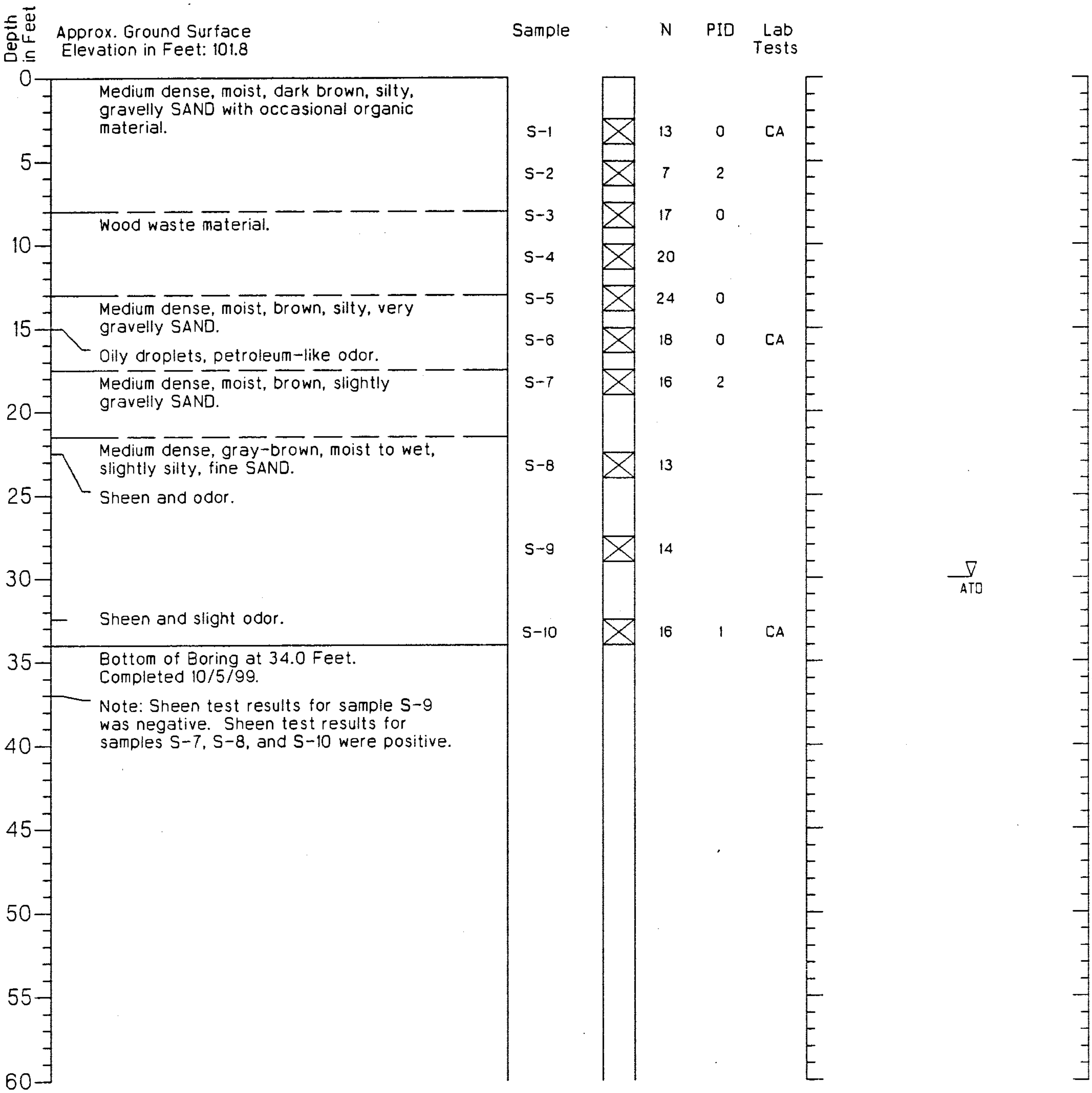
J-7026-02 2/00

Figure A-5

Boring Log SB-6

Geologic Log

Backfilled Boring



Approx. Ground Surface Elevation in Feet: 101.8

Medium dense, moist, dark brown, silty, gravelly SAND with occasional organic material.

Wood waste material.

Medium dense, moist, brown, silty, very gravelly SAND.

Oily droplets, petroleum-like odor.

Medium dense, moist, brown, slightly gravelly SAND.

Medium dense, gray-brown, moist to wet, slightly silty, fine SAND.

Sheen and odor.

Sheen and slight odor.

Bottom of Boring at 34.0 Feet.
Completed 10/5/99.

Note: Sheen test results for sample S-9 was negative. Sheen test results for samples S-7, S-8, and S-10 were positive.

Sample	N	PID	Lab Tests
S-1	13	0	CA
S-2	7	2	
S-3	17	0	
S-4	20		
S-5	24	0	
S-6	18	0	CA
S-7	16	2	
S-8	13		
S-9	14		
S-10	16	1	CA

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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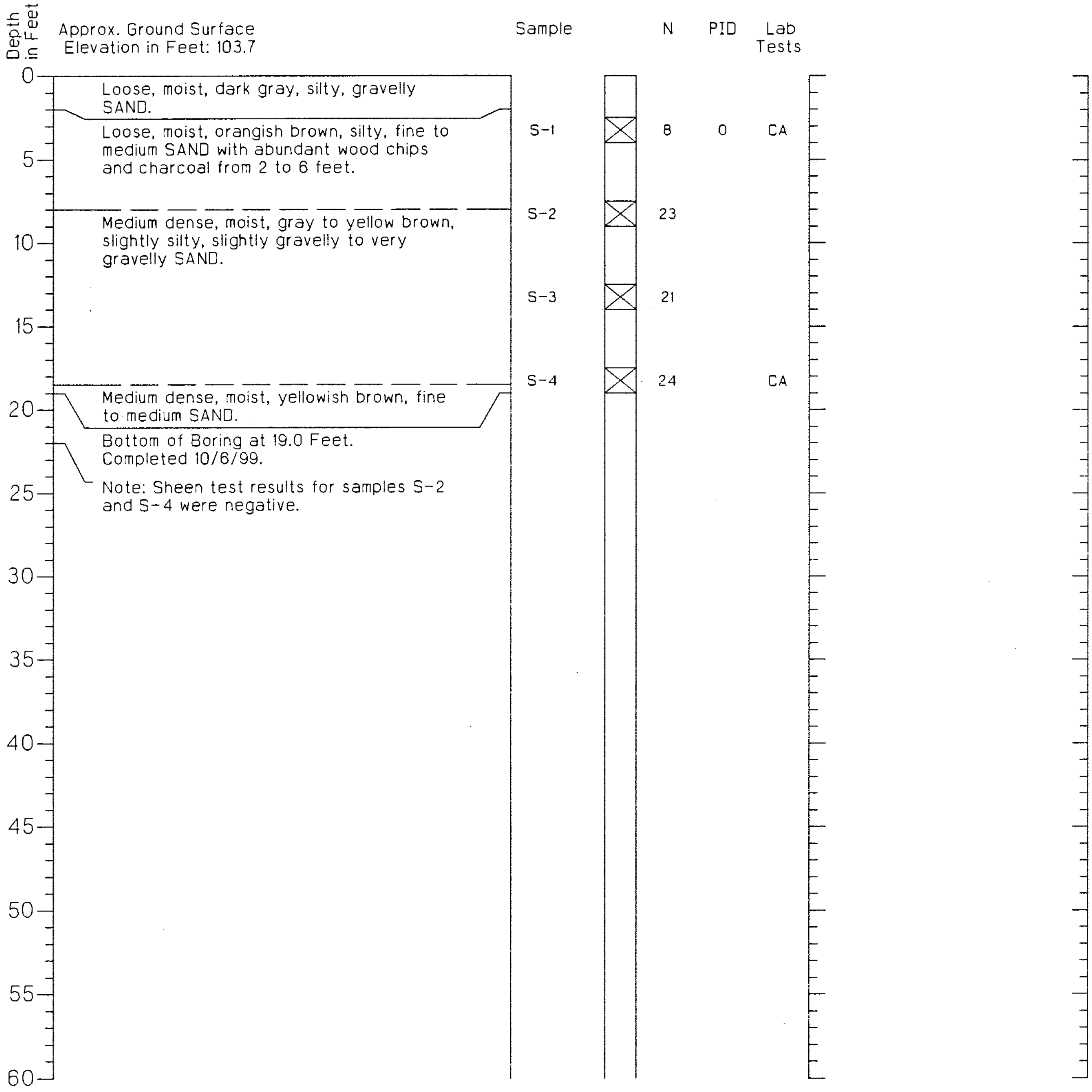
J-7026-02 10/99

Figure A-6

Boring Log SB-7

Geologic Log

Backfilled Boring



Approx. Ground Surface Elevation in Feet: 103.7

Loose, moist, dark gray, silty, gravelly SAND.

Loose, moist, orangish brown, silty, fine to medium SAND with abundant wood chips and charcoal from 2 to 6 feet.

Medium dense, moist, gray to yellow brown, slightly silty, slightly gravelly to very gravelly SAND.

Medium dense, moist, yellowish brown, fine to medium SAND.

Bottom of Boring at 19.0 Feet.
Completed 10/6/99.

Note: Sheen test results for samples S-2 and S-4 were negative.

Sample	N	PID	Lab Tests
S-1	8	0	CA
S-2	23		
S-3	21		
S-4	24		CA

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

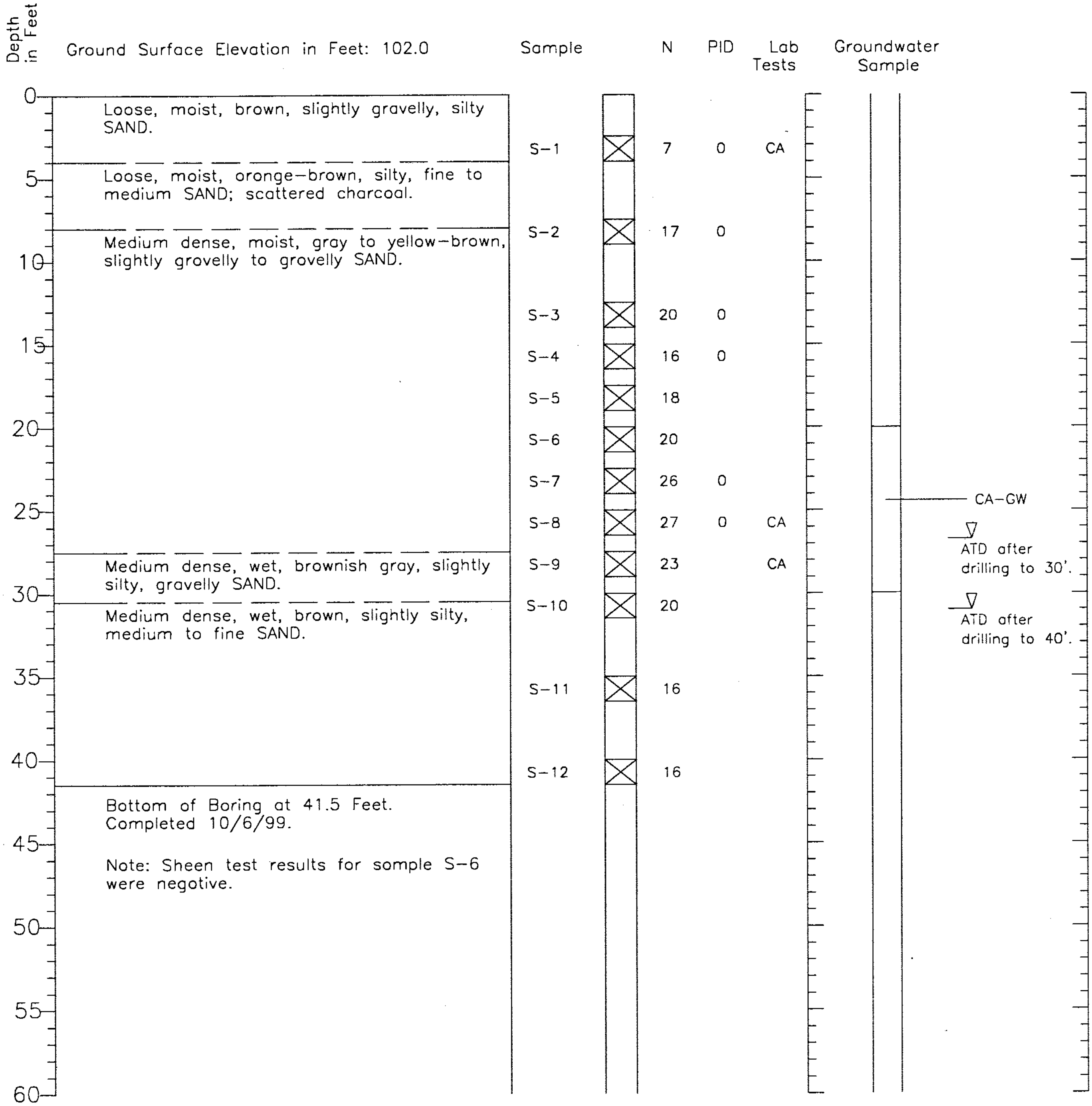
HARTCROWSER
J-7026-02 **10/99**
Figure A-7

Boring Log SB-8

Geologic Log

Backfilled Boring

Ground Surface Elevation in Feet: 102.0



Loose, moist, brown, slightly gravelly, silty SAND.

Loose, moist, orange-brown, silty, fine to medium SAND; scattered charcoal.

Medium dense, moist, gray to yellow-brown, slightly gravelly to gravelly SAND.

Medium dense, wet, brownish gray, slightly silty, gravelly SAND.

Medium dense, wet, brown, slightly silty, medium to fine SAND.

Bottom of Boring at 41.5 Feet.
Completed 10/6/99.

Note: Sheen test results for sample S-6 were negative.

Sample	N	PID	Lab Tests
S-1	7	0	CA
S-2	17	0	
S-3	20	0	
S-4	16	0	
S-5	18		
S-6	20		
S-7	26	0	
S-8	27	0	CA
S-9	23		CA
S-10	20		
S-11	16		
S-12	16		

Groundwater Sample

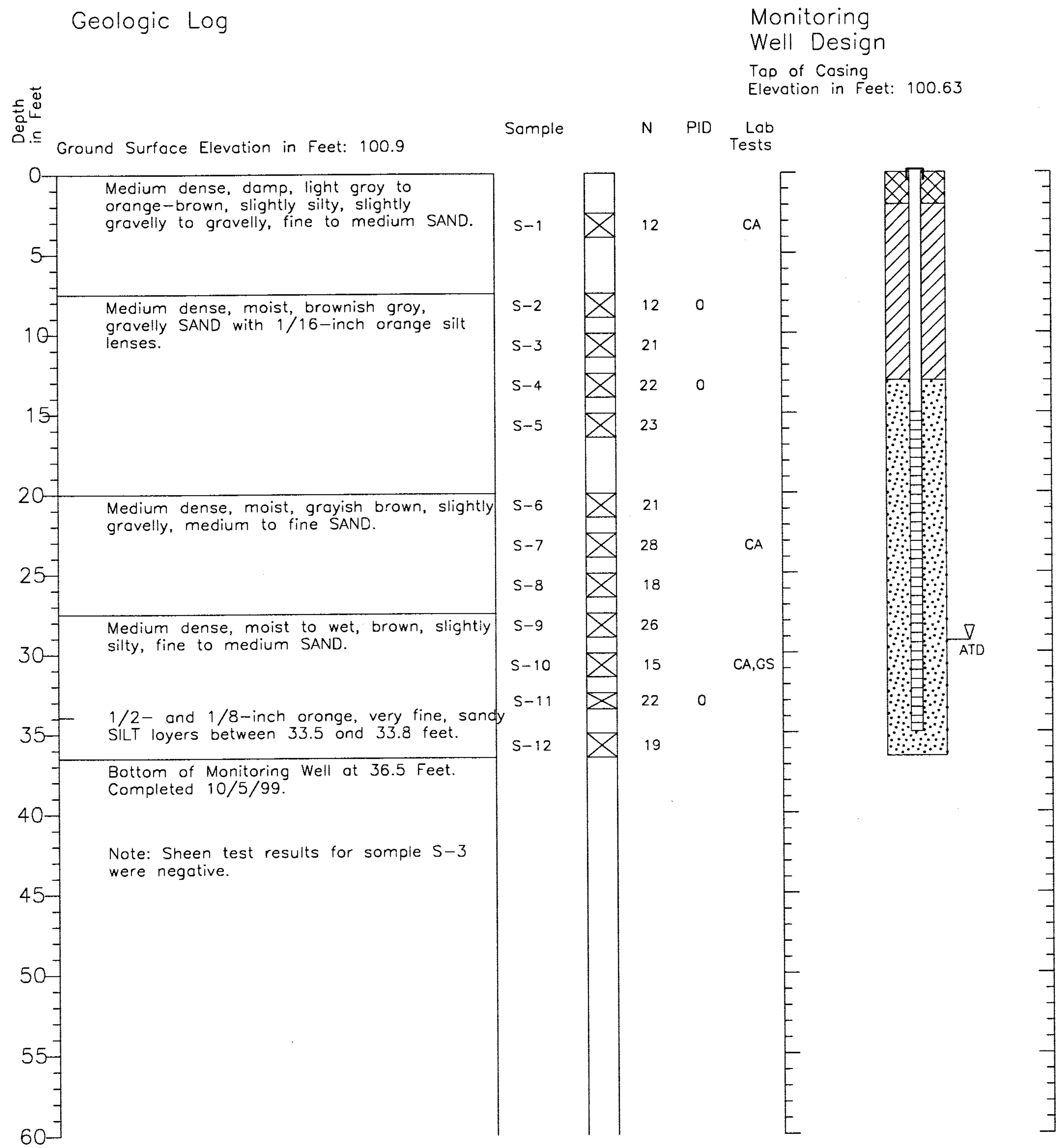
∇ ATD after drilling to 30'.

∇ ATD after drilling to 40'.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-7026-02 2/00
Figure A-8

Boring Log and Construction Data for Monitoring Well HC-MW-5



Top of Casing Elevation in Feet: 100.63

Ground Surface Elevation in Feet: 100.9

Medium dense, damp, light groy to orange-brown, slightly silty, slightly gravelly to gravelly, fine to medium SAND.

Medium dense, moist, brownish groy, gravelly SAND with 1/16-inch orange silt lenses.

Medium dense, moist, grayish brown, slightly gravelly, medium to fine SAND.

Medium dense, moist to wet, brown, slightly silty, fine to medium SAND.

1/2- and 1/8-inch orange, very fine, sandy SILT loyers between 33.5 and 33.8 feet.

Bottom of Monitoring Well at 36.5 Feet. Completed 10/5/99.

Note: Sheen test results for somple S-3 were negative.

Sample	N	PID	Lab Tests
S-1	12		CA
S-2	12	0	
S-3	21		
S-4	22	0	
S-5	23		
S-6	21		
S-7	28		CA
S-8	18		
S-9	26		
S-10	15		CA,GS
S-11	22	0	
S-12	19		

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level moy vory with time.

HARTCROWSER

J-7026-02 10/99

Figure A-9

\CAD LOG 2/23/00 1=1 WDSTK-8.PC2

702602\M-WELLS.DWG

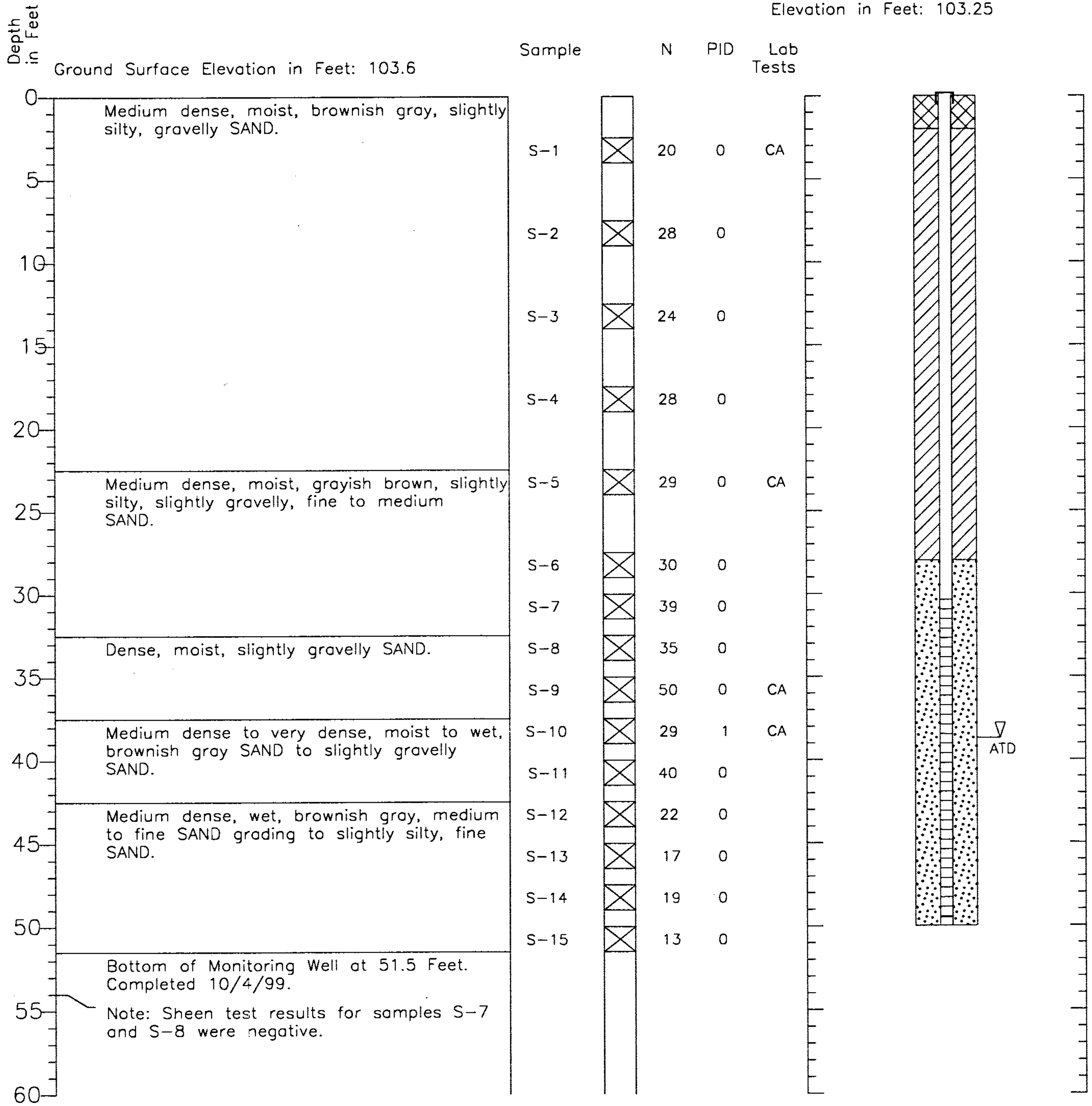
Boring Log and Construction Data for Monitoring Well HC-MW-6

Geologic Log

Monitoring Well Design

Top of Casing Elevation in Feet: 103.25

Ground Surface Elevation in Feet: 103.6



Medium dense, moist, brownish gray, slightly silty, gravelly SAND.

Medium dense, moist, grayish brown, slightly silty, slightly gravelly, fine to medium SAND.

Dense, moist, slightly gravelly SAND.

Medium dense to very dense, moist to wet, brownish gray SAND to slightly gravelly SAND.

Medium dense, wet, brownish gray, medium to fine SAND grading to slightly silty, fine SAND.

Bottom of Monitoring Well at 51.5 Feet. Completed 10/4/99.

Note: Sheen test results for samples S-7 and S-8 were negative.

Sample	N	PID	Lab Tests
S-1	20	0	CA
S-2	28	0	
S-3	24	0	
S-4	28	0	
S-5	29	0	CA
S-6	30	0	
S-7	39	0	
S-8	35	0	
S-9	50	0	CA
S-10	29	1	CA
S-11	40	0	
S-12	22	0	
S-13	17	0	
S-14	19	0	
S-15	13	0	

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-7026-02 10/99

Figure A-10

\CAD LOG 2/23/00 1=1 WDSTK-8.PC2

702602\M-WELLS.DWG

Boring Log and Construction Data for Monitoring Well HC-MW-7

Geologic Log

Depth in Feet

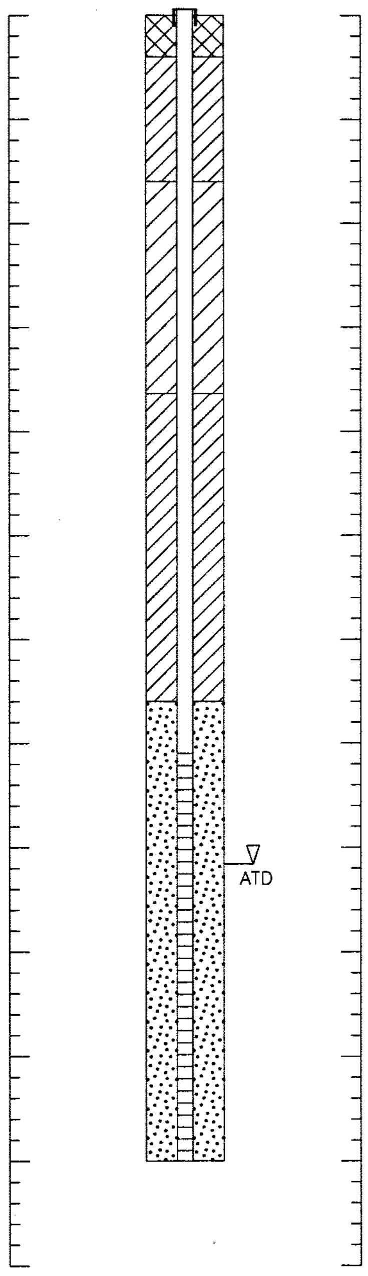
Ground Surface Elevation in Feet: 101.9

Geologic Log	Sample	N	Lab Tests
Topsoil.			
Oronge to light brown, medium to fine SAND.			
Medium dense, moist, light brown, slightly silty SAND.	S-1	14	
Medium dense, moist, brownish gray, gravelly, coarse to medium SAND.	S-2	16	
Medium dense, moist, brown, fine to medium SAND.	S-3	21	
	S-4	20	
Medium dense, moist, brownish gray, slightly gravelly SAND.	S-5	38	
	S-6	31	
Medium dense, moist, brown, slightly silty, fine SAND.			
Dense, moist, brownish gray, medium to fine SAND.	S-7	43	
Medium dense, moist, grayish brown, slightly gravelly SAND.	S-8	24	
Medium dense, wet, gray, slightly silty, fine to medium SAND.	S-9	30	CA
Medium dense, wet, gray, medium to coarse SAND.	S-10	38	
Very dense, wet, gray, fine to medium SAND.	S-11	54	

Bottom of Monitoring Well at 54.0 Feet.
Completed 10/7/99.

Monitoring Well Design

Top of Casing Elevation in Feet: 101.68



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

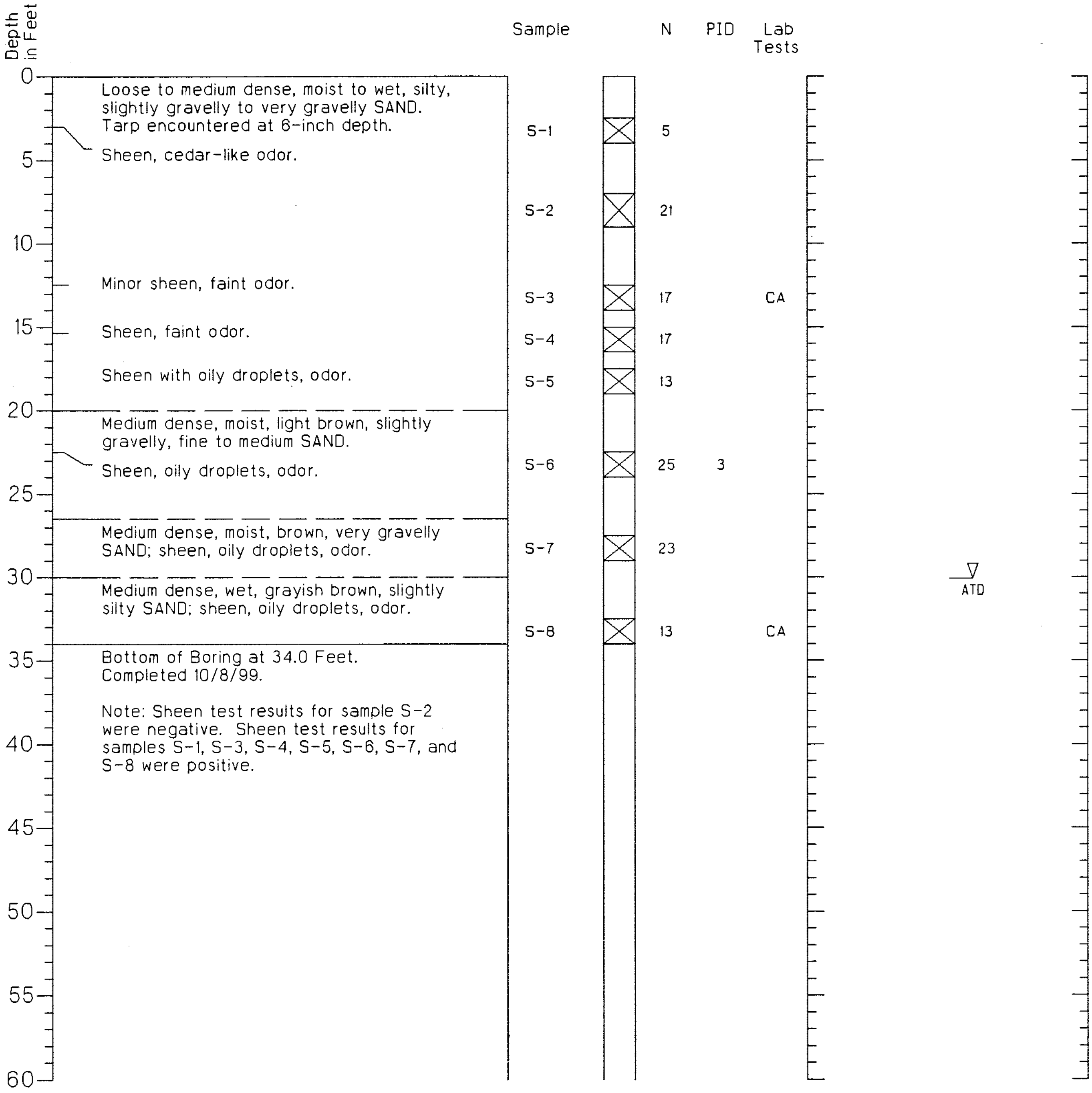
\CAD LOG 2/23/00 1=1 WDSTK-8.PC2
702602\M-WELLS.DWG

HARTCROWSER
J-7026-02 10/99
Figure A-11

Boring Log BT-S

Geologic Log

Backfilled Boring



Loose to medium dense, moist to wet, silty, slightly gravelly to very gravelly SAND. Tarp encountered at 6-inch depth.

Sheen, cedar-like odor.

Minor sheen, faint odor.

Sheen, faint odor.

Sheen with oily droplets, odor.

Medium dense, moist, light brown, slightly gravelly, fine to medium SAND.

Sheen, oily droplets, odor.

Medium dense, moist, brown, very gravelly SAND; sheen, oily droplets, odor.

Medium dense, wet, grayish brown, slightly silty SAND; sheen, oily droplets, odor.

Bottom of Boring at 34.0 Feet.
Completed 10/8/99.

Note: Sheen test results for sample S-2 were negative. Sheen test results for samples S-1, S-3, S-4, S-5, S-6, S-7, and S-8 were positive.

Sample	N	PID	Lab Tests
S-1	5		
S-2	21		
S-3	17		CA
S-4	17		
S-5	13		
S-6	25	3	
S-7	23		
S-8	13		CA

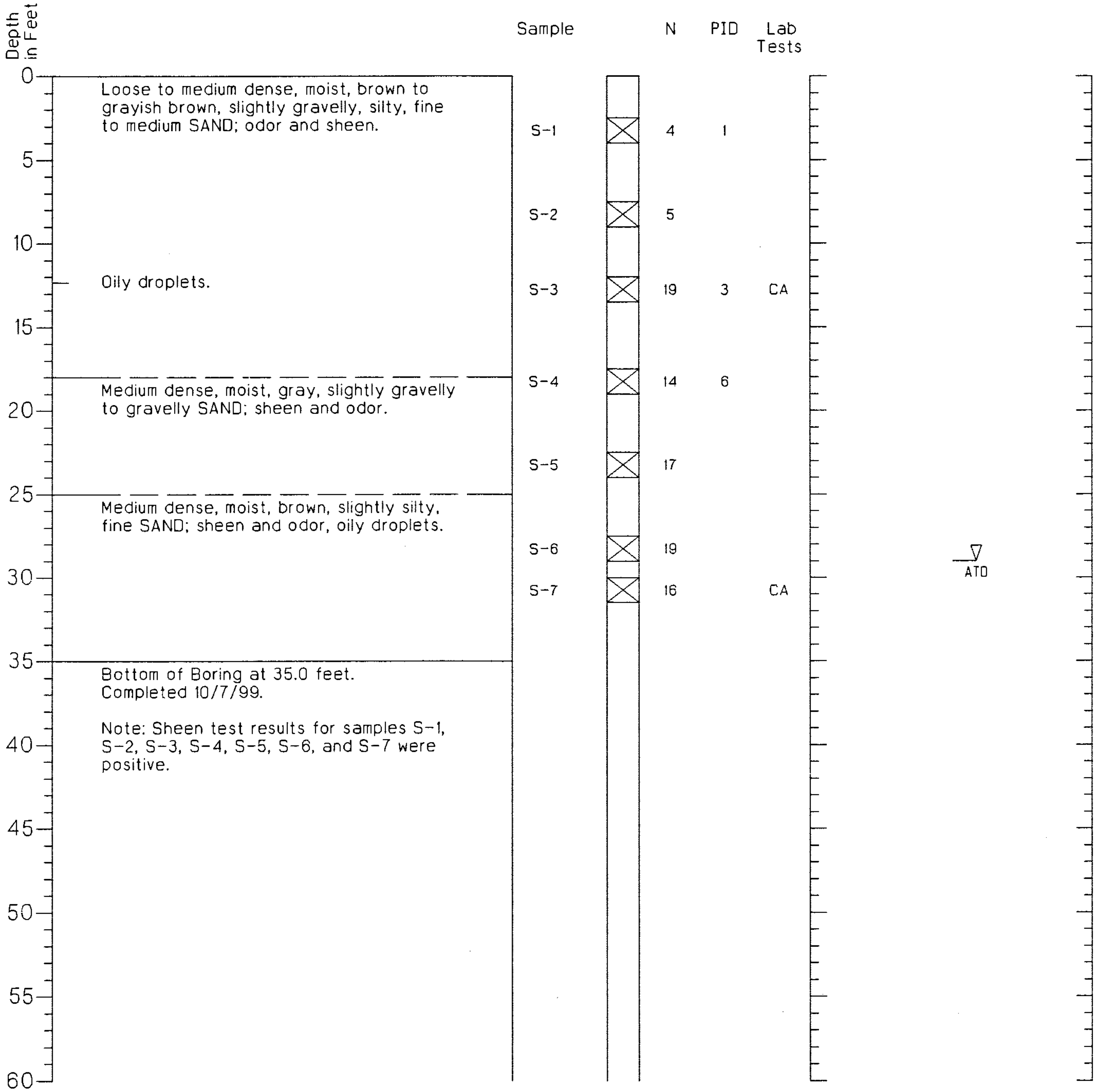
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-7028-02 **10/99**
Figure A-12

Boring Log BT-W

Geologic Log

Backfilled Boring



Loose to medium dense, moist, brown to grayish brown, slightly gravelly, silty, fine to medium SAND; odor and sheen.

Oily droplets.

Medium dense, moist, gray, slightly gravelly to gravelly SAND; sheen and odor.

Medium dense, moist, brown, slightly silty, fine SAND; sheen and odor, oily droplets.

Bottom of Boring at 35.0 feet.
Completed 10/7/99.

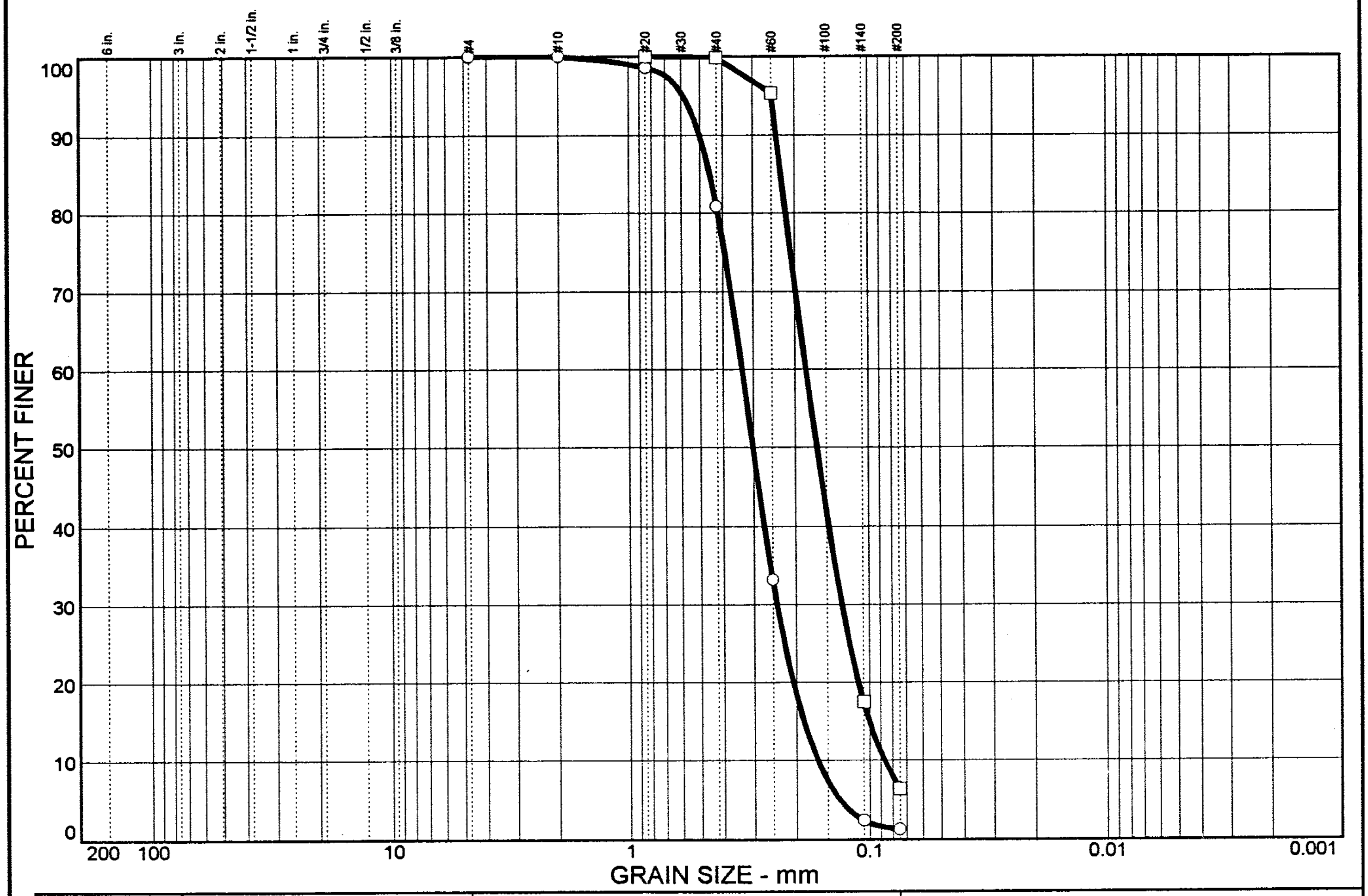
Note: Sheen test results for samples S-1, S-2, S-3, S-4, S-5, S-6, and S-7 were positive.

Sample	N	PID	Lab Tests
S-1	4	1	
S-2	5		
S-3	19	3	CA
S-4	14	6	
S-5	17		
S-6	19		
S-7	16		CA

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER
J-7026-02 **10/99**
Figure A-13

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	19.1	79.6	1.3	
□	0.0	0.0	0.0	0.0	0.1	93.5	6.4	

☒	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.453	0.333	0.301	0.240	0.186	0.164	1.06	2.04
□			0.228	0.181	0.163	0.129	0.100	0.0866	1.07	2.09

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Medium to fine SAND	SP	
□ Slightly silty, medium SAND	SP-SM	

Remarks:

○

□

Project: JH Baxter

Client:

○ **Source:** Sample No.: SB-2 S-5/7

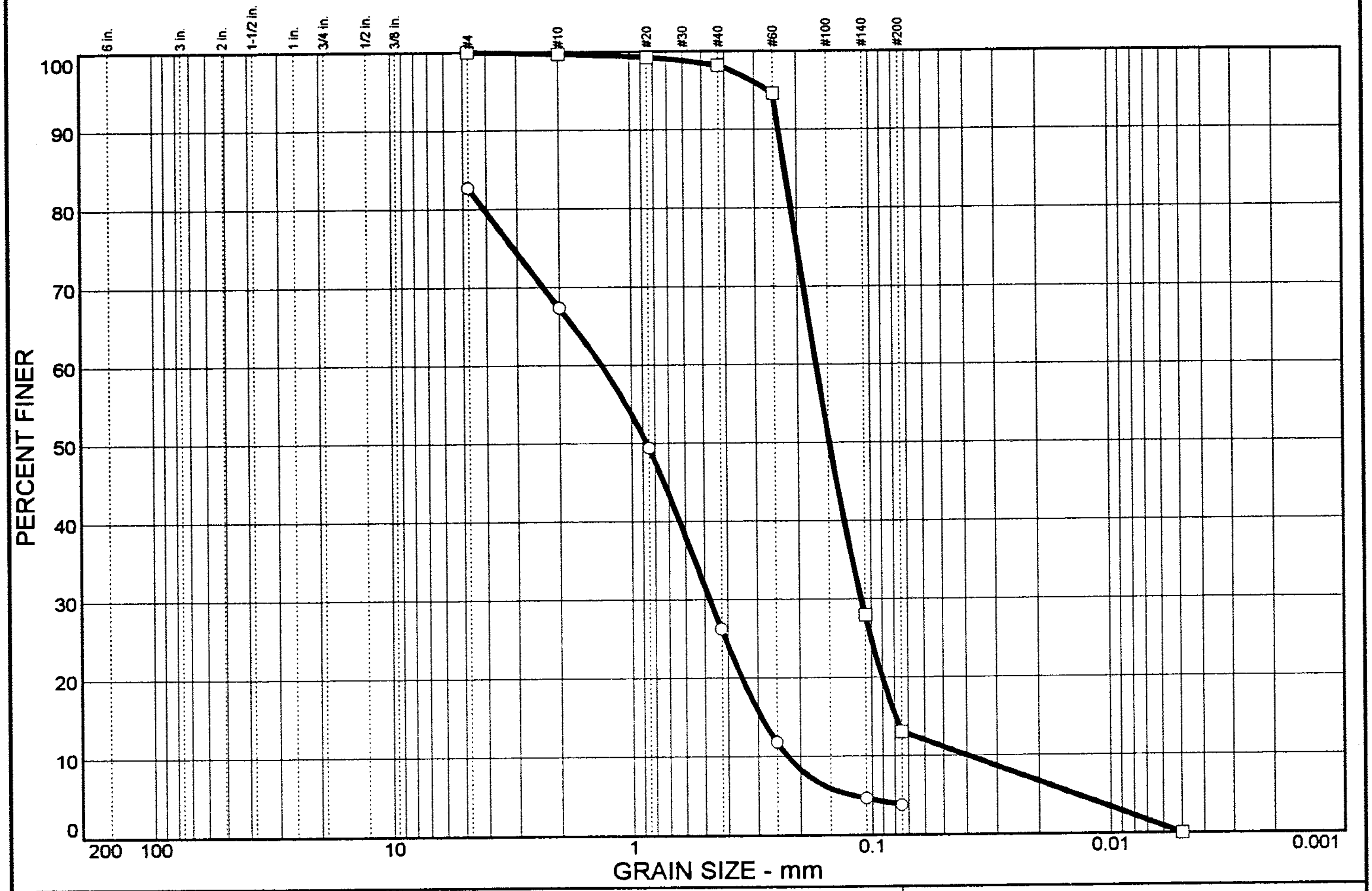
□ **Source:** Sample No.: MW-5 S-10

HARTCROWSER

J7026-02 2/4/00

Figure No. A-14

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○				15.4	41.1	22.4	3.8	
□	0.0	0.0	0.0	0.3	1.5	85.1	13.1	0.0

☒	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				1.33	0.868	0.475	0.290	0.225	0.75	5.92
□			0.224	0.167	0.148	0.110	0.0792	0.0395	1.83	4.24

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Gravelly SAND	SP	
□ Silty fine SAND	SM	

Remarks:

○

□

Project: JH Baxter

Client:

○ **Source:** **Sample No.:** SB-4 S-3

□ **Source:** **Sample No.:** SB-5 S-13

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J7026-02 2/4/00

Figure No. A–15

APPENDIX B
CHEMICAL DATA TABLES AND DATA QUALITY REVIEW

APPENDIX B
CHEMICAL DATA TABLES AND DATA QUALITY REVIEW

Chemical Data Tables

Tables B-1 through B-5 present the complete, validated chemical analysis data for samples collected during this investigation at the Baxter site. These tables are included at the end of this appendix following discussions of our data quality review effort and overall data quality. Prior to the table is an explanation of qualifiers assigned to the data. The laboratory certificates of analysis for these samples are on file at Hart Crowser and available for review through proper arrangements.

Chemical data are presented by media, and in the case of dioxins, in separate tables. Table B-1 presents the chemical data for surface and subsurface soil samples collected and analyzed for the site. Tables B-2 and B-3 present the chemical data for surface water and groundwater samples, respectively, collected and analyzed from 1998 to the present. Tables B-4 and B-5 present the dioxin data for surface and subsurface soil samples, and surface water and groundwater samples, respectively.

Chemical Data Quality Review

This section discusses the results of the quality assurance (QA) review of chemical data for 43 soil and 11 groundwater samples collected in accordance with the J.H. Baxter/Arlington RI.

Chemical analyses were performed by Columbia Analytical Services of Kelso, Washington. The laboratory submitted data packages were reviewed by Hart Crowser. The following criteria were evaluated in the standard validation process:

- Holding Times;
- Method Blanks;
- Surrogate Recoveries;
- Blank Spike and Laboratory Control Sample Recoveries;
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recoveries and Relative Percent Differences (RPD);
- Laboratory and Field Duplicate Relative Percent Differences (FPDs); and
- Reported Detection Limits.

Overall Data Quality

The overall data quality objectives (DQOs), as set forth in the QAPP are met, and the data for this site are acceptable for use as qualified. The completeness for the associated data is 100 percent. Detailed discussions are presented below.

Quality Assurance Objectives

Precision. Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Precision is generally evaluated using both MS/MSD (or laboratory duplicate) results and field duplicate results. MS/MSD and laboratory duplicate results provide information on laboratory (only) precision, while field duplicates provide information on field and laboratory precision combined.

Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) samples for organics analyses, and laboratory duplicate samples for metals and other inorganic analyses. Analytical precision is quantitatively expressed as the relative percent difference (RPD) between the MS/MSD or laboratory duplicates. Analytical precision measurements were carried out on project-specific soil and groundwater samples at a minimum frequency of one in twenty samples. No qualifiers were required.

Accuracy. Accuracy measures the closeness of the measured value to the true value. The accuracy of chemical test results was assessed by analyzing standard reference materials or by "spiking" samples with known standards (surrogates, laboratory control samples, blank spikes, and/or matrix spike) and measuring the percent recovery.

Accuracy measurements for all fractions were carried out in accordance with CLP SOW requirements for organic and inorganic analyses and at a minimum frequency of one in twenty samples. Recoveries of surrogates, matrix spike/matrix spike duplicates (MS/MSDs), and laboratory control samples (LCSs) were generally acceptable. Data qualifiers were required for NWTPH-Dx results in a groundwater sample due to low surrogate recoveries.

Completeness. Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness of the data is the ratio of acceptable data points to the total number of data points (expressed as a percent). A target completeness goal for this work was 90 percent. There were 426 data points and no sample was rejected; therefore, the completeness of the data for this project was 100 percent.

Comparability. Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Because of the use of standard techniques for both sample collection and laboratory analysis, the data collected from same sampling locations and depths should be comparable to both internal and other data generated.

No Major Problems Encountered

No problems were encountered with the analysis and reporting of the data.

Minor Problems Encountered

Semivolatile Organic (cPAH) Analysis. Seven compounds were detected below detection limits in method blank. Dibenz(a,h)anthracene in sample SB-6 S-10 was qualified as not detected (U). Surrogate recoveries were outside control limits in sample SB-6 S-6. No qualifiers were assigned since the sample was diluted due to high concentrations.

Total Organic Carbon Analysis. No problems were encountered with the total organic carbon analysis.

Total **Solids/Total Suspended Solids Analyses.** No problems were encountered with the total solids and total suspended solids analyses.

NWTPH-Dx Analysis. Surrogate recoveries of o-terphenyl were above laboratory control limits in one groundwater and two soil samples. No qualifiers were assigned since remaining recoveries were acceptable. Recoveries of both o-terphenyl and n-triacontane were above control limits in sample BT-W-GW. The results for this sample were qualified as estimated (UJ/J).

NWTPH-G/BTEX Organics Analysis. MS/MSD recoveries of benzene were above control limits. No qualifiers were assigned since sample concentration exceeded spike concentration by a factor greater than four. Reporting limits were elevated in several samples due to sample dilutions.

Chlorinated Phenols Analysis. Surrogate recoveries were below control limits in several soil and groundwater samples. No qualifiers were assigned since samples were diluted due to high concentrations. MS/MSD recoveries were not reported due to high concentration in sample. Reporting limits were elevated in several samples due to sample dilutions.

Data Qualifiers

Data qualifiers have been assigned to the chemical data presented in the following Tables B-1 through B-5. The assigned qualifiers and their meaning include the following:

U	Not detected at detection limit indicated or qualified as not detect based on concentration less than 5 times the blank concentration.
J	Estimated concentration below detection limit or qualified concentration based on surrogate recoveries.

A blank in the tables indicates the sample was not analyzed for the specific analyte.

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Table B-1 - Chemical Results for Surface and Subsurface Soil Samples

Sample ID	40-3/25/92	41-3/25/92	42-3/25/92	43-3/25/92	B-1-14-15	B-1-17-18	B-1-24-25	B-1-39-40
Sampling Date	3/25/92	3/25/92	3/25/92	3/25/92	8/24/90	8/24/90	8/24/90	8/24/90
Depth in Feet								
Conventionals in %								
Total Organic Carbon								
Total Solids								
PAHs in mg/kg								
Acenaphthene	0.046 J	0.39 U	0.9 U	0.45 U	0.17 U	0.17 U	0.17 U	0.17 U
Acenaphthylene					0.17 U	0.17 U	0.17 U	0.17 U
Anthracene	0.87	0.375	0.9 U	0.45 J	0.17 U	0.17 U	0.17 U	0.17 U
Benzo(a)anthracene	2.6	0.39 U	2.6 J	0.45 U	0.17 U	0.17 U	0.17 U	0.17 U
Benzo(a)pyrene	2.3 J	0.39 U	0.57 J	0.45 UJ	0.17 U	0.17 U	0.17 U	0.17 U
Benzo(b)fluoranthene	8.2 J	0.18 J	1.2 J	0.31 J	0.17 U	0.17 U	0.17 U	0.17 U
Benzo(g,h,i)perylene					0.17 U	0.17 U	0.17 U	0.17 U
Benzo(k)fluoranthene					0.17 U	0.17 U	0.17 U	0.17 U
Carbazole	2.4 J	2 UJ	4.6 UJ	2.3 UJ				
Chrysene	2.6	0.17 J	2.4 J	0.39 J	0.17 U	0.17 U	0.17 U	0.17 U
Dibenz(a,h)anthracene	1.2 J	0.39 U	0.16 J	1.1 UJ	0.17 U	0.17 U	0.17 U	0.17 U
Fluoranthene	9.2	0.16 J	5.7 J	0.31 J	0.17 U	0.17 U	0.17 U	0.17 U
Fluorene	0.11 J	0.39 U	0.9 U	0.45 U	0.17 U	0.17 U	0.17 U	0.17 U
Indeno(1,2,3-cd)pyrene					0.17 U	0.17 U	0.17 U	0.17 U
Naphthalene					0.17 U	0.17 U	0.17 U	0.17 U
Phenanthrene					0.17 U	0.17 U	0.17 U	0.17 U
Pyrene	7.6 J	0.26 J	13 J	0.77 J	0.17 U	0.17 U	0.17 U	0.17 U
Total cPAHs	16.9	0.35	6.93	0.7	0.17 U	0.17 U	0.17 U	0.17 U
Phenols in mg/kg								
2,4,6-Trichlorophenol								
Pentachlorophenol	6.4 J	6 J	1900 J	31	0.85 U	0.85 U	0.29	2.4
Total Tetrachlorophenols								
TPH in mg/kg								
Diesel								
Heavy Fuel Oil								
Jet Fuel as Jet A								
Kerosene								
Lube Oil								
Mineral Spirits								
Non-PHC as Diesel								
PHC as Diesel								

Table B-1 - Chemical Results for Surface and Subsurface Soil Samples

Sheet 2 of 7

Sample ID	B-1-COMP	BT-S S-3	BT-S S-8	BT-W S-3	BT-W S-7	HCMW-5 S-1	HCMW-5 S-7	HCMW-5 S-10
Sampling Date	8/24/90	10/07/99	10/08/99	10/07/99	10/08/99	10/05/99	10/05/99	10/05/99
Depth in Feet		12.5 to 14.0	32.5 to 34.0	12.0 to 13.5	30.0 to 31.5	2.5 to 4.0	22.5 to 24.0	30.0 to 31.5
Conventionals in %								
Total Organic Carbon								0.09
Total Solids		94.9	78.9	91	78.9	92.8	93.7	75.5
PAHs in mg/kg								
Acenaphthene	0.17 U							
Acenaphthylene	0.17 U							
Anthracene	0.17 U							
Benzo(a)anthracene	0.17 U							
Benzo(a)pyrene	0.17 U							
Benzo(b)fluoranthene	0.17 U							
Benzo(g,h,i)perylene	0.17 U							
Benzo(k)fluoranthene	0.17 U							
Carbazole								
Chrysene	0.17 U							
Dibenz(a,h)anthracene	0.17 U							
Fluoranthene	0.17 U							
Fluorene	0.17 U							
Indeno(1,2,3-cd)pyrene	0.17 U							
Naphthalene	0.17 U							
Phenanthrene	0.17 U							
Pyrene	0.24							
Total cPAHs	0.17 U							
Phenols in mg/kg								
2,4,6-Trichlorophenol		0.05 U	0.5 U	5 U	50 U	0.005 U	0.005 U	0.005 U
Pentachlorophenol	3.9	1.2	40	110	1400	0.033	0.011	0.002 J
Total Tetrachlorophenols		0.03 J	1.4	4 J	40 J	0.005 U	0.005 U	0.005 U
TPH in mg/kg								
Diesel		20 J	25 U	25 U	25 U	25 U		25 U
Heavy Fuel Oil		100 U	100 U	100 U	100 U	100 U		100 U
Jet Fuel as Jet A		25 U	25 U	25 U	25 U	25 U		25 U
Kerosene		25 U	25 U	25 U	25 U	25 U		25 U
Lube Oil		100 U	100 U	100 U	100 U	100 U		100 U
Mineral Spirits		25 U	25 U	25 U	25 U	25 U		25 U
Non-PHC as Diesel		100 U	100 U	100 U	100 U	100 U		100 U
PHC as Diesel		100 U	2900	4900	56000	100 U		100 U

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Table B-1 - Chemical Results for Surface and Subsurface Soil Samples

Sample ID	HCMW-6 S-1	HCMW-6 S-5	HCMW-6 S-9	HCMW-6 S-10	HCMW-7 S-9	MW-1-23-24	MW-1-3-4	MW-1-8-9
Sampling Date	10/04/99	10/04/99	10/04/99	10/04/99	10/07/99			
Depth in Feet	2.5 to 4.0	22.5 to 24.0	35.0 to 36.5	37.5 to 39.0	42.5 to 44.0	23.0 to 24.0	3.0 to 4.0	8.0 to 9.0
Conventionals in %								
Total Organic Carbon		0.07		0.07				
Total Solids	96.9	95.2	95.7	88.5	82			
PAHs in mg/kg								
Acenaphthene						0.17 U	0.17 U	0.17 U
Acenaphthylene						0.17 U	0.17 U	0.17 U
Anthracene						0.17 U	0.17 U	0.17 U
Benzo(a)anthracene						0.17 U	0.17 U	0.17 U
Benzo(a)pyrene						0.17 U	0.17 U	0.17 U
Benzo(b)fluoranthene						0.17 U	0.17 U	0.17 U
Benzo(g,h,i)perylene						0.17 U	0.17 U	0.17 U
Benzo(k)fluoranthene						0.17 U	0.17 U	0.17 U
Carbazole								
Chrysene						0.17 U	0.17 U	0.17 U
Dibenz(a,h)anthracene						0.17 U	0.17 U	0.17 U
Fluoranthene						0.17 U	0.17 U	0.17 U
Fluorene						0.17 U	0.17 U	0.17 U
Indeno(1,2,3-cd)pyrene						0.17 U	0.17 U	0.17 U
Naphthalene						0.17 U	0.17 U	0.17 U
Phenanthrene						0.17 U	0.17 U	0.17 U
Pyrene						0.17 U	0.17 U	0.17 U
Total cPAHs						0.17 U	0.17 U	0.17 U
Phenols in mg/kg								
2,4,6-Trichlorophenol	0.05 U	0.005 U	0.005 U	0.005 U	0.005 U			
Pentachlorophenol	0.39	0.005 U	0.005 U	0.002 J	0.001 J	0.85 U	8.2	0.85 U
Total Tetrachlorophenols	0.05 U	0.005 U	0.005 U	0.005 U	0.005 U			
TPH in mg/kg								
Diesel								
Heavy Fuel Oil								
Jet Fuel as Jet A								
Kerosene								
Lube Oil								
Mineral Spirits								
Non-PHC as Diesel								
PHC as Diesel								

Table B-1 - Chemical Results for Surface and Subsurface Soil Samples

Sheet 4 of 7

Sample ID	SB-2 S-1	SB-2 S-5/7	SB-2 S-9	SB-3 S-8	SB-3 S-11	SB-4 S-2	SB-4 S-3	SB-4 S-10
Sampling Date	10/06/99	10/06/99	10/06/99	10/05/99	10/05/99	10/07/99	10/07/99	10/07/99
Depth in Feet	2.5 to 4.0	17.5 to 22.5	27.5 to 29.0	25.0 to 26.5	32.5 to 34.0	7.5 to 9.0	12.5 to 14.0	37.5 to 39.0
Conventionals in %								
Total Organic Carbon		0.12			0.09		0.09	
Total Solids	95.9	91.3	81.4	93.4	81	95	95	83.8
PAHs in mg/kg								
Acenaphthene								
Acenaphthylene								
Anthracene								
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthene								
Benzo(g,h,i)perylene								
Benzo(k)fluoranthene								
Carbazole								
Chrysene								
Dibenz(a,h)anthracene								
Fluoranthene								
Fluorene								
Indeno(1,2,3-cd)pyrene								
Naphthalene								
Phenanthrene								
Pyrene								
Total cPAHs								
Phenols in mg/kg								
2,4,6-Trichlorophenol	0.05 U	0.005 U	0.05 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Pentachlorophenol	0.16	0.001 J	0.69	0.007	0.02	0.018	0.025	0.023
Total Tetrachlorophenols	0.05 U	0.005 U	0.05 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
TPH in mg/kg								
Diesel			25 U					25 U
Heavy Fuel Oil			100 U					100 U
Jet Fuel as Jet A			25 U					25 U
Kerosene			25 U					25 U
Lube Oil			100 U					100 U
Mineral Spirits			25 U					25 U
Non-PHC as Diesel			100 U					100 U
PHC as Diesel			100 U					100 U

Table B-1 - Chemical Results for Surface and Subsurface Soil Samples

Sample ID	SB-5 S-1	SB-5 S-4	SB-5 S-13	SB-6 S-1	SB-6 S-6	SB-6 S-10	SB-7 S-1	SB-7 S-4
Sampling Date	10/04/99	10/04/99	10/04/99	10/05/99	10/05/99	10/05/99	10/06/99	10/06/99
Depth in Feet	2.5 to 4.0	10.0 to 11.5	32.5 to 34.0	2.5 to 4.0	15 to 16.5	32.5 to 34.0	2.5 to 4.0	17.5 to 19.0
Conventionals in %								
Total Organic Carbon			0.09					
Total Solids	83.7	72.9	77	90.2	92.5	75.6	86.6	94.6
PAHs in mg/kg								
Acenaphthene					58	0.084		
Acenaphthylene					1.2	0.003 J		
Anthracene					31	0.087		
Benzo(a)anthracene					8.9	0.041		
Benzo(a)pyrene					3.7	0.017		
Benzo(b)fluoranthene					2.9	0.014		
Benzo(g,h,i)perylene					1.1	0.006		
Benzo(k)fluoranthene					4.1	0.017		
Carbazole								
Chrysene					9.1	0.043		
Dibenz(a,h)anthracene					0.6	0.005 U		
Fluoranthene					51	0.22		
Fluorene					68	0.14		
Indeno(1,2,3-cd)pyrene					1.6	0.009		
Naphthalene					68	0.009		
Phenanthrene					150	0.38		
Pyrene					39	0.15		
Total cPAHs					30.9	0.141		
Phenols in mg/kg								
2,4,6-Trichlorophenol	5 U	0.005 U	0.005 U	0.5 U	5 U	0.5 U	0.5 U	0.05 U
Pentachlorophenol	110	0.016	0.005	5.7	560	0.78	7	0.42
Total Tetrachlorophenols	10	0.005 U	0.005 U	0.5 U	35	0.5 U	0.3 J	0.05 U
TPH in mg/kg								
Diesel					17000	170		
Heavy Fuel Oil					100 U	100 U		
Jet Fuel as Jet A					25 U	25 U		
Kerosene					25 U	25 U		
Lube Oil					100 U	100 U		
Mineral Spirits					25 U	25 U		
Non-PHC as Diesel					100 U	100 U		
PHC as Diesel					100 U	100 U		

Table B-1 - Chemical Results for Surface and Subsurface Soil Samples

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Sample ID	SB-8 S-1	SB-8 S-8	SB-8 S-9	SS-1-D	SS-1-S	SS-2-D	SS-2-S	SS-3-D	SS-3-S
Sampling Date	10/06/99	10/06/99	10/06/99	10/08/99	10/01/99	10/08/99	10/01/99	10/08/99	10/01/99
Depth in Feet	2.5 to 4.0	25.0 to 26.5	27.5 to 29.0	0.6 to 1.0	0 to 0.2	0.6 to 1.0	0 to 0.2	0.6 to 1.0	0 to 0.2
Conventionals in %									
Total Organic Carbon					1.59		0.49		
Total Solids	90.1	94	84.5	94.4	95.6	94.2	96.8	92.9	90.2
PAHs in mg/kg									
Acenaphthene									
Acenaphthylene									
Anthracene									
Benzo(a)anthracene									
Benzo(a)pyrene									
Benzo(b)fluoranthene									
Benzo(g,h,i)perylene									
Benzo(k)fluoranthene									
Carbazole									
Chrysene									
Dibenz(a,h)anthracene									
Fluoranthene									
Fluorene									
Indeno(1,2,3-cd)pyrene									
Naphthalene									
Phenanthrene									
Pyrene									
Total cPAHs									
Phenols in mg/kg									
2,4,6-Trichlorophenol	0.5 U	0.005 U	0.05 U	0.05 U	0.5 U	0.5 U	0.05 U	5 U	0.5 U
Pentachlorophenol	19	0.002 J	0.19	0.15	6	3.2	0.33	16	90
Total Tetrachlorophenols	0.5 U	0.005 U	0.05 U	0.05 U	0.5 U	0.2 J	0.05 U	5 U	1.7
TPH in mg/kg									
Diesel			25 U	25 U	25 U	25 U	25 U		
Heavy Fuel Oil			100 U	100 U	100 U	100 U	100 U		
Jet Fuel as Jet A			25 U	25 U	25 U	25 U	25 U		
Kerosene			25 U	25 U	25 U	25 U	25 U		
Lube Oil			100 U	60 J	630	100 U	190		
Mineral Spirits			25 U	25 U	25 U	25 U	25 U		
Non-PHC as Diesel			100 U	100 U	100 U	100 U	100 U		
PHC as Diesel			100 U	100 U	100 U	1400	100 U		

Table B-1 - Chemical Results for Surface and Subsurface Soil Samples

Sample ID	SS-4-D	SS-4-S	SS-5-D	SS-5-S	SS-6-D	SS-6-S
Sampling Date	10/08/99	10/01/99	10/08/99	10/01/99	10/07/99	10/07/99
Depth in Feet	0.6 to 1.0	0 to 0.2	0.6 to 1.0	0 to 0.2	0.6 to 1.0	0 to 0.2
Conventionals in %						
Total Organic Carbon		1.15				
Total Solids	93.4	92.2	92.4	90.6	94.1	93.7
PAHs in mg/kg						
Acenaphthene						
Acenaphthylene						
Anthracene						
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene						
Carbazole						
Chrysene						
Dibenz(a,h)anthracene						
Fluoranthene						
Fluorene						
Indeno(1,2,3-cd)pyrene						
Naphthalene						
Phenanthrene						
Pyrene						
Total cPAHs						
Phenols in mg/kg						
2,4,6-Trichlorophenol	0.05 U	0.5 U	0.005 U	0.5 U	0.005 U	0.005 U
Pentachlorophenol	0.59	5.3	0.096	9.3	0.015	0.022
Total Tetrachlorophenols	0.05 U	0.5 U	0.01	0.5 U	0.005 U	0.005 U
TPH in mg/kg						
Diesel						
Heavy Fuel Oil						
Jet Fuel as Jet A						
Kerosene						
Lube Oil						
Mineral Spirits						
Non-PHC as Diesel						
PHC as Diesel						

Table B-2 - Chemical Results for Surface Water Samples (1998 to Present)

Sheet 1 of 7

Sample ID	Drain 13	Drain 13	Drain 13	Drain 14	Drain 14	Drain 14	Drains 13/14	Drains 13/14
Sampling Date	3/1-4/30/98	5/1-5/31/98	3/11/98	3/1-4/30/98	5/1-5/31/98	3/11/98	1/1-2/28/98	1/08/98
Conventionals								
pH	7.19	7.06	7.18	7.56	7.45	7.56	7.66	7.69
Total Suspended Solids	560	788	412	228	1400	228	544	676
PAHs in µg/L								
Acenaphthene			2 U			2 U		1 U
Acenaphthylene			30 U			15 U		1 U
Anthracene			0.2 U			0.2 U		0.1 U
Benzo(a)anthracene			0.7 U			0.2 U		0.9
Benzo(a)pyrene			1.8			0.5		1.3
Benzo(b)fluoranthene			2.5			0.9		1.4
Benzo(g,h,i)perylene			2 U			0.5 U		0.8
Benzo(k)fluoranthene			1.2			0.4		0.6
Chrysene			2.6			1 U		1.2
Dibenz(a,h)anthracene			0.6 U			0.2 U		0.2 U
Fluoranthene			11 U			5 U		5.1
Fluorene			2 U			1 U		0.2 U
Indeno(1,2,3-cd)pyrene			2 U			0.5 U		0.2 U
Naphthalene			2 U			2 U		1 U
Phenanthrene			5 U			2 U		2
Pyrene			30 U			17 U		6.8
Total PAHs	84.8 U	11.6 U		48.4 U	11.5 U		15.8	
Phenols in µg/L								
2,4,6-Trichlorophenol			5 U			5 U		0.5 U
Pentachlorophenol	435	120	410	410	220	410	135	130
Total Tetrachlorophenols			9			8		4
TPH in mg/L								
Oil and Grease	2.5	5	5 U	2.5	6	5 U	2.5	5 U

Table B-2 - Chemical Results for Surface Water Samples (1998 to Present)

Sheet 2 of 7

Sample ID	Drains 13/14	Drains 13/14	Drains 13/14	Drains 13/14	Drains 13/14	Drain 23	Drain 23
Sampling Date	11/17/98	1/21/99	3/25/99	5/20/99	10/13/99	1/1-2/28/98	3/1-4/30/98
Conventionals							
pH	7.31	7.69	7.15	6.88	7.77	7.2	7.08
Total Suspended Solids	454	1030	270	1270	256	98	564
PAHs in µg/L							
Acenaphthene	1 U	1 U	1 U	10 U	1 U		
Acenaphthylene	1 U	1 U	1 U	10 U	2 U		
Anthracene	0.1 U	0.1 U	0.1 U	1 U	0.1 U		
Benzo(a)anthracene	0.3	0.4	0.1 U	1 U	0.2		
Benzo(a)pyrene	0.6	0.7	0.3	1 U	0.3		
Benzo(b)fluoranthene	0.8	0.8	0.4	2 U	0.5		
Benzo(g,h,i)perylene	0.7	0.8	0.4	2 U	0.4		
Benzo(k)fluoranthene	0.3	0.3	0.2	1 U	0.2		
Chrysene	0.8	1.3	0.6	1 U	0.4		
Dibenz(a,h)anthracene	0.1 U	0.1 U	0.1 U	1 U	0.1		
Fluoranthene	0.3	0.2 U	3 U	2 U	0.2 U		
Fluorene	0.2 U	0.2 U	0.2 U	2 U	0.2 U		
Indeno(1,2,3-cd)pyrene	0.7	0.7	0.4	1 U	0.5		
Naphthalene	3 U	1 U	1 U	10 U	1 U		
Phenanthrene	0.6 U	0.5	0.7	1.7 U	0.3		
Pyrene	3 U	0.2 U	4 U	10 U	2 U		
Total PAHs							41.3 U
Phenols in µg/L							
2,4,6-Trichlorophenol	0.5 U	5 U	50 U	50 U	1 U		
Pentachlorophenol	180	480	180	210	130	250	400
Total Tetrachlorophenols	6.1	15	50 U	50 U	4.3		
TPH in mg/L							
Oil and Grease	5 U	5 U	5 U	5 U	6	5	5

Table B-2 - Chemical Results for Surface Water Samples (1998 to Present)

Sheet 3 of 7

Sample ID	Drain 23	Drain 23	Drain 23	Drain 23	Drain 23	Drain 23	Drain 23	Drain 23
Sampling Date	5/1-5/31/98	1/08/98	3/11/98	11/17/98	1/21/99	3/25/99	5/20/99	10/13/99
Conventionals								
pH	6.43	7.2	7.08	7.42	7.31	6.88	7.02	6.86
Total Suspended Solids	21	98	564	20	216	328	143	66
PAHs in µg/L								
Acenaphthene		1 U	1 U	1 U	1 U	1 U	1 U	1 U
Acenaphthylene		1 U	35 U	3 U	1 U	1 U	11 U	3 U
Anthracene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene		0.1 U	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene		2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysene		0.1 U	0.2 U	0.1 U	0.5 U	0.4	0.1	0.1
Dibenz(a,h)anthracene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene		0.2 U	0.4 U	0.2 U	0.2 U	5 U	0.2 U	0.2 U
Fluorene		0.2 U	0.7 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene		1 U	1 U	2 U	1 U	1 U	1 U	1 U
Phenanthrene		0.1 U	2 U	0.1 U	0.2 U	0.2	0.1 U	0.1 U
Pyrene		0.2 U	3 U	0.2 U	0.3 U	4 U	0.2 U	0.2 U
Total PAHs	3.1 U							
Phenols in µg/L								
2,4,6-Trichlorophenol		0.5 U	5 U	0.5 U	5 U	5 U	5 U	1 U
Pentachlorophenol	13	250	400	80	350	210	32	120
Total Tetrachlorophenols		8.7	12	6.6	13	10	5 U	8.3
TPH in mg/L								
Oil and Grease	ND	5	5	5 U	5 U	7	5 U	5 U

Table B-2 - Chemical Results for Surface Water Samples (1998 to Present)

Sheet 4 of 7

Sample ID	Drain 24	Drain 24	Drain 24	Drain 24	Drain 24	Drain 24	Drain 24	Drain 24
Sampling Date	1/1-2/28/98	3/1-4/30/98	5/1-5/31/98	1/08/98	3/11/98	11/17/98	1/21/99	3/25/99
Conventionals								
pH	7.3	7.05	6.84	7.3	7.05	7.62	7.25	6.82
Total Suspended Solids	282	620	71	282	620	12	84	224
PAHs in µg/L								
Acenaphthene				1 U	2 U	1 U	1 U	1 U
Acenaphthylene				1 U	2 U	4 U	1 U	1 U
Anthracene				0.1 U	0.2 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene				0.1 U	0.2 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene				0.2	0.2	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene				0.3	0.4 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene				2 U	0.4 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene				0.1	0.2	0.1 U	0.1 U	0.1 U
Chrysene				0.3	0.5 U	0.1 U	1 U	0.5
Dibenz(a,h)anthracene				0.1 U	0.2 U	0.1 U	0.1 U	0.1 U
Fluoranthene				0.4 U	0.9 U	0.2 U	0.2 U	5 U
Fluorene				0.2 U	0.7 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene				0.2	0.3 U	0.1 U	0.1 U	0.1 U
Naphthalene				1 U	2 U	1 U	1 U	1 U
Phenanthrene				0.1 U	3 U	0.1 U	0.1 U	0.6
Pyrene				0.5 U	7 U	0.4 U	0.4 U	2 U
Total PAHs	1.1	18.2 U	0.2 U					
Phenols in µg/L								
2,4,6-Trichlorophenol				5 U	5 U	0.5 U	5 U	5 U
Pentachlorophenol	550	370	15	550	370	56	440	260
Total Tetrachlorophenols				10	11	1.2	15	11
TPH in mg/L								
Oil and Grease	5	2.5	ND	5	5 U	5 U	5 U	5 U

Table B-2 - Chemical Results for Surface Water Samples (1998 to Present)

Sample ID	Drain 24	Drain 24	Drain 25	Drain 25	Drain 25	Drain 25	Drain 25	Drain 25
Sampling Date	5/20/99	10/13/99	1/1-2/28/98	3/1-4/30/98	5/1-5/31/98	1/08/98	3/11/98	11/17/98
Conventionals								
pH	6.94	6.92	7.43	7.43	7.3	7.43	7.43	8.42
Total Suspended Solids	67	5	62	676	268	62	676	128
PAHs in µg/L								
Acenaphthene	1 U	1 U				1 U	1 U	1 U
Acenaphthylene	1 U	1 U				7 U	1 U	4 U
Anthracene	0.1 U	0.1 U				0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U				0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.1 U	0.1 U				0.1 U	0.3 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U				0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U				2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U				0.1 U	0.1 U	0.1 U
Chrysene	0.1	0.1 U				0.1 U	0.4 U	0.2
Dibenz(a,h)anthracene	0.1 U	0.1 U				0.1 U	0.1 U	0.1 U
Fluoranthene	0.2 U	0.2 U				0.2 U	0.4 U	0.2 U
Fluorene	0.2 U	0.2 U				0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U				0.1 U	0.1 U	0.1 U
Naphthalene	1 U	1 U				1 U	1 U	1 U
Phenanthrene	0.1 U	0.1 U				0.1 U	0.1 U	0.1 U
Pyrene	0.2 U	0.2 U				0.2 U	3 U	0.2 U
Total PAHs				4.1 U	1.6 U			
Phenols in µg/L								
2,4,6-Trichlorophenol	0.5 U	1 U				5 U	5 U	0.5 U
Pentachlorophenol	17	3.1	180	150	120	180	150	240
Total Tetrachlorophenols	1	1 U				7	6	9.7
TPH in mg/L								
Oil and Grease	6	5	5	2.5	ND	5	5 U	5 U

Table B-2 - Chemical Results for Surface Water Samples (1998 to Present)

Sample ID	Drain 25	Drain 25	Drain 25	Drain 25	Drains 10-22	Drains 10-22	Drains 10-22
Sampling Date	1/21/99	3/25/99	5/20/99	10/13/99	1/08/98	3/11/98	11/17/98
Conventionals							
pH	7.69	8.34	7.26	7.74	7.61	7.29	8.22
Total Suspended Solids	372	2100	314	587	6700	1370	422
PAHs in µg/L							
Acenaphthene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Acenaphthylene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U	0.2 U	0.2 U	2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysene	0.1 U	0.8	0.1 U	0.2	0.1	0.1 U	0.1
Dibenz(a,h)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene	0.4 U	0.5 U	0.2 U	0.2 U	0.3 U	0.4 U	0.2 U
Fluorene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Phenanthrene	0.1	0.1 U	0.1 U	0.1 U	0.2	0.2 U	0.1 U
Pyrene	0.2 U	0.7 U	0.2 U	0.2 U	1 U	0.2 U	0.4 U
Total PAHs							
Phenols in µg/L							
2,4,6-Trichlorophenol	1 U	5 U	0.5 U	1 U	0.5 U	1 U	0.5 U
Pentachlorophenol	220	30	1.8	56	27.7	19	68
Total Tetrachlorophenols	8	5 U	0.5 U	2.8	1.9	2	2
TPH in mg/L							
Oil and Grease	5 U	5 U	6	5 U	13	5	5 U

Table B-2 - Chemical Results for Surface Water Samples (1998 to Present)

Sample ID	Drains 10-22	Drains 10-22	Drains 10-22
Sampling Date	12/17/98	3/25/99	10/13/99
Conventionals			
pH	7.36	7.38	7.33
Total Suspended Solids	486	462	338
PAHs in µg/L			
Acenaphthene	1 U	1 U	1 U
Acenaphthylene	1 U	1 U	1 U
Anthracene	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.2 U	0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U	0.1 U
Chrysene	0.1 U	0.1	0.1 U
Dibenz(a,h)anthracene	0.1 U	0.1 U	0.1 U
Fluoranthene	0.2 U	3 U	0.2 U
Fluorene	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	0.1 U
Naphthalene	1 U	1 U	1 U
Phenanthrene	0.1 U	0.2	0.1 U
Pyrene	0.2 U	3 U	0.2 U
Total PAHs			
Phenols in µg/L			
2,4,6-Trichlorophenol	1 U	5 U	1 U
Pentachlorophenol	16.3	41	35
Total Tetrachlorophenols	1 U	5 U	1 U
TPH in mg/L			
Oil and Grease	5 U	5 U	7

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sheet 1 of 22

Sample ID	SB-2-GW	SB-3-GW	SB-4 GW	SB-5-GW	SB-8-GW
Sampling Date	10/06/99	10/05/99	10/06/99	10/01/99	10/06/99
Conventionals in mg/L					
Total Suspended Solids (TSS)	31400	19700	1290	19600	10500
TSS Supernatant	35		8		45
Phenols in µg/L					
2,4,6-Trichlorophenol	0.5 U	0.5 U	0.5 U	5 U	0.5 U
Pentachlorophenol	0.6	21	1.2	47	4.8
Total Tetrachlorophenols	0.5 U	1.3	0.5 U	5 U	0.1 J
TPH in µg/L					
Diesel	250 U		250 U		250 U
Gasoline	250 U		250 U		250 U
Heavy Fuel Oil	500 U		500 U		500 U
Jet Fuel as Jet A	250 U		250 U		250 U
Kerosene	250 U		250 U		250 U
Lube Oil	500 U		500 U		500 U
Mineral Spirits	250 U		250 U		250 U
PHC as Diesel	500 U		500 U		500 U
Non-PHC as Diesel	70 J		89 J		80 J
PHC as Gasoline	250 U		250 U		250 U
Non-PHC as Gasoline	250 U		250 U		250 U
Volatiles in µg/L					
Benzene	0.5 U		0.5 U		0.5 U
Ethylbenzene	1 U		1 U		1 U
Toluene	1 U		1 U		1 U
Total Xylenes	1 U		1 U		1 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sheet 2 of 22

Sample ID	HCMW-5	HCMW-5	HCMW-6	HCMW-6	HCMW-7	HCMW-7	BT-S-GW	BT-W-GW
Sampling Date	10/22/99	1/11/00	10/22/99	1/11/00	10/22/99	1/11/00	10/08/99	10/07/99
Conventionals in mg/L								
Total Suspended Solids (TSS)	60	996	31	960	185	2330	22700	8650
TSS Supernatant							145	124
Phenols in µg/L								
2,4,6-Trichlorophenol	0.5 U		0.5 U		0.5 U			
Pentachlorophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	58000	22000
Total Tetrachlorophenols	0.5 U		0.5 U		0.5 U		2600	650
TPH in µg/L								
Diesel	250 U						590000	1500000 J
Gasoline	250 U						500 U	500 UJ
Heavy Fuel Oil	500 U						500 U	500 UJ
Jet Fuel as Jet A	250 U						250 U	250 UJ
Kerosene	250 U						250 U	250 UJ
Lube Oil	500 U						500 U	500 UJ
Mineral Spirits	250 U						250 U	250 UJ
PHC as Diesel	500 U						500 U	500 UJ
Non-PHC as Diesel	500 U						500 U	500 UJ
PHC as Gasoline	250 U						710	1000 J
Non-PHC as Gasoline	250 U						500 U	500 UJ
Volatiles in µg/L								
Benzene	0.5 U						5 U	5 U
Ethylbenzene	1 U						10 U	10 U
Toluene	1 U						10 U	10 U
Total Xylenes	1 U						10 U	10 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sheet 3 of 22

Sample ID	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1
Sampling Date	1/15/98	4/15/98	7/16/98	10/06/98	1/12/99	4/13/99	7/21/99	10/04/99	1/13/00
Field Data									
Conductivity	378	385	425	447	427	399	409	424	
Dissolved Oxygen	1.6	1.2	0.6	0.0	0.0	0.0	3.1	3.6	
pH	7.08	7.14	7.32	8.24	7.37	6.75	7.54	8.17	
Temperature	10.1	15.8	15.2	13.7	10.7	14.4	13.4	15	
Conventionals in mg/L									
Ammonia as Nitrogen					0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Bicarb. Alkalinity as CaCO3	184	181	204	222	201	198	218	231	200
Chemical Oxygen Demand	7	14			19	17	22	28	17
Calcium	39.7	40.6	42.4	46	43.3	40.9	41.4	45.2	34200
Chloride	11.4	11.8	10.8	12.2	11.5	12	9.9	9	8.8
Conductivity	319	397			407	397	434	420	371
Nitrate+Nitrite as Nitrogen	0.4	0.3			0.4	0.7	0.2	0.2 U	0.6
pH	5.96	6.3			6.4	6.26	6.16	6.24	6.17
Sulfate	11	10.1	8.8	9.4	9.6	8.3	7.5	7.2	8.1
Total Dissolved Solids	238	230			267	398	274	284	250
Total Organic Carbon	6.6	6.4	7	7.5	6.9	6.8	7.1	7.7	6.4
Tannin-Lignin	0.2 U	0.2 U			1	1	0.6	0.7	0.2
Total Alkalinity as CaCO3	184	181	204	222	201	198	218	231	200
Total Coliforms in MPN/100ml	2 U	2 U		2 U	7	2	4	2 U	2 U
Total Suspended Solids								122	4 U
Dissolved Metals in µg/L									
Arsenic	5 U	5 U			5 U	5 U	5 U	5 U	5 U
Barium	26	26			28	23	25	35	23
Cadmium	4 U	4 U			4 U	4 U	4 U	4 U	4 U
Copper	10 U	10 U			10 U	10 U	10 U	10 U	10 U
Iron	51	20 U	24	108	49	20 U	20 U	27	20 U
Magnesium	24400		27100	29400	26800	25000	26700	29800	21000
Manganese	141	143	164	172	219	164	210	234	172
Nickel	20 U	20 U			22	20 U	20	25	20 U
Potassium	2170		2300	2300	3000	2000 U	2000 U	2000 U	3800
Sodium	9410		9070	9140	10700	9370	10700	11700	9150

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1	BXS-1
Sampling Date	1/15/98	4/15/98	7/16/98	10/06/98	1/12/99	4/13/99	7/21/99	10/04/99	1/13/00
Zinc	14	10			16	20	10 U	10 U	10 U
Phenols in µg/L									
2,4,6-Trichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Nitrophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Nitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Pentachlorophenol	34	17	9.8	27	39	36	21	23	35
Phenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PAHs in µg/L									
Acenaphthene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Acenaphthylene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dibenz(a,h)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Fluorene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Phenanthrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Pyrene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2
Sampling Date	1/15/98	4/16/98	7/16/98	10/06/98	1/12/99	4/13/99	7/21/99	10/05/99	1/11/00
Field Data									
Conductivity	733	716	735	747	769	762	834	793	
Dissolved Oxygen	1.5	1.2	0.9	1.0	0.0	0.0	3.2	2.3	
pH	6.97	7	7.26	8.22	7.87	6.75	7.61	8.06	
Temperature	13.1	14.5	17.5	15.2	11.9	15.1	18.4	13.7	
Conventionals in mg/L									
Ammonia as Nitrogen					0.05 U	0.05 U	0.1 U	0.05 U	
Bicarb. Alkalinity as CaCO3	402	406	418	416	436	440	478	479	
Chemical Oxygen Demand	33	51			44	44	50	53	
Calcium	68.3	70.5	71.6	73.2	79.4	79.6	77.2	77.7	72700
Chloride	11.8	13.4	10.7	11.2	8.8	26.4	9.9	7.4	
Conductivity	554	770			727	811	804	803	
Nitrate+Nitrite as Nitrogen	0.2 U	0.2 U			0.2 U	0.2 U	0.2 U	0.2 U	
pH	6.21	6.84			6.43	6.29	6.46	6.42	
Sulfate	0.5	0.4	0.3	0.3	0.4	0.4	0.2 U	0.2	
Total Dissolved Solids	470	442			489	545	524	520	
Total Organic Carbon	15.3	15.4	16.5	16.4	15.6	17.7	15.3	15.1	
Tannin-Lignin	0.9	0.8			1.8	1.9	1.2	21.7	
Total Alkalinity as CaCO3	402	406	418	416	436	440	478	479	
Total Coliforms in MPN/100ml	2	2 U			8	2 U	900	50	8
Total Suspended Solids								338	
Dissolved Metals in µg/L									
Arsenic	5 U	5 U			5 U	5 U	5 U	5 U	5 U
Barium	50	53			53	51	46	56	49
Cadmium	4 U	4 U			4 U	4 U	4 U	4 U	4 U
Copper	10 U	10 U			10 U	10 U	10 U	10 U	10 U
Iron	1520	851	1220	1290	1160	1110	862	1120	703
Magnesium	52200	53700	55700	56800	61400	60900	60800	63200	55000
Manganese	1700	1640	1610	1630	1710	1610	1380	1440	1250
Nickel	39	44			55	31	41	38	34
Potassium	3460	3150	3100	3700	4000	3480	2960	2500	5000
Sodium	11600	12100	11500	11700	12300	12100	10800	11400	9240

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2	BXS-2
Sampling Date	1/15/98	4/16/98	7/16/98	10/06/98	1/12/99	4/13/99	7/21/99	10/05/99	1/11/00
Zinc	10 U	10 U			10 U	11	10 U	10 U	10 U
Phenols in µg/L									
2,4,6-Trichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Nitrophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Nitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Pentachlorophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U
Phenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PAHs in µg/L									
Acenaphthene	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U
Acenaphthylene	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U
Anthracene	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.1 U	0.1 U	1 U	0.1 U	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U	2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U	2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysene	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dibenz(a,h)anthracene	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene	0.2 U	0.2 U	2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Fluorene	0.2 U	0.2 U	2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene	1 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U
Phenanthrene	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Pyrene	0.2 U	0.2 U	2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3
Sampling Date	1/15/98	4/16/98	7/16/98	10/06/98	1/12/99	4/13/99	7/21/99	10/05/99	1/11/00
Field Data									
Conductivity	910	869	821	810	864	803	801	774	
Dissolved Oxygen	1.7	1.2	1.7	1.4	0.0	0.0	3.6	3.7	
pH	7.1	6.87	7.17	8.38	7.94	6.78	7.63	8.18	
Temperature	12.7	14.6	16.6	16.2	12.6	18.5	18.2	14.8	
Conventionals in mg/L									
Ammonia as Nitrogen					0.32	0.21	0.09	0.15	
Bicarb. Alkalinity as CaCO3	490	474	470	459	457	444	470	456	
Chemical Oxygen Demand	81	94			97	77	93	93	
Calcium	95.6	96.4	100	94.2	96.1	97.2	92.8	89.4	78000
Chloride	5.4	6.5	6.2	6.6	5.8	6.4	5.7	4.2	
Conductivity	638	882			733	818	783	794	
Nitrate+Nitrite as Nitrogen	0.2 U	0.2 U			0.2 U	0.2 U	0.2 U	0.2 U	
pH	6.37	6.47			6.51	6.36	6.44	6.47	
Sulfate	0.8	0.4	0.2 U	0.2 U	0.2 U	0.4	0.2 U	0.2	
Total Dissolved Solids	622	602			522	491	573	539	
Total Organic Carbon	34.3	33.3	33.3	31.8	29.9	31.7	31	31.3	
Tannin-Lignin	6.2	11.4			7.3	8.1	7.5	10.6	
Total Alkalinity as CaCO3	490	474	470	459	457	444	470	456	
Total Coliforms in MPN/100ml	4	2			2	2 U	2	22	2 U
Total Suspended Solids								296	
Dissolved Metals in µg/L									
Arsenic	17				23	33	24	26	52
Barium	54				81	55	50	64	61
Cadmium	4 U				4 U	4 U	4 U	4 U	4 U
Copper	10 U				10 U	10 U	50 U	10 U	10 U
Iron	18800	23000	16300	12200	31200	35000	23200	26200	53700
Magnesium	53700	52200	55500	51200	51200	47600	47500	45500	32400
Manganese	12700	14000	14200	13200	13900	15800	14600	15200	13500
Nickel	20 U				28	29	20 U	27	22
Potassium	4710	4780	4500	5400	7100	4260	4180	2900	8500
Sodium	4660	5000	5070	4690	5120	5390	4990	5140	4230

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3	BXS-3
Sampling Date	1/15/98	4/16/98	7/16/98	10/06/98	1/12/99	4/13/99	7/21/99	10/05/99	1/11/00
Zinc	10 U				10 U	10 U	11	10 U	10 U
Phenols in µg/L									
2,4,6-Trichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Nitrophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Nitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Pentachlorophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Phenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PAHs in µg/L									
Acenaphthene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Acenaphthylene	2 U	1 U	1 U	1 U	1	1 U	1 U	1 U	
Anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Benzo(a)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Benzo(a)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	0.1 U	0.1 U	0.1 U	
Benzo(b)fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
Benzo(g,h,i)perylene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
Benzo(k)fluoranthene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Chrysene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Dibenz(a,h)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
Fluorene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Phenanthrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Pyrene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4
Sampling Date	1/14/98	4/16/98	7/16/98	10/06/98	1/12/99	4/13/99	7/21/99	10/05/99	1/11/00
Field Data									
Conductivity			190	181.2	188.4	185	181.6	186	
Dissolved Oxygen	1.6		0.9	0.0	0.0	0.0	3.1	4.8	
pH	7.69		7.42	8.3	8.23	6.95	7.74	8.48	
Temperature	9.3		13.6	13.1	8.9	10.7	12.7	10.6	
Conventionals in mg/L									
Ammonia as Nitrogen					0.49	0.55	0.49	0.51	
Bicarb. Alkalinity as CaCO3	95	92	93	95	97	96	96	100	
Chemical Oxygen Demand	32	5 U			7	6	58	88	
Calcium	19.3	18.8	18.6	18.5		19.2	17.7	18.3	16800
Chloride	2.1	2.2	2.1	2.1	2.1	2.1	2.2	2.3	
Conductivity	148	193			176	182	184	178	
Nitrate+Nitrite as Nitrogen	0.2 U	0.2 U			0.2 U	0.2 U	0.2 U	0.2 U	
pH	8.04	8.21			8.02	7.96	7.87	7.91	
Sulfate	1.5	1.3	1.6	1	1.2	1.7	1.2	1.6	
Total Dissolved Solids	186	131			133	160	151	168	
Total Organic Carbon	7.8	33.3	7.1	1.6	1.2	4.3	2.7	7.5	
Tannin-Lignin	30.4	0.2 U			0.7	0.5	0.5	0.6	
Total Alkalinity as CaCO3	95	92	93	95	97	96	96	100	
Total Coliforms in MPN/100ml	2 U	2 U			2 U	2 U	2 U	2	4
Total Suspended Solids								1440	
Dissolved Metals in µg/L									
Arsenic	5	5				6	5	6	6
Barium	26	27				27	21	31	30
Cadmium	4 U	4 U				4 U	4 U	4 U	4 U
Copper	10 U	10 U				27	10 U	10 U	10 U
Iron	41	63	47	45		40	27	41	20 U
Magnesium	8040	7780	7780	7780		8000	7380	7750	6960
Manganese	127	124	128	118		125	109	122	106
Nickel	20 U	20 U				20 U	20 U	20 U	20 U
Potassium	3100	2800	2500	2800		2000 U	2000 U	2050	4400
Sodium	7340	7170	6760	6930		7140	6540	7210	6050

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4	BXS-4
Sampling Date	1/14/98	4/16/98	7/16/98	10/06/98	1/12/99	4/13/99	7/21/99	10/05/99	1/11/00
Zinc	24	10 U				24	10 U	10 U	10 U
Phenols in µg/L									
2,4,6-Trichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Nitrophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Nitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Pentachlorophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Phenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PAHs in µg/L									
Acenaphthene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Acenaphthylene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene	0.5	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.8	0.7
Benzo(g,h,i)perylene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dibenz(a,h)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Fluorene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Phenanthrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1	0.1 U	0.1 U
Pyrene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sheet 11 of 22

Sample ID	MW-1	MW-1	MW-1	MW-1	MW-1	MW-1	MW-1
Sampling Date	1/14/98	4/15/98	7/15/98	10/06/98	1/12/99	1/21/99	4/13/99
Field Data							
Conductivity	138.9	130.8	147	190	140.3		143.1
Dissolved Oxygen	3	1.4	1.4	3.2	0.0		0.0
pH	7.27	7.04	6.4	7.77	7.98		6.76
Temperature	11.7	12.9	13.6	11.2	11.9		11.3
Conventionals in mg/L							
Bicarb. Alkalinity as CaCO3	44	43	51	75	39		40
Calcium	11.6	11.4	12.2	15.8	11.6		11.3
Chloride	4.7	3.7	3.4	3.3	4.5		4.6
Sulfate			12.1				13.7
Sulfide	11.5	11.5		11.8	14.3		
Total Organic Carbon	3.8	2.2	1.8	2.5	0.8		1.7
Total Alkalinity as CaCO3	44	43	51	75	39		40
Total Coliforms					7		
Total Suspended Solids							
Dissolved Metals in µg/L							
Iron	735	20 U	20 U	20	20 U		20 U
Magnesium	6930	6730	7510	9890	6800		6930
Manganese	20	5 U	5 U	5 U	5 U		5 U
Potassium	2000 U	2000 U	2000 U	2000 U	2000 U		2000 U
Sodium	5100	4320	4640	5540	4460		3960
Phenols in µg/L							
2,4,6-Trichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U
2-Chlorophenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
2-Nitrophenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
4-Nitrophenol	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U
Pentachlorophenol	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-1	MW-1	MW-1	MW-1	MW-1	MW-1	MW-1
Sampling Date	1/14/98	4/15/98	7/15/98	10/06/98	1/12/99	1/21/99	4/13/99
Phenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
PAHs in µg/L							
Acenaphthene	1 U	1 U	1 U	1 U		1 U	1 U
Acenaphthylene	1 U	1 U	1 U	1 U		1 U	1 U
Anthracene	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U
Benzo(a)pyrene	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U
Chrysene	0.1 U	0.1 U	0.1 U	0.1 U		1 U	0.1 U
Dibenz(a,h)anthracene	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U
Fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Fluorene	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U
Naphthalene	1 U	1 U	1 U	1 U		1 U	1 U
Phenanthrene	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U
Pyrene	0.2 U	0.2 U	0.2 U	0.2 U		0.4 U	0.2 U
TPH in µg/L							
Diesel							
Heavy Fuel Oil							
Jet Fuel as Jet A							
Kerosene							
Lube Oil							
Mineral Spirits							
Non-PHC as Diesel							
PHC as Diesel							

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-1	MW-1	MW-1	MW-1	MW-2	MW-2	MW-2
Sampling Date	7/21/99	10/04/99	10/25/99	1/11/00	1/14/98	4/15/98	7/15/98
Field Data							
Conductivity	136	146.4			160.3	147.5	157.7
Dissolved Oxygen	7.2	7.4			1.6	1.5	1.3
pH	7.34	8.28			7.23	6.87	7.27
Temperature	11.8	8.7			9.6	11.5	14.1
Conventionals in mg/L							
Bicarb. Alkalinity as CaCO3	52	61		47	31	35	39
Calcium	13	12.4		10600	11.9	11.2	12
Chloride	3.6	3.1		3.9	9.7	5.4	8.6
Sulfate				12.6			15.3
Sulfide	10.7	10.2			15.5	17.7	
Total Organic Carbon	1.8	2.6		3.9	5.6	3	2.3
Total Alkalinity as CaCO3	52	61		47	31	35	39
Total Coliforms							
Total Suspended Solids		331		304			
Dissolved Metals in µg/L							
Iron	20 U	20 U		20 U	187	20 U	20 U
Magnesium	7520	7780		5880	7400	6870	7540
Manganese	5 U	5 U		5 U	5 U	5 U	5 U
Potassium	2000 U	2000 U		2500	2000 U	2000 U	2000 U
Sodium	100	4590		4290	5390	4830	4610
Phenols in µg/L							
2,4,6-Trichlorophenol	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorophenol	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
2-Nitrophenol	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
4-Nitrophenol	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U
Pentachlorophenol	0.5 U	0.5 U		0.5 U	2.5	0.7	1

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-1	MW-1	MW-1	MW-1	MW-2	MW-2	MW-2
Sampling Date	7/21/99	10/04/99	10/25/99	1/11/00	1/14/98	4/15/98	7/15/98
Phenol	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
PAHs in µg/L							
Acenaphthene	1 U	1 U		1 U	1 U	1 U	1 U
Acenaphthylene	1 U	1 U		1 U	1 U	1 U	1 U
Anthracene	0.1 U	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.1 U	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
Chrysene	0.1 U	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
Dibenz(a,h)anthracene	0.1 U	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
Fluorene	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene	1 U	1 U		1 U	1 U	1 U	1 U
Phenanthrene	0.1 U	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
Pyrene	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U
TPH in µg/L							
Diesel			250 U				
Heavy Fuel Oil			500 U				
Jet Fuel as Jet A			250 U				
Kerosene			250 U				
Lube Oil			500 U				
Mineral Spirits			250 U				
Non-PHC as Diesel			500 U				
PHC as Diesel			500 U				

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2
Sampling Date	10/06/98	1/12/99	1/21/99	4/13/99	7/21/99	10/04/99	1/13/00
Field Data							
Conductivity	161.3	157.4		153.4	182	169.2	
Dissolved Oxygen	3.2	2.4		1.4	7.9	7.2	
pH	8.15	7.28		6.81	7.44	8.06	
Temperature	12.9	10.4		10.7	12.6	10.8	
Conventionals in mg/L							
Bicarb. Alkalinity as CaCO3	39	42		46	43	42	43
Calcium	11.7	12.3		11.7	14.7	13	12300
Chloride	11.8	5.4		5.9	9.8	13.4	7.8
Sulfate				17.3			17
Sulfide	10.3	17.3			21.1	16.6	
Total Organic Carbon	2.6	1.1		0.9	1.9	4	0.7
Total Alkalinity as CaCO3	39	42		46	43	42	43
Total Coliforms		2 U					
Total Suspended Solids						504	4 U
Dissolved Metals in µg/L							
Iron	76	24		20 U	20 U	20 U	20 U
Magnesium	7160	7710		7590	8900	8060	7700
Manganese	5 U	5 U		5 U	5 U	5 U	5 U
Potassium	2000 U	2000 U		2100	2000 U	2000 U	2700
Sodium	5400	5840		4840	5680	6380	5920
Phenols in µg/L							
2,4,6-Trichlorophenol	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorophenol	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Nitrophenol	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Nitrophenol	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Pentachlorophenol	4.6		3.6	0.9	1.4	2.1	0.5 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2
Sampling Date	10/06/98	1/12/99	1/21/99	4/13/99	7/21/99	10/04/99	1/13/00
Phenol	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PAHs in µg/L							
Acenaphthene	1 U		1 U	1 U	1 U	1 U	1 U
Acenaphthylene	1 U		1 U	1 U	1 U	1 U	1 U
Anthracene	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysene	0.1 U		1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dibenz(a,h)anthracene	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Fluorene	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene	1 U		1 U	1 U	1 U	1 U	1 U
Phenanthrene	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Pyrene	0.2 U		0.4 U	0.2 U	0.2 U	0.2 U	0.2 U
TPH in µg/L							
Diesel							250 U
Heavy Fuel Oil							500 U
Jet Fuel as Jet A							250 U
Kerosene							250 U
Lube Oil							500 U
Mineral Spirits							250 U
Non-PHC as Diesel							500 U
PHC as Diesel							500 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3
Sampling Date	1/14/98	4/15/98	7/15/98	10/06/98	1/12/99	1/21/99	4/13/99
Field Data							
Conductivity		157.3	168.3	132.5	132.7		192.7
Dissolved Oxygen	2	1.2	0.9	0.6	0.0		0.1
pH	7.21	7.06	6.35	8.21	7.6		6.73
Temperature	9.8	13	14.2	13.7	10		13
Conventionals in mg/L							
Bicarb. Alkalinity as CaCO3	38	52	57	42	40		66
Calcium	9.64	13.1	13.8	9.63	10.5		
Chloride	5	5.5	4.8	5.8	6		9.5
Sulfate			14.2				15
Sulfide	12.8	12.5		12.9	13.6		
Total Organic Carbon	1.7	3.1	3	1.4	1.8		2.1
Total Alkalinity as CaCO3	38	52	57	42	40		66
Total Coliforms					2 U		
Total Suspended Solids							
Dissolved Metals in µg/L							
Iron	20 U	59	20 U	59	84		
Magnesium	6130	8160	8750	6470	7000		
Manganese	33	14	15	248	191		
Potassium	2000 U	2000 U	2000 U	2000 U	2000 U		
Sodium	4700	5460	5220	5330	5480		
Phenols in µg/L							
2,4,6-Trichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U
2-Chlorophenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
2-Nitrophenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
4-Nitrophenol	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U
Pentachlorophenol	220	27	510	570		360	3.9

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3
Sampling Date	1/14/98	4/15/98	7/15/98	10/06/98	1/12/99	1/21/99	4/13/99
Phenol	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
PAHs in µg/L							
Acenaphthene	1 U	1 U	10 U	1 U		1 U	1 U
Acenaphthylene	1 U	1 U	10 U	1 U		1 U	1 U
Anthracene	0.1 U	0.1 U	1 U	0.1 U		0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U	1 U	0.1 U		0.1 U	0.1 U
Benzo(a)pyrene	0.1 U	0.1 U	1 U	0.1 U		0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U	2 U	0.2 U		0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U	2 U	0.2 U		0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U	1 U	0.1 U		0.1 U	0.1 U
Chrysene	0.1 U	0.1 U	1 U	0.1 U		1 U	0.1 U
Dibenz(a,h)anthracene	0.1 U	0.1 U	1 U	0.1 U		0.1 U	0.1 U
Fluoranthene	0.2 U	0.2 U	2 U	0.2 U		0.2 U	0.2 U
Fluorene	0.2 U	0.2 U	2 U	0.2		0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	1 U	0.1 U		0.1 U	0.1 U
Naphthalene	1 U	1 U	10 U	1.7		1 U	1 U
Phenanthrene	0.1 U	0.1 U	1 U	0.1 U		0.1 U	0.1 U
Pyrene	0.2 U	0.2 U	2 U	0.2 U		0.4 U	0.2 U
TPH in µg/L							
Diesel							
Heavy Fuel Oil							
Jet Fuel as Jet A							
Kerosene							
Lube Oil							
Mineral Spirits							
Non-PHC as Diesel							
PHC as Diesel							

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-3	MW-3	MW-3	MW-4	MW-4	MW-4	MW-4
Sampling Date	7/21/99	10/05/99	1/13/00	1/15/98	4/15/98	7/15/98	10/06/98
Field Data							
Conductivity	179.4	160.8		189.1	188.1	183.5	188.6
Dissolved Oxygen	4.2	3.4		1.4	0.8	0.6	0.0
pH	7.38	8.08		7.78	6.73	7.4	8.36
Temperature	13.1	12.3		9.2	9.1	13.1	12.9
Conventionals in mg/L							
Bicarb. Alkalinity as CaCO3	61	48	53	92	92	32	94
Calcium	16	12.7	15300	17.1	17.2	16.6	16.8
Chloride	6.1	5.1	10.6	2.4	2.3	2.3	2.5
Sulfate			15.9	0.9		0.8	
Sulfide	15.5	17.1			1		0.8
Total Organic Carbon	2.1	0.7	1.5	2.6	3.5	1.4	1.9
Total Alkalinity as CaCO3	61	48	53	92	92	32	94
Total Coliforms							
Total Suspended Solids		4 U	4 U				
Dissolved Metals in µg/L							
Iron	20 U	20 U	20 U	297	214	211	262
Magnesium	9900	8310	9620	8630	8750	8630	8600
Manganese	17	76	12	134	136	130	132
Potassium	2000 U	2000 U	3200	3200	2800	2780	2040
Sodium	5580	5670	5360	6410	6560	6280	6490
Phenols in µg/L							
2,4,6-Trichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dichlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dimethylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dinitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Nitrophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4,6-Dinitro-2-methylphenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-Chloro-3-methylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Nitrophenol	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Pentachlorophenol	300	870	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-3	MW-3	MW-3	MW-4	MW-4	MW-4	MW-4
Sampling Date	7/21/99	10/05/99	1/13/00	1/15/98	4/15/98	7/15/98	10/06/98
Phenol	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PAHs in µg/L							
Acenaphthene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Acenaphthylene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dibenz(a,h)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Fluorene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Phenanthrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Pyrene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
TPH in µg/L							
Diesel			250 U				
Heavy Fuel Oil			500 U				
Jet Fuel as Jet A			250 U				
Kerosene			250 U				
Lube Oil			500 U				
Mineral Spirits			250 U				
Non-PHC as Diesel			500 U				
PHC as Diesel			500 U				

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-4	MW-4	MW-4	MW-4	MW-4	MW-4
Sampling Date	1/12/99	1/21/99	4/13/99	7/21/99	10/05/99	1/11/00
Field Data						
Conductivity	181.9		182.8	181	182.6	
Dissolved Oxygen	0.0		0.0	3.4	3.8	
pH	8.03		6.87	7.46	8.31	
Temperature	9		8.8	11.8	10.2	
Conventionals in mg/L						
Bicarb. Alkalinity as CaCO3	90		90	96	97	118
Calcium	18		16.7	17.4	16.6	16500
Chloride	2.3		2.5	2.4	2.2	2.3
Sulfate			0.9			0.8
Sulfide	0.8			0.8	0.8	
Total Organic Carbon	0.6		1.2	0.7	1.8	0.7
Total Alkalinity as CaCO3	90		90	96	97	118
Total Coliforms	2 U					
Total Suspended Solids						168
Dissolved Metals in µg/L						
Iron	267		230	270	258	270
Magnesium	9160		8900	8740	8620	8350
Manganese	139		134	132	130	124
Potassium	3000		3700	3200	2300	4100
Sodium	6770		6120	6410	6730	6140
Phenols in µg/L						
2,4,6-Trichlorophenol		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dichlorophenol		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dimethylphenol		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-Dinitrophenol		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorophenol		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Nitrophenol		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4,6-Dinitro-2-methylphenol		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-Chloro-3-methylphenol		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Nitrophenol		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Pentachlorophenol		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table B-3 - Chemical Results for Groundwater Samples (1998 to Present)

Sample ID	MW-4	MW-4	MW-4	MW-4	MW-4	MW-4
Sampling Date	1/12/99	1/21/99	4/13/99	7/21/99	10/05/99	1/11/00
Phenol		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PAHs in µg/L						
Acenaphthene		1 U	1 U	1 U	1 U	1 U
Acenaphthylene		1 U	1 U	1 U	1 U	1 U
Anthracene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)anthracene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(a)pyrene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo(b)fluoranthene		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chrysene		1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dibenz(a,h)anthracene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Fluoranthene		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Fluorene		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene		1 U	1 U	1 U	1 U	1 U
Phenanthrene		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Pyrene		0.4 U	0.2 U	0.2 U	0.2 U	0.2 U
TPH in µg/L						
Diesel						
Heavy Fuel Oil						
Jet Fuel as Jet A						
Kerosene						
Lube Oil						
Mineral Spirits						
Non-PHC as Diesel						
PHC as Diesel						

Table B-4 - Dioxin Results for Surface and Subsurface Soil Samples

Sample ID	SS-1-S	SS-2-S	SS-3-S	SS-4-S	SS-5-S	SB-6-S-6	SB-6-S-10
Sampling Date	10/1/99	10/1/99	10/1/99	10/1/99	10/1/99	10/5/99	10/5/99
Depth in Feet	0 to 0.2	0 to 0.2	0 to 0.2	0 to 0.2	0 to 0.2	15.0 to 16.5	32.5 to 34.0
Dioxins in ng/kg							
2378-TCDD	80.664 U	18.88 U	101.885 U	31.321	41.83 U	1295.2 U	145.75 U
12378-PeCDD	561.977	217.555	782.204	818.386	373.67	2492.6 U	276.13 U
123478-HxCDD	1978.7	572.056	2462.61	2091.99	1616.62	2084.4 U	231.63 U
123678-HxCDD	6756.32	1114.27	6432.28	5502.58	4655.19	2525.13	155.95 U
123789-HxCDD	4290.94	1186.85	4966.08	4308.15	3160.4	1608.7 U	178.77 U
1234678-HpCDD	170848	25033	182351	123079	130648	247615	3762.4
OCDD	1790474	224974	2061571	1187669	1485435	3234410	36607
2378-TCDF	53.447 U	15.745 U	104.937 U	36.688 U	44.848 U	1976.8 U	24.946 U
12378-PeCDF	175.286 U	49.34 U	221.371	88.42 U	41.28 U	1902.3 U	25.452 U
23478-PeCDF	177.224 U	49.885 U	70.416 U	89.397 U	41.736 U	1923.3 U	25.733 U
123478-HxCDF	16510.3	1822.73	18169	10854.8	17151.4	5832.58	101.4 U
123678-HxCDF	1860.8 U	216.711 U	2328.7 U	1100.1 U	1343.9 U	1609.3 U	76.049 U
123789-HxCDF	2945.8 U	343.064 U	3686.5 U	1740.5 U	2127.4 U	2547.6 U	120.39 U
234678-HxCDF	2175.7 U	253.388 U	2722.8 U	1286.3 U	1571.3 U	1881.6 U	88.919 U
1234678-HpCDF	28856	6772.99	35205.1	18584	20112.2	30131.9	330.05
1234789-HpCDF	2250.64	442.667 U	2850.07	1399.75	3092.7 U	951.09 U	95.538 U
OCDF	198590	39257	376802	132389	181537	244297	1470.6
TCDDs (Total)	80.664 U	18.88 U	101.885 U	31.321 U	41.83 U	1295.2 U	145.75 U
PeCDDs (Total)	377.461	359.029	1301.88	1710.32	373.67	2492.6 U	276.13 U
HxCDDs (Total)	32276.6	7181.28	30793	27009.9	21675.5	1403.4 U	155.95 U
HpCDDs (Total)	278369	42644.2	284579	191922	210510	483210	6646.4
TCDFs (Total)	161.032	15.745 U	104.937 U	117.771	51.319	1976.8 U	24.946 U
PeCDFs (Total)	3661.08	1513.04	4190.27	3988.87	2429.28	1923.3 U	25.733 U
HxCDFs (Total)	28013	6858.55	26188.3	18395.3	16099.5	4795.49	71.695
HpCDFs (Total)	31106.7	6772.99	38055.2	19983.8	20112.2	30131.9	67.837 U
TEF Equivalent	7243	1161	8248	5436	6020	7092	79

Table B-5 - Dioxin Results for Surface Water and Groundwater Samples

Sheet 1 of 3

Sample ID	Drains 13/14	13/14-Diss.	13/14-Diss.	13/14-Total	Drains 13/14	Drain 23	Drain 24
Sampling Date	1/08/98	6/24/98	6/24/98 Duplicate	6/24/98	11/18/98	1/08/98	1/08/98
Dioxins in pg/L							
2378-TCDD	2.4 U	7.1 J	3.7 U	110	2.4 U	2.4 U	29.6
12378-PeCDD	1011.3	70	18 U	1800	1376.9	273	681.7
123478-HxCDD	3822.1	200	18 U	4700	4615.3	2773.7	3133.6
123678-HxCDD	11648.5	450	41 J	11000	5717.9	4581.3	14728.8
123789-HxCDD	11663.8	450	35 J	12000	7351.9	5147.4	13322.4
1234678-HpCDD	429316	16000	1500	310000	205823.2	85674.4	194781
OCDD	4016164	150000	15000	2700000	1144071	394351	749445
2378-TCDF	7.4 U	3.4 U	3.5 U	36	7.4 U	7.4 U	7.4 U
12378-PeCDF	21.7 U	8.8 U	8.4 U	150	118.9	750.8	1289
23478-PeCDF	13.5 U	9.8 U	4.3 U	220	132.3	13.5 U	13.5 U
123478-HxCDF	1011.5	110	11 U	2700 U	1184.5	25.1 U	25.1 U
123678-HxCDF	2094.8	390 U	55 U	17000 U	1298.2	15.5 U	15.5 U
123789-HxCDF	29.4 U	1.5 U	4 U	52	29.4 U	29.4 U	29.4 U
234678-HxCDF	1863.1	94	11 U	3300	1159.5	13.4 U	13.4 U
1234678-HpCDF	95637.7	3700	360	70000	39733.9	16196.8	43499.2
1234789-HpCDF	4181.8	280	33 J	5000	3048.2	21.2 U	21.2 U
OCDF	544878	25000	3800	360000	111305	67842.8	113184
TCDDs (Total)	2.4 U	7.1	3.7 U	550	2.4 U	2.4 U	229.7
PeCDDs (Total)	1794	140	18 U	6000	2769.5	762.8	3111.2
HxCDDs (Total)	78863.3	2600	190	61000	60394	26006.1	60909.7
HpCDDs (Total)	746104	26000	2500	490000	360713	190915	311187
TCDFs (Total)	329.7	53	8.1	1700	7.4 U	7.4 U	7.4 U
PeCDFs (Total)	12177.4	460	32	15000	8731.7	13301.3	12580.4
HxCDFs (Total)	99373.5	3300	300	84000	98165	20654.6	64416.8
HpCDFs (Total)	419941	13000	1400	250000	168023	89248.5	181922
TEF Equivalent	13568.4	547.3	45.33	11146.3	6634.704	2905.19	6798.81

Table B-5 - Dioxin Results for Surface Water and Groundwater Samples

Sheet 2 of 3

Sample ID	Drain 25	25-Diss.	25-Total	Drain 30	BXS-1	BXS-1	MW-2
Sampling Date	1/08/98	6/24/98	6/24/98	1/08/98 Duplicate 13/14	10/4/99	1/13/00	10/4/99
Dioxins in pg/L							
2378-TCDD	2.4 U	3.5 U	5.4 U	2.4 U	4.998 U	2.762 U	3.693 U
12378-PeCDD	360.2	8.5 U	40 U	763.3	4.612 U	2.58 U	103.196
123478-HxCDD	1190.9	5 U	75	2718.4	3.423 U	1.93 U	262.243
123678-HxCDD	7132.2	7.6 U	180	8651.9	3.252 U	1.695 U	781.167
123789-HxCDD	7262.1	7 U	150	8764	3.155 U	1.678 U	569.969
1234678-HpCDD	106342	25 JB	5300	357390	6.641	4.296 X	25496.7
OCDD	478617	110 B	46000	1292467	78.237	31.533 BX	228345
2378-TCDF	7.4 U	3.5 U	4.1 U	7.4 U	6.651 U	3.932 U	6.083 U
12378-PeCDF	21.7 U	5.3 U	4.5 U	21.7 U	3.936 U	1.673 U	8.434 U
23478-PeCDF	13.5 U	6.5 U	4.5 U	13.5 U	3.814 U	1.63 U	7.576 U
123478-HxCDF	2812.7	5.1 U	40 J	1707.4	4.349 U	1.28 U	3102.41
123678-HxCDF	15.5 U	4.5 U	290 U	1797.1	4.226 U	1.278 U	249.855 U
123789-HxCDF	29.4 U	7.7 U	1.8 U	29.4 U	5.846 U	1.381 U	370.885 U
234678-HxCDF	13.4 U	7.1 U	41 J	1613.3	4.688 U	1.873 U	276.499 U
1234678-HpCDF	21380.1	9.7 U	930	74647.1	4.69 U	1.165 U	3294.05
1234789-HpCDF	4650.6	6.9 U	67	7240.5	6.949 U	1.543 U	383.684 U
OCDF	64550.4	19 U	4800	184840	5.211 U	1.875 U	17067.2
TCDDs (Total)	2.4 U	3.5 U	5.4 U	2.4 U	4.998 U	2.762 U	3.693 U
PeCDDs (Total)	1226.6	8.5 U	40 U	1953.5	4.612 U	2.58 U	249.241
HxCDDs (Total)	39898	7.6 U	1100	54700	3.252 U	1.695 U	3248.59
HpCDDs (Total)	186942	25 B	9300	615501	3.7 U	4.607	25496.7
TCDFs (Total)	313.7	3.5 U	14	383.1	6.651 U	3.932 U	35.993
PeCDFs (Total)	4294.6	6.5 U	210	7585.8	3.814 U	1.63 U	166.117
HxCDFs (Total)	25303.6	7.7 U	1000	86241.4	4.226 U	1.278 U	1562.07
HpCDFs (Total)	82518.4	9.7 U	2600	373357	6.47	1.165 U	4644.99
TEF Equivalent	3886.78	0.36	162.37	8776.94	0.1446	0.0745	1056

Table B-5 - Dioxin Results for Surface Water and Groundwater Samples

Sample ID	MW-2		MW-3		MW-3	
Sampling Date	1/13/00		10/5/99		1/13/00	
Dioxins in pg/L						
2378-TCDD	2.282	U	3.862	U	2.93	U
12378-PeCDD	4.524	U	3.921	U	3.117	U
123478-HxCDD	2.101	U	3.198	U	1.676	U
123678-HxCDD	1.8	U	6.48		1.473	U
123789-HxCDD	1.795	U	7.04		1.456	U
1234678-HpCDD	68.221		244.866		6.783	X
OCDD	654.07	B	2644.25		70.488	B
2378-TCDF	2.74	U	4.806	U	3.586	U
12378-PeCDF	3.224	U	3.206	U	2.03	U
23478-PeCDF	3.096	U	2.838	U	1.969	U
123478-HxCDF	10.286	I	32.97		1.925	U
123678-HxCDF	3.03	U	7.827	U	1.835	U
123789-HxCDF	3.35	U	9.881	U	2.014	U
234678-HxCDF	4.61	U	7.629	U	2.715	U
1234678-HpCDF	6.201	X	63.067		3.529	U
1234789-HpCDF	5.967	U	13.608	U	4.805	U
OCDF	57.903		320.309		7.185	
TCDDs (Total)	2.282	U	3.862	U	2.93	U
PeCDDs (Total)	4.524	U	3.921	U	3.117	U
HxCDDs (Total)	1.8	U	15.095		1.473	U
HpCDDs (Total)	117.51		244.866		2.69	U
TCDFs (Total)	2.74	U	4.806	U	3.586	U
PeCDFs (Total)	3.096	U	2.838	U	1.969	U
HxCDFs (Total)	3.03	U	15.83		1.835	U
HpCDFs (Total)	23.654		10.84	U	3.529	U
TEF Equivalent	2.485		10.69		0.1455	

APPENDIX C
MODELING APPROACH AND ASSUMPTIONS

APPENDIX C
MODELING APPROACH AND ASSUMPTIONS

Predicting chemical fate and transport in soil and groundwater using the MULTIMED model requires estimating properties specific to the soil, groundwater, chemicals, and chemical sources present at the site. These properties simplify by necessity a highly complicated system. We discuss below some of the major simplifying assumptions inherent in the model, how site-specific parameters were estimated, and how the variability in these estimates affects the model results.

Model Assumptions

Some of the major simplifying assumptions in the MULTIMED model include:

- Homogeneous soil properties within the saturated zone and discrete unsaturated zone layers;
- A uniform rectangular source area perpendicular to the groundwater flow path;
- A uniform groundwater flow gradient;
- No seasonal groundwater, infiltration, or recharge fluctuations;
- Uniform aquifer thickness and depth; and
- Soil layers of uniform thickness.

Estimation of Site-Specific Modeling Parameters

Three potential PCP sources were modeled as described below and shown on Figure 23, surface water infiltration (direct infiltration), storm water infiltration (captured in catch basin), and NAPL present in subsurface soils beneath the former butt treating tank. Estimated parameter values for the model are listed in Table C-1 for surface water infiltration, Table C-2 for storm water infiltration, and Table C-3 for NAPL beneath the former butt treating tank. Also included for each source is a sensitivity analysis that tests how variations in parameter values affect the output. The parameters were estimated as described below. Parameters not listed in Tables C-1, C-2, and C-3 were derived by the model.

Chemical Parameters. K_{OC} was estimated using a mid-range literature value for PCP adsorption to soil (as opposed to the desorption K_{OC} calculated from leaching tests). The desorption K_{OC} of 12,000 mL/g calculated during this study was used as a maximum. For steady state modeling, however, this value does not affect the model output.

One of the parameters most important and difficult to estimate is the biodegradation rate of the chemical. The biodegradation coefficient was estimated using the decline in average PCP concentration between well MW-3 and BXS-1. To address the uncertainty in this parameter a 'worst case' model assuming no biodegradation was also used. A maximum biodegradation rate was estimated using the decline in PCP concentration between well MW-3 and boring SB-4 in the October 1999 data.

Source Properties. To estimate the infiltration rate for each source, we assumed that half of the site precipitation evaporates, one quarter infiltrates directly into the surface, and one quarter is collected by catch basins and infiltrates into the ground at the catch basin drain fields. We estimated a potential range for the rates of direct surface water infiltration, the rate of infiltration through catch basins, and the recharge rate to be between 15 to 100 percent of the total precipitation not evaporating (0.6 m/yr).

For wells BXS-1, MW-3, and MW-2, catch basins 13 and 14 were used as a storm water source, and for wells HCMW-7 and MW-H (a hypothetical compliance point downgradient of Drain 23), Drain 23 was used as a storm water source. Note that since catch basins 13 and 14 are piped directly to the drainage ditch, we modeled the open ditch area as a drain field. Since much of the drainage ditch is enclosed with a culvert, the estimated area of the open drainage ditch sections was added and the source placed (in the model) at the open ditch section closest to MW-3 (50 feet upgradient). Although the drain field connected to catch basin 23 was used as a source, much of the storm water within the Drain 23 collection area likely infiltrates through the drainage ditch along the western site boundary.

The concentration of PCP in infiltrating surface and storm water was estimated to be 40 ug/L using the lognormal average of surface soil concentrations and the SPLP - surface soil correlation shown on Figure 10. Two other estimates of PCP concentrations in surface water can be used to determine a range of potential concentrations. In an AKART study performed by AGI (AGI, 1997), the dissolved PCP concentration in surface water was estimated to be 2 ug/L based on filtering samples with a 0.45 micron filter. Using correlations of TSS and PCP concentrations detected in samples from catch basins 23 and 24, we estimated dissolved PCP concentrations between 100 and 200 ug/L.

The infiltration rate for the NAPL source was estimated by combining the rate of surface water infiltration and the rate of groundwater movement through the smear zone. The height of the smear zone was estimated to be 15 feet using the range of maximum and minimum water table elevations from the past 12 years. Groundwater was estimated to flow through an average of 7.5 feet of NAPL-containing soil. The minimum and maximum infiltration rate were calculated assuming no flow through the NAPL smear zone and constant flow through a 15-foot smear zone, respectively, and also using the minimum and maximum surface water infiltration rates. The infiltrating water was assumed to be saturated with PCP (14 mg PCP/L). The minimum concentration of PCP in the leachate was estimated to be 0.7 mg/L using Raoult's Law for a 5 percent PCP in oil solution; however, PCP concentrations detected in groundwater grab samples beneath the former butt-treating tank indicate PCP is close to or above the saturated concentration when water is in contact with the NAPL.

The recharge rate (surface water infiltration outside of the source areas) for the three sources was assumed to be the same as the surface infiltration rate. The model assumes the concentration of PCP in recharge water is 0 mg/L.

Soil Properties. The unsaturated zone was modeled as having three distinct layers: an upper, gravelly surface layer with a high organic carbon and silt content, a middle sandy gravel layer, and a lower fine sand layer. The saturated zone was modeled as a fine sand layer. Organic carbon content for each zone and pH use were those measured during this investigation.

For groundwater flow modeling, the site-average hydraulic gradient of 0.01 was used. The field-measured hydraulic conductivity at wells MW-1 and MW-3 (see Table 3) were used for the fine sand and gravelly sand layers, respectively.

Sensitivity Analysis

A sensitivity analysis for each source was performed on the estimated parameters. Reasonable ranges for each parameter were chosen based on observed site conditions. The model was then run with the minimum and maximum estimates to calculate the concentration of PCP at MW-3. In these cases (except when testing the sensitivity of the biodegradation coefficient), the model assumed no biodegradation was used. The results of the sensitivity analysis are included in Tables C-1, C-2, and C-3 and summarized below. Note that only one parameter was varied at a time, and that the error from variation in several parameters may be more severe than observed in this analysis.

Parameters Not Affecting Model Output

Since the model was run at steady state, sorption effects are not included. As a result, variations in K_{OC} and organic carbon content do not affect model results. Potential variations in particle size and bulk density do not significantly affect the model results either. Since chemical reactions are not believed to be significant, changes in pH do not affect the results.

Variations in unsaturated zone parameters such as material thickness and hydraulic conductivity do not affect the model because biodegradation was not included in the sensitivity analysis. Material thickness and hydraulic conductivity affect only the residence time in these areas, and for a steady-state model without degradation a longer residence time does not affect the result.

NAPL Source Results

According to the sensitivity analysis, the predicted concentration at MW-3 is most strongly affected (potentially by an order of magnitude) by the biodegradation coefficient, the volume of groundwater moving through the NAPL smear zone (identified as an infiltration rate), and the initial concentration. Since water table fluctuations at the site are relatively well characterized and the concentration detected in the groundwater beneath the former butt-treating tank was close to the saturated concentration, error in these parameters is likely relatively small.

Surface Water Infiltration Results

According to the sensitivity analysis, the predicted concentration at MW-3 is most strongly affected (although generally by less than an order of magnitude), by the biodegradation coefficient, the infiltration rate, and the initial concentration. Of these parameters, the initial concentration is the most uncertain because of the large variation in several estimates. Since PCP was detected in groundwater samples collected beneath the Treated Pole Storage Yard at very low or non-detectable concentrations, the actual concentration in infiltrating surface water is likely in the lower end of the tested range.

Note that MW-3 is located within the source area, so the small residence time between the source and well location (at the model minimum distance of 1 meter downgradient) minimizes the contribution of biodegradation within the saturated zone and dilution from recharge water. Wells, such as BXS-1 and HCMW-7, further downgradient of the source are likely to be more sensitive to biodegradation and recharge rate.

Storm Water Infiltration Results

According to the sensitivity analysis, the predicted concentration at MW-3 is most strongly affected, although generally by less than an order of magnitude, by the biodegradation coefficient, the infiltration rate, and the initial concentration. As for direct infiltration of surface water, the initial concentration is the most uncertain because of the large variation in several estimates.

Summary of Model Results

Of the tested parameters, the concentration of PCP in surface soil leachate and the rate of PCP biodegradation at the site are the parameters producing the greatest uncertainty in the model results. Using our best parameter estimates, the model predicts that the NAPL is the primary source of PCP detected at MW-3. If the biodegradation coefficient is greater than estimated, the contribution of each source to PCP at MW-3 is diminished. Although the average measured concentration of PCP would then be underestimated by the model, the relative contribution of the NAPL remains the most dominant. This situation would imply an additional NAPL source closer to MW-3.

If the PCP concentration in infiltrating surface and storm water is higher than estimated, all three potential sources may be significant contributors to groundwater PCP concentrations. However, if this surface and storm water were significant contributors we would expect more consistency in groundwater PCP concentrations throughout the site.

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Table C-1 - Model Parameters and Sensitivity Analysis for NAPL Source

			Sensitivity Analysis		
				Concentration in ug/L @ MW-3	
Parameter	**Value**	**Unit**	**Range Tested**	**Minimum Parameter Value**	**Maximum Parameter Value**
			Predicted Concentration Using Estimated Parameters:	**850**	
Chemical Parameters					
Koc	1000	mL/g	0 to 10,000	850	850
Biodegradation Coefficient	0/0.1	1/yr	0 to 0.37	850	77
Source Area Parameters					
Infiltration Rate	3.7 (1)	m/yr	0.1 to 7.2	44	1,200
Area of Source	232	sq.m.	40 to 400	310	1,100
Recharge Rate	0.3	m/yr	0.1 to 10	1,000	340
Initial Concentration	14	mg/L	0.7 to 14	43	850
Saturated Zone Parameters					
Particle Diameter	0.015	cm	0.004 to 0.08	850	850
Bulk Density	1.6	g/mL	1.2 to 2	850	850
Aquifer Thickness	30	m	10 to 100	780	1,000
Hydraulic Conductivity	630	m/yr	220 to 2,200	1,300	260
Hydraulic Gradient	0.01		0.006 to 0.04	660	550
pH	6.8		5 to 9	850	850
Organic Carbon Content	0.0008		0.0001 to 0.1	850	850

Notes:

(1) Infiltration rate of 0.3 m/yr increased to account for groundwater flow through a NAPL smear zone, using a hydraulic conductivity of 630 m/yr (5 ft/day) and a hydraulic gradient beneath the butt tank of 0.035. The volume moving through the smear zone of GW zone was then converted to an infiltration rate moving vertically through the source area.

(2) NAPL source model does not include unsaturated zone transport.

Table C-2 - Model Parameters and Sensitivity Analysis for Surface Water Infiltration Source

			Sensitivity Analysis		
				Concentration in ug/L @ MW-3	
Parameter	**Value**	**Unit**	**Range Tested**	**Minimum Parameter Value**	**Maximum Parameter Value**
			Predicted Concentration Using Estimated Parameters:	**26**	
Chemical Parameters					
Koc	1000	mL/g	0 to 10,000	26	26
Biodegradation Coefficient	0/0.1	1/yr	0 to 0.37	26	6
Source Area Parameters					
Infiltration Rate	0.3	m/yr	0.1 to 0.6	10	38
Area of Source	36,000	sq.m.	18,000 to 42,000	22	27
Recharge Rate	0.3	m/yr	0.1 to 0.6	26	26
Initial Concentration	0.04	mg/L	0.002 to 0.1	1.30	65
Saturated Zone Parameters					
Particle Diameter	0.015	cm	0.004 to 0.08	26	26
Bulk Density	1.6	g/mL	1.2 to 2	26	26
Aquifer Thickness	30	m	10 to 100	52 (2)	26
Hydraulic Conductivity	630	m/yr	220 to 2,200	43 (2)	10
Hydraulic Gradient	0.01		0.006 to 0.04	34	9
pH	6.8		5 to 9	26	26
Organic Carbon Content	0.0008		0.0001 to 0.1	26	26
Unsaturated Zone Parameters - Surface Layer					
Saturated Hydraulic Conductivity	630	m/yr	210 to 2,100	26	26
Organic Carbon Content	0.01		0 to 0.1	26	26
Thickness	2	m	1 to 3	26	26
Unsaturated Zone Parameters - Middle Layer					
Saturated Hydraulic Conductivity	6,300	m/yr	2,100 to 12,600	26	26
Organic Carbon Content	0.0008		0 to 0.1	26	26
Thickness	4	m	3 to 5	26	26
Unsaturated Zone Parameters - Lower Layer					
Saturated Hydraulic Conductivity	630	m/yr	210 to 2,100	26	26
Organic Carbon Content	0.0008		0 to 0.1	26	26
Thickness	3	m	2 to 4	26	26

Notes:

(1) Concentration above source concentration; model mixing zone factor greater than 1.

MODEL OUTPUT

```
                      U. S.   E N V I R O N M E N T A L   P R O T E C T I O N   A G E N C Y

                                  E X P O S U R E   A S S E S S M E N T

                                     M U L T I M E D I A   M O D E L

                                  MULTIMED  (Version 1.01, June 1991)
1
 Run options
 --- -------




 Deterministic simulation.
 Chemical simulated is Pentachlorophenol


 Option Chosen                       Saturated zone model
 Run was                             DETERMIN
 Infiltration input by user
 Run was transient
 Reject runs if Y coordinate outside plume
 Reject runs if Z coordinate outside plume
 Gaussian source used in saturated zone model
1
1
                                          CHEMICAL SPECIFIC VARIABLES


         -----------------------------------------------------------------------------------------------------
                  VARIABLE NAME                UNITS      DISTRIBUTION        PARAMETERS              LIMITS
                                                                            MEAN     STD DEV       MIN        MAX
         -----------------------------------------------------------------------------------------------------
         Solid phase decay coefficient          1/yr        DERIVED        0.000E+00 0.000E+00   0.000E+00  0.100E+11
         Dissolved phase decay coefficient      1/yr        DERIVED        0.000E+00 0.000E+00   0.000E+00  0.100E+11
         Overall chemical decay coefficient     1/yr        DERIVED        0.000E+00 0.000E+00   0.000E+00  0.100E+11
         Acid catalyzed hydrolysis rate         1/M-yr      CONSTANT       0.000E+00 0.000E+00   0.000E+00  -999.
         Neutral hydrolysis rate constant       1/yr        CONSTANT       0.000E+00 0.000E+00   0.000E+00  -999.
         Base catalyzed hydrolysis rate         1/M-yr      CONSTANT       0.000E+00 0.000E+00   0.000E+00  -999.
         Reference temperature                  C           CONSTANT        25.0     0.000E+00   0.000E+00   100.
         Normalized distribution coefficient    ml/g        CONSTANT       0.100E+04 0.000E+00   0.000E+00  -999.
         Distribution coefficient               --          DERIVED         10.0     0.000E+00   0.000E+00  0.100E+11
         Biodegradation coefficient (sat. zone) 1/yr        CONSTANT       0.000E+00 0.000E+00   0.000E+00  -999.
         Air diffusion coefficient              cm2/s       CONSTANT       0.000E+00 0.645E-02   0.000E+00   10.0
         Reference temperature for air diffusion C          CONSTANT       0.000E+00 0.000E+00   0.000E+00   100.
         Molecular weight                       g/M         CONSTANT       -999.     0.000E+00   0.000E+00  -999.
         Mole fraction of solute                --          CONSTANT       -999.     0.100E-01   0.100E-08   1.00
         Vapor pressure of solute               mm Hg       CONSTANT       -999.     0.230E-01   0.000E+00   100.
         Henry`s law constant                 atm-m^3/M     CONSTANT       -999.     0.000E+00   0.100E-09   1.00
         Overall 1st order decay sat. zone      1/yr        DERIVED        0.000E+00 0.000E+00   0.000E+00   1.00
         Not currently used                                 CONSTANT        1.00     0.000E+00   0.000E+00   1.00
         Not currently used                                 CONSTANT        1.00     0.000E+00   0.000E+00   1.00
1
                                          SOURCE SPECIFIC VARIABLES


         -----------------------------------------------------------------------------------------------------
                  VARIABLE NAME                UNITS      DISTRIBUTION        PARAMETERS              LIMITS
                                                                            MEAN     STD DEV       MIN        MAX
         -----------------------------------------------------------------------------------------------------
         Infiltration rate                      m/yr        CONSTANT        3.70     -999.       0.100E-09  0.100E+11
         Area of waste disposal unit            m^2         CONSTANT        232.     -999.       0.100E-01  -999.
         Duration of pulse                      yr          CONSTANT        20.0     -999.       0.100E-08  -999.
         Spread of contaminant source           m           DERIVED        -999.     -999.       0.100E-08  0.100E+11
         Recharge rate                          m/yr        CONSTANT       0.300     -999.       0.000E+00  0.100E+11
         Source decay constant                  1/yr        CONSTANT       0.000E+00 -999.       0.000E+00  -999.
         Initial concentration at landfill      mg/l        CONSTANT        14.0     -999.       0.000E+00  -999.
         Length scale of facility               m           DERIVED        -999.     -999.       0.100E-08  0.100E+11
         Width scale of facility                m           DERIVED        -999.     -999.       0.100E-08  0.100E+11
         Near field dilution                                DERIVED         1.00     0.000E+00   0.000E+00   1.00
1
                                          AQUIFER SPECIFIC VARIABLES


         -----------------------------------------------------------------------------------------------------
                  VARIABLE NAME                UNITS      DISTRIBUTION        PARAMETERS              LIMITS
                                                                            MEAN     STD DEV       MIN        MAX
         -----------------------------------------------------------------------------------------------------
         Particle diameter                      cm          CONSTANT       0.150E-01 -999.       0.100E-08   100.
         Aquifer porosity                       --          DERIVED        0.545     -999.       0.100E-08  0.990
         Bulk density                           g/cc        CONSTANT        1.60     -999.       0.100E-01   5.00
         Aquifer thickness                      m           CONSTANT        30.0     -999.       0.100E-08  0.100E+06
         Source thickness (mixing zone depth)   m           DERIVED         30.0     -999.       0.100E-08  0.100E+06
         Conductivity (hydraulic)               m/yr        CONSTANT        630.     -999.       0.100E-06  0.100E+09
         Gradient (hydraulic)                               CONSTANT       0.100E-01 -999.       0.100E-07  -999.
         Groundwater seepage velocity           m/yr        DERIVED        -999.     -999.       0.100E-09  0.100E+09
         Retardation coefficient                --          DERIVED        -999.     -999.        1.00      0.100E+09
         Longitudinal dispersivity              m           FUNCTION OF X   160.     -999.       0.100E-02  0.100E+05
         Transverse dispersivity                m           FUNCTION OF X   15.2     -999.       0.100E-02  0.100E+05
         Vertical dispersivity                  m           FUNCTION OF X   8.00     -999.       0.100E-02  0.100E+05
         Temperature of aquifer                 C           CONSTANT        14.4     -999.       0.000E+00   100.
         pH                                     --          CONSTANT        6.80     -999.       0.300       14.0
         Organic carbon content (fraction)                  CONSTANT       0.800E-03 -999.       0.100E-05   1.00
         Well distance from site                m           CONSTANT        105.     -999.        1.00      -999.
         Angle off center                     degree        CONSTANT       0.000E+00 -999.       0.000E+00   360.
         Well vertical distance                 m           CONSTANT       0.000E+00 -999.       0.000E+00   1.00


      CONCENTRATION AFTER SATURATED ZONE MODEL 0.8454
```

```
1
















                        U. S.   E N V I R O N M E N T A L   P R O T E C T I O N   A G E N C Y
                                             E X P O S U R E   A S S E S S M E N T
                                               M U L T I M E D I A   M O D E L
                                              MULTIMED  (Version 1.01, June 1991)
1
 Run options
 --- -------


 JH BAXTER SURFACE WATER INFILTRATION


 Deterministic simulation.
 Chemical simulated is Pentachlorophenol


 Option Chosen                       Saturated and unsaturated zone models
 Run was                             DETERMIN
 Infiltration input by user
 Run was steady-state
 Reject runs if Y coordinate outside plume
 Reject runs if Z coordinate outside plume
 Gaussian source used in saturated zone model
1
1
 UNSATURATED ZONE FLOW MODEL PARAMETERS
 (input parameter description and value)
 NP      - Total number of nodal points                 240
 NMAT    - Number of different porous materials           3
 KPROP   - Van Genuchten or Brooks and Corey              1
 IMSHGN  - Spatial discretization option                  1
 NVFLAYR - Number of layers in flow model                 3


 OPTIONS CHOSEN
 ------- ------
 Van Genuchten functional coefficients
 User defined coordinate system
1


 Layer information
 -----------------
 LAYER NO.    LAYER THICKNESS    MATERIAL PROPERTY
 ---------    ---------------    -----------------
     1                  2.00             3
     2                  4.00             1
     3                  3.00             2

                                             DATA FOR MATERIAL  1
                                             ---- --- --------
                                          VADOSE ZONE MATERIAL VARIABLES

               -------------------------------------------------------------------------------------------
                         VARIABLE NAME            UNITS      DISTRIBUTION         PARAMETERS             LIMITS
                                                                               MEAN      STD DEV      MIN         MAX
               -------------------------------------------------------------------------------------------
               Saturated hydraulic conductivity   cm/hr       CONSTANT         72.0      -999.      0.100E-10  0.100E+05
               Unsaturated zone porosity           --         CONSTANT        0.450      -999.      0.100E-08  0.990
               Air entry pressure head             m          CONSTANT        0.000E+00 -999.      0.000E+00  -999.
               Depth of the unsaturated zone       m          CONSTANT         9.00      -999.      0.100E-08  -999.

                                             DATA FOR MATERIAL  1
                                             ---- --- --------
                                          VADOSE ZONE FUNCTION VARIABLES

               -------------------------------------------------------------------------------------------
                         VARIABLE NAME            UNITS      DISTRIBUTION         PARAMETERS             LIMITS
                                                                               MEAN      STD DEV      MIN         MAX
               -------------------------------------------------------------------------------------------
               Residual water content              --         CONSTANT        0.450E-01 -999.      0.100E-08   1.00
               Brook and Corey exponent,EN         --         CONSTANT        0.500      -999.      0.000E+00   10.0
               ALFA coefficient                   1/cm        CONSTANT        0.145      -999.      0.000E+00   1.00
               Van Genuchten exponent, ENN         --         CONSTANT         2.68      -999.       1.00       5.00
```

```
                                            DATA FOR MATERIAL  2
                                            ---- --- --------
                                         VADOSE ZONE MATERIAL VARIABLES


      ------------------------------------------------------------------------------------------------------------
                  VARIABLE NAME                 UNITS      DISTRIBUTION          PARAMETERS              LIMITS
                                                                               MEAN      STD DEV      MIN         MAX
      ------------------------------------------------------------------------------------------------------------
      Saturated hydraulic conductivity          cm/hr        CONSTANT          7.20      -999.       0.100E-10  0.100E+05
      Unsaturated zone porosity                  --          CONSTANT         0.540      -999.       0.100E-08  0.990
      Air entry pressure head                    m           CONSTANT         0.000E+00 -999.        0.000E+00  -999.
      Depth of the unsaturated zone              m           CONSTANT          9.00      -999.       0.100E-08  -999.

                                            DATA FOR MATERIAL  2
                                            ---- --- --------
                                         VADOSE ZONE FUNCTION VARIABLES


      ------------------------------------------------------------------------------------------------------------
                  VARIABLE NAME                 UNITS      DISTRIBUTION          PARAMETERS              LIMITS
                                                                               MEAN      STD DEV      MIN         MAX
      ------------------------------------------------------------------------------------------------------------
      Residual water content                     --          CONSTANT         0.450E-01 -999.        0.100E-08   1.00
      Brook and Corey exponent,EN                --          CONSTANT         0.000E+00 -999.        0.000E+00   10.0
      ALFA coefficient                          1/cm         CONSTANT         0.145      -999.       0.000E+00   1.00
      Van Genuchten exponent, ENN                --          CONSTANT          2.68      -999.        1.00       5.00

                                            DATA FOR MATERIAL  3
                                            ---- --- --------
                                         VADOSE ZONE MATERIAL VARIABLES


      ------------------------------------------------------------------------------------------------------------
                  VARIABLE NAME                 UNITS      DISTRIBUTION          PARAMETERS              LIMITS
                                                                               MEAN      STD DEV      MIN         MAX
      ------------------------------------------------------------------------------------------------------------
      Saturated hydraulic conductivity          cm/hr        CONSTANT          7.20      -999.       0.100E-10  0.100E+05
      Unsaturated zone porosity                  --          CONSTANT         0.540      -999.       0.100E-08  0.990
      Air entry pressure head                    m           CONSTANT         0.000E+00 -999.        0.000E+00  -999.
      Depth of the unsaturated zone              m           CONSTANT          9.00      -999.       0.100E-08  -999.

                                            DATA FOR MATERIAL  3
                                            ---- --- --------
                                         VADOSE ZONE FUNCTION VARIABLES


      ------------------------------------------------------------------------------------------------------------
                  VARIABLE NAME                 UNITS      DISTRIBUTION          PARAMETERS              LIMITS
                                                                               MEAN      STD DEV      MIN         MAX
      ------------------------------------------------------------------------------------------------------------
      Residual water content                     --          CONSTANT         0.450E-01 -999.        0.100E-08   1.00
      Brook and Corey exponent,EN                --          CONSTANT         0.000E+00 -999.        0.000E+00   10.0
      ALFA coefficient                          1/cm         CONSTANT         0.145      -999.       0.000E+00   1.00
      Van Genuchten exponent, ENN                --          CONSTANT          2.68      -999.        1.00       5.00
1
 UNSATURATED ZONE TRANSPORT MODEL PARAMETERS

 NLAY   - Number of different layers used                3
 NTSTPS - Number of time values concentration calc      40
 DUMMY  - Not presently used                             1
 ISOL   - Type of scheme used in unsaturated zone        1
 N      - Stehfest terms or number of increments        18
 NTEL   - Points in Lagrangian interpolation             3
 NGPTS  - Number of Gauss points                       104
 NIT    - Convolution integral segments                  2
 IBOUND - Type of boundary condition                     1
 ITSGEN - Time values generated or input                 1
 TMAX   - Max simulation time             --            0.0
 WTFUN  - Weighting factor                --            1.2


 OPTIONS CHOSEN
 ------- ------
 Stehfest numerical inversion algorithm
 Nondecaying continuous source
 Computer generated times for computing concentrations
1

                                            DATA FOR LAYER   1
                                            ---- --- -----
                                            VADOSE TRANSPORT VARIABLES


      ------------------------------------------------------------------------------------------------------------
                  VARIABLE NAME                 UNITS      DISTRIBUTION          PARAMETERS              LIMITS
                                                                               MEAN      STD DEV      MIN         MAX
      ------------------------------------------------------------------------------------------------------------
      Thickness of layer                         m           CONSTANT          4.00      -999.       0.100E-08  -999.
      Longitudinal dispersivity of layer         m           DERIVED          -999.      -999.       0.100E-02  0.100E+05
      Percent organic matter                     --          CONSTANT         0.800E-03 -999.        0.000E+00   100.
      Bulk density of soil for layer            g/cc         CONSTANT          1.60      -999.       0.100E-01   5.00
      Biological decay coefficient              1/yr         CONSTANT         0.000E+00 -999.        0.000E+00  -999.

                                            DATA FOR LAYER   2
                                            ---- --- -----
                                            VADOSE TRANSPORT VARIABLES


      ------------------------------------------------------------------------------------------------------------
                  VARIABLE NAME                 UNITS      DISTRIBUTION          PARAMETERS              LIMITS
                                                                               MEAN      STD DEV      MIN         MAX
      ------------------------------------------------------------------------------------------------------------
      Thickness of layer                         m           CONSTANT          3.00      -999.       0.100E-08  -999.
      Longitudinal dispersivity of layer         m           DERIVED          -999.      -999.       0.100E-02  0.100E+05
      Percent organic matter                     --          CONSTANT         0.800E-03 -999.        0.000E+00   100.
      Bulk density of soil for layer            g/cc         CONSTANT          1.80      -999.       0.100E-01   5.00
```

```
        Biological decay coefficient           1/yr          CONSTANT        0.000E+00 -999.        0.000E+00  -999.

                                                      DATA FOR LAYER   3
                                                      ---- --- -----
                                                      VADOSE TRANSPORT VARIABLES


        ------------------------------------------------------------------------------------------------------------------
                    VARIABLE NAME               UNITS        DISTRIBUTION         PARAMETERS              LIMITS
                                                                               MEAN      STD DEV       MIN         MAX
        ------------------------------------------------------------------------------------------------------------------
        Thickness of layer                       m             CONSTANT         2.00      -999.       0.100E-08  -999.
        Longitudinal dispersivity of layer       m             DERIVED         -999.      -999.       0.100E-02  0.100E+05
        Percent organic matter                   --            CONSTANT        0.100E-01 -999.        0.000E+00   100.
        Bulk density of soil for layer           g/cc          CONSTANT         1.60      -999.       0.100E-01   5.00
        Biological decay coefficient            1/yr           CONSTANT        0.000E+00 -999.        0.000E+00  -999.
 1
                                                     CHEMICAL SPECIFIC VARIABLES


        ------------------------------------------------------------------------------------------------------------------
                    VARIABLE NAME               UNITS        DISTRIBUTION         PARAMETERS              LIMITS
                                                                               MEAN      STD DEV       MIN         MAX
        ------------------------------------------------------------------------------------------------------------------
        Solid phase decay coefficient           1/yr           DERIVED         0.000E+00 0.000E+00    0.000E+00  0.100E+11
        Dissolved phase decay coefficient       1/yr           DERIVED         0.000E+00 0.000E+00    0.000E+00  0.100E+11
        Overall chemical decay coefficient      1/yr           DERIVED         0.000E+00 0.000E+00    0.000E+00  0.100E+11
        Acid catalyzed hydrolysis rate          1/M-yr         CONSTANT        0.000E+00 0.000E+00    0.000E+00  -999.
        Neutral hydrolysis rate constant        1/yr           CONSTANT        0.000E+00 0.000E+00    0.000E+00  -999.
        Base catalyzed hydrolysis rate          1/M-yr         CONSTANT        0.000E+00 0.000E+00    0.000E+00  -999.
        Reference temperature                   C              CONSTANT         25.0     0.000E+00    0.000E+00   100.
        Normalized distribution coefficient     ml/g           CONSTANT        0.100E+04 0.000E+00    0.000E+00  -999.
        Distribution coefficient                 --            DERIVED          10.0     0.000E+00    0.000E+00  0.100E+11
        Biodegradation coefficient (sat. zone)  1/yr           CONSTANT        0.000E+00 0.000E+00    0.000E+00  -999.
        Air diffusion coefficient               cm2/s          CONSTANT        0.000E+00 0.645E-02    0.000E+00   10.0
        Reference temperature for air diffusion C              CONSTANT        0.000E+00 0.000E+00    0.000E+00   100.
        Molecular weight                        g/M            CONSTANT        -999.     0.000E+00    0.000E+00  -999.
        Mole fraction of solute                  --            CONSTANT        -999.     0.100E-01    0.100E-08   1.00
        Vapor pressure of solute                 mm Hg         CONSTANT        -999.     0.230E-01    0.000E+00   100.
        Henry`s law constant                   atm-m^3/M       CONSTANT        -999.     0.000E+00    0.100E-09   1.00
        Overall 1st order decay sat. zone       1/yr           DERIVED         0.000E+00 0.000E+00    0.000E+00   1.00
        Not currently used                                     CONSTANT         1.00     0.000E+00    0.000E+00   1.00
        Not currently used                                     CONSTANT         1.00     0.000E+00    0.000E+00   1.00
 1
                                                       SOURCE SPECIFIC VARIABLES


        ------------------------------------------------------------------------------------------------------------------
                    VARIABLE NAME               UNITS        DISTRIBUTION         PARAMETERS              LIMITS
                                                                               MEAN      STD DEV       MIN         MAX
        ------------------------------------------------------------------------------------------------------------------
        Infiltration rate                       m/yr           CONSTANT        0.300      -999.       0.100E-09  0.100E+11
        Area of waste disposal unit             m^2            CONSTANT        0.360E+05 -999.        0.100E-01  -999.
        Duration of pulse                       yr             CONSTANT         20.0      -999.       0.100E-08  -999.
        Spread of contaminant source            m              DERIVED         -999.      -999.       0.100E-08  0.100E+11
        Recharge rate                           m/yr           CONSTANT        0.300      -999.       0.000E+00  0.100E+11
        Source decay constant                   1/yr           CONSTANT        0.000E+00 -999.        0.000E+00  -999.
        Initial concentration at landfill       mg/l           CONSTANT        0.400E-01 -999.        0.000E+00  -999.
        Length scale of facility                m              CONSTANT         120.      -999.       0.100E-08  0.100E+11
        Width scale of facility                 m              CONSTANT         300.      -999.       0.100E-08  0.100E+11
        Near field dilution                                    DERIVED          1.00     0.000E+00    0.000E+00   1.00
 1
                                                      AQUIFER SPECIFIC VARIABLES


        ------------------------------------------------------------------------------------------------------------------
                    VARIABLE NAME               UNITS        DISTRIBUTION         PARAMETERS              LIMITS
                                                                               MEAN      STD DEV       MIN         MAX
        ------------------------------------------------------------------------------------------------------------------
        Particle diameter                       cm             CONSTANT        0.300E-01 -999.        0.100E-08   100.
        Aquifer porosity                        --             DERIVED         0.545      -999.       0.100E-08  0.990
        Bulk density                            g/cc           CONSTANT         1.60      -999.       0.100E-01   5.00
        Aquifer thickness                       m              CONSTANT         30.0      -999.       0.100E-08  0.100E+06
        Source thickness (mixing zone depth)    m              DERIVED         -999.      -999.       0.100E-08  0.100E+06
        Conductivity (hydraulic)                m/yr           CONSTANT         630.      -999.       0.100E-06  0.100E+09
        Gradient (hydraulic)                                   CONSTANT        0.100E-01 -999.        0.100E-07  -999.
        Groundwater seepage velocity            m/yr           DERIVED         -999.      -999.       0.100E-09  0.100E+09
        Retardation coefficient                 --             DERIVED         -999.      -999.        1.00      0.100E+09
        Longitudinal dispersivity               m              FUNCTION OF X    160.      -999.       0.100E-02  0.100E+05
        Transverse dispersivity                 m              FUNCTION OF X    15.2      -999.       0.100E-02  0.100E+05
        Vertical dispersivity                   m              FUNCTION OF X    8.00      -999.       0.100E-02  0.100E+05
        Temperature of aquifer                  C              CONSTANT         14.4      -999.       0.000E+00   100.
        pH                                      --             CONSTANT         9.00      -999.       0.300       14.0
        Organic carbon content (fraction)                      CONSTANT        0.800E-03 -999.        0.100E-05   1.00
        Well distance from site                 m              CONSTANT         1.00      -999.        1.00      -999.
        Angle off center                       degree          CONSTANT        0.000E+00 -999.        0.000E+00   360.
        Well vertical distance                  m              CONSTANT        0.000E+00 -999.        0.000E+00   1.00


     CONCENTRATION AFTER SATURATED ZONE MODEL 0.2576E-01
```

```
                        U. S.   E N V I R O N M E N T A L   P R O T E C T I O N   A G E N C Y

                                           E X P O S U R E   A S S E S S M E N T

                                              M U L T I M E D I A   M O D E L

                                          MULTIMED  (Version 1.01, June 1991)
1
 Run options
 --- -------


 JH BAXTER SURFACE WATER INFILTRATION


 Deterministic simulation.
 Chemical simulated is Pentachlorophenol


 Option Chosen                       Saturated and unsaturated zone models
 Run was                             DETERMIN
 Infiltration input by user
 Run was steady-state
 Reject runs if Y coordinate outside plume
 Reject runs if Z coordinate outside plume
 Gaussian source used in saturated zone model
1
1
 UNSATURATED ZONE FLOW MODEL PARAMETERS
 (input parameter description and value)
 NP      - Total number of nodal points               240
 NMAT    - Number of different porous materials         2
 KPROP   - Van Genuchten or Brooks and Corey            1
 IMSHGN  - Spatial discretization option                1
 NVFLAYR - Number of layers in flow model               2


 OPTIONS CHOSEN
 ------- ------
 Van Genuchten functional coefficients
 User defined coordinate system
1


 Layer information
 -----------------
 LAYER NO.    LAYER THICKNESS    MATERIAL PROPERTY
 ---------    ---------------    -----------------
     1                4.00               1
     2                3.00               2

                                            DATA FOR MATERIAL  1
                                            ---- --- --------
                                        VADOSE ZONE MATERIAL VARIABLES


          ------------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS      DISTRIBUTION          PARAMETERS             LIMITS
                                                                                     MEAN      STD DEV       MIN         MAX
          ------------------------------------------------------------------------------------------------------------------------
          Saturated hydraulic conductivity          cm/hr        CONSTANT           72.0      -999.       0.100E-10  0.100E+05
          Unsaturated zone porosity                  --          CONSTANT          0.450      -999.       0.100E-08  0.990
          Air entry pressure head                    m           CONSTANT          0.000E+00 -999.        0.000E+00  -999.
          Depth of the unsaturated zone              m           CONSTANT           7.00      -999.       0.100E-08  -999.

                                            DATA FOR MATERIAL  1
                                            ---- --- --------
                                        VADOSE ZONE FUNCTION VARIABLES


          ------------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS      DISTRIBUTION          PARAMETERS             LIMITS
                                                                                     MEAN      STD DEV       MIN         MAX
          ------------------------------------------------------------------------------------------------------------------------
          Residual water content                     --          CONSTANT          0.450E-01 -999.        0.100E-08   1.00
          Brook and Corey exponent,EN                --          CONSTANT          0.500      -999.       0.000E+00   10.0
          ALFA coefficient                          1/cm         CONSTANT          0.145      -999.       0.000E+00   1.00
          Van Genuchten exponent, ENN                --          CONSTANT           2.68      -999.        1.00       5.00

                                            DATA FOR MATERIAL  2
                                            ---- --- --------
                                        VADOSE ZONE MATERIAL VARIABLES


          ------------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS      DISTRIBUTION          PARAMETERS             LIMITS
                                                                                     MEAN      STD DEV       MIN         MAX
          ------------------------------------------------------------------------------------------------------------------------
          Saturated hydraulic conductivity          cm/hr        CONSTANT           7.20      -999.       0.100E-10  0.100E+05
          Unsaturated zone porosity                  --          CONSTANT          0.540      -999.       0.100E-08  0.990
          Air entry pressure head                    m           CONSTANT          0.000E+00 -999.        0.000E+00  -999.
          Depth of the unsaturated zone              m           CONSTANT           7.00      -999.       0.100E-08  -999.

                                            DATA FOR MATERIAL  2
                                            ---- --- --------
                                        VADOSE ZONE FUNCTION VARIABLES


          ------------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS      DISTRIBUTION          PARAMETERS             LIMITS
                                                                                     MEAN      STD DEV       MIN         MAX
          ------------------------------------------------------------------------------------------------------------------------
          Residual water content                     --          CONSTANT          0.450E-01 -999.        0.100E-08   1.00
          Brook and Corey exponent,EN                --          CONSTANT          0.000E+00 -999.        0.000E+00   10.0
          ALFA coefficient                          1/cm         CONSTANT          0.145      -999.       0.000E+00   1.00
          Van Genuchten exponent, ENN                --          CONSTANT           2.68      -999.        1.00       5.00
1
```

```
UNSATURATED ZONE TRANSPORT MODEL PARAMETERS

NLAY   - Number of different layers used              2
NTSTPS - Number of time values concentration calc    40
DUMMY  - Not presently used                           1
ISOL   - Type of scheme used in unsaturated zone      1
N      - Stehfest terms or number of increments      18
NTEL   - Points in Lagrangian interpolation           3
NGPTS  - Number of Gauss points                     104
NIT    - Convolution integral segments                2
IBOUND - Type of boundary condition                   1
ITSGEN - Time values generated or input               1
TMAX   - Max simulation time           --           0.0
WTFUN  - Weighting factor              --           1.2


OPTIONS CHOSEN
------- ------
Stehfest numerical inversion algorithm
Nondecaying continuous source
Computer generated times for computing concentrations
1

                                                     DATA FOR LAYER   1
                                                     ---- --- -----
                                                     VADOSE TRANSPORT VARIABLES


          -----------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS       DISTRIBUTION        PARAMETERS              LIMITS
                                                                                    MEAN     STD DEV        MIN        MAX
          -----------------------------------------------------------------------------------------------------------------------
          Thickness of layer                          m             CONSTANT        4.00      -999.         0.100E-08  -999.
          Longitudinal dispersivity of layer          m             DERIVED        -999.      -999.         0.100E-02  0.100E+05
          Percent organic matter                      --            CONSTANT       0.800E-03 -999.          0.000E+00   100.
          Bulk density of soil for layer              g/cc          CONSTANT        1.60      -999.         0.100E-01   5.00
          Biological decay coefficient               1/yr           CONSTANT       0.000E+00 -999.          0.000E+00  -999.

                                                     DATA FOR LAYER   2
                                                     ---- --- -----
                                                     VADOSE TRANSPORT VARIABLES


          -----------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS       DISTRIBUTION        PARAMETERS              LIMITS
                                                                                    MEAN     STD DEV        MIN        MAX
          -----------------------------------------------------------------------------------------------------------------------
          Thickness of layer                          m             CONSTANT        3.00      -999.         0.100E-08  -999.
          Longitudinal dispersivity of layer          m             DERIVED        -999.      -999.         0.100E-02  0.100E+05
          Percent organic matter                      --            CONSTANT       0.800E-03 -999.          0.000E+00   100.
          Bulk density of soil for layer              g/cc          CONSTANT        1.80      -999.         0.100E-01   5.00
          Biological decay coefficient               1/yr           CONSTANT       0.000E+00 -999.          0.000E+00  -999.
1
                                                    CHEMICAL SPECIFIC VARIABLES


          -----------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS       DISTRIBUTION        PARAMETERS              LIMITS
                                                                                    MEAN     STD DEV        MIN        MAX
          -----------------------------------------------------------------------------------------------------------------------
          Solid phase decay coefficient               1/yr          DERIVED        0.000E+00 0.000E+00      0.000E+00  0.100E+11
          Dissolved phase decay coefficient           1/yr          DERIVED        0.000E+00 0.000E+00      0.000E+00  0.100E+11
          Overall chemical decay coefficient          1/yr          DERIVED        0.000E+00 0.000E+00      0.000E+00  0.100E+11
          Acid catalyzed hydrolysis rate              1/M-yr        CONSTANT       0.000E+00 0.000E+00      0.000E+00  -999.
          Neutral hydrolysis rate constant            1/yr          CONSTANT       0.000E+00 0.000E+00      0.000E+00  -999.
          Base catalyzed hydrolysis rate              1/M-yr        CONSTANT       0.000E+00 0.000E+00      0.000E+00  -999.
          Reference temperature                       C             CONSTANT        25.0     0.000E+00      0.000E+00   100.
          Normalized distribution coefficient         ml/g          CONSTANT       0.100E+04 0.000E+00      0.000E+00  -999.
          Distribution coefficient                     --           DERIVED         10.0     0.000E+00      0.000E+00  0.100E+11
          Biodegradation coefficient (sat. zone)      1/yr          CONSTANT       0.000E+00 0.000E+00      0.000E+00  -999.
          Air diffusion coefficient                   cm2/s         CONSTANT       0.000E+00 0.645E-02      0.000E+00   10.0
          Reference temperature for air diffusion     C             CONSTANT       0.000E+00 0.000E+00      0.000E+00   100.
          Molecular weight                            g/M           CONSTANT       -999.     0.000E+00      0.000E+00  -999.
          Mole fraction of solute                     --            CONSTANT       -999.     0.100E-01      0.100E-08   1.00
          Vapor pressure of solute                     mm Hg        CONSTANT       -999.     0.230E-01      0.000E+00   100.
          Henry`s law constant                      atm-m^3/M       CONSTANT       -999.     0.000E+00      0.100E-09   1.00
          Overall 1st order decay sat. zone           1/yr          DERIVED        0.000E+00 0.000E+00      0.000E+00   1.00
          Not currently used                                        CONSTANT        1.00     0.000E+00      0.000E+00   1.00
          Not currently used                                        CONSTANT        1.00     0.000E+00      0.000E+00   1.00
1
                                                      SOURCE SPECIFIC VARIABLES


          -----------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS       DISTRIBUTION        PARAMETERS              LIMITS
                                                                                    MEAN     STD DEV        MIN        MAX
          -----------------------------------------------------------------------------------------------------------------------
          Infiltration rate                           m/yr          CONSTANT        20.0      -999.         0.100E-09  0.100E+11
          Area of waste disposal unit                 m^2           CONSTANT        13.5      -999.         0.100E-01  -999.
          Duration of pulse                           yr            CONSTANT        20.0      -999.         0.100E-08  -999.
          Spread of contaminant source                m             DERIVED        -999.      -999.         0.100E-08  0.100E+11
          Recharge rate                               m/yr          CONSTANT       0.600      -999.         0.000E+00  0.100E+11
          Source decay constant                       1/yr          CONSTANT       0.000E+00 -999.          0.000E+00  -999.
          Initial concentration at landfill           mg/l          CONSTANT       0.400E-01 -999.          0.000E+00  -999.
          Length scale of facility                    m             CONSTANT        13.5      -999.         0.100E-08  0.100E+11
          Width scale of facility                     m             CONSTANT        1.00      -999.         0.100E-08  0.100E+11
          Near field dilution                                       DERIVED         1.00     0.000E+00      0.000E+00   1.00
1
                                                     AQUIFER SPECIFIC VARIABLES


          -----------------------------------------------------------------------------------------------------------------------
                      VARIABLE NAME                   UNITS       DISTRIBUTION        PARAMETERS              LIMITS
                                                                                    MEAN     STD DEV        MIN        MAX
          -----------------------------------------------------------------------------------------------------------------------
          Particle diameter                            cm           CONSTANT       0.300E-01 -999.          0.100E-08   100.
          Aquifer porosity                             --           DERIVED        0.545      -999.         0.100E-08  0.990
          Bulk density                                 g/cc         CONSTANT        1.60      -999.         0.100E-01   5.00
          Aquifer thickness                            m            CONSTANT        30.0      -999.         0.100E-08  0.100E+06
          Source thickness (mixing zone depth)         m            DERIVED        -999.      -999.         0.100E-08  0.100E+06
          Conductivity (hydraulic)                     m/yr         CONSTANT        630.      -999.         0.100E-06  0.100E+09
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          Gradient (hydraulic)                                 CONSTANT        0.100E-01 -999.        0.100E-07  -999.
          Groundwater seepage velocity          m/yr           DERIVED         -999.      -999.       0.100E-09  0.100E+09
          Retardation coefficient               --             DERIVED         -999.      -999.        1.00      0.100E+09
          Longitudinal dispersivity             m              FUNCTION OF X    160.      -999.       0.100E-02  0.100E+05
          Transverse dispersivity               m              FUNCTION OF X    15.2      -999.       0.100E-02  0.100E+05
          Vertical dispersivity                 m              FUNCTION OF X    8.00      -999.       0.100E-02  0.100E+05
          Temperature of aquifer                C              CONSTANT         14.4      -999.       0.000E+00   100.
          pH                                    --             CONSTANT         9.00      -999.       0.300       14.0
          Organic carbon content (fraction)                    CONSTANT        0.800E-03 -999.        0.100E-05   1.00
          Well distance from site               m              CONSTANT         15.0      -999.        1.00      -999.
          Angle off center                    degree           CONSTANT        0.000E+00 -999.        0.000E+00   360.
          Well vertical distance                m              CONSTANT        0.000E+00 -999.        0.000E+00   1.00


    CONCENTRATION AFTER SATURATED ZONE MODEL 0.6029E-02
*** WARNING *** Near field mixing factor is greater than 1.
Mixing factor =   3.42
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