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June 11, 1999

Mr. Tony Rutter
Remedial Project Manager
U.S. Environmental Protection Agency
Remedial Response Branch (SR-6J)
77 West Jackson Boulevard
Chicago, IL 60604-3590

Dear Tony:

Subject: Design Criteria Report (Preliminary Design)
Penta Wood Products Remedial Design
Town of Daniels, Wisconsin
Work Assignment No. 040-RDRD-05WE
Contract No. 68-W6-0025

Enclosed please find three copies of the Design Criteria Report which constitutes the Preliminary Design submittal for the Penta Wood Products Remedial Design. Please call me if you have any questions or concerns.

Sincerely,

CH2M HILL

Regina Bayer

Regina Bayer

Site Manager

c: Stephen Nathan/PO/USEPA (w/o enclosure)
Eben Greybourne/CO/USEPA (w/o enclosure)
Tom Kendzierski/PM/WDNR
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Ike Johnson/PM/CH2M HILL, Milwaukee
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DESIGN CRITERIA REPORT

PENTA WOOD PRODUCTS
Town of Daniels, Wisconsin

Remedial Design

WA No. 040-RDRD-05WE/Contract No. 68-W6-0025
June 1999

Contents

1 Introduction

This Design Criteria Report (DCR) is being prepared for the United States Environmental Protection Agency (USEPA) by CH2M HILL under Contract 68-W6-0025 in accordance with the Statement of Work (SOW), the Record of Decision (ROD) issued on September 29, 1998, and the Remedial Design/Remedial Action (RD/RA) Handbook. The DCR includes all the elements required for the Remedial Design Preliminary Design Task as stated in the SOW issued by the USEPA on February 4, 1999 and summarized in the Final Remedial Design Work Plan dated March 1999. The DCR is organized in the following Sections:

- Section 1 Introduction
- Section 2 Preliminary Design Approach, Assumptions and Parameters
- Section 3 Recommended Project Delivery Strategy and Scheduling
- Section 4 Preliminary Construction Schedule
- Section 5 Specifications Outline
- Section 6 Preliminary Drawings
- Section 7 Basis of Design
- Section 8 Preliminary Cost Estimate
- Section 9 Variances With the ROD
- Section 10 Land Acquisition and Easement Requirements

1.1 Site Description

The Penta Wood Products (PWP) site is an inactive wood treating facility located on Daniels 70 (former State Route 70) in Burnett County, Wisconsin. It is approximately 78 miles northeast of Minneapolis, Minnesota, and 60 miles south of Duluth, Minnesota (Drawing G-1). The Village of Siren, Wisconsin, is approximately two miles east of the site and there are three residences within 200 feet of the site using private wells.

The PWP property currently consists of approximately 82 acres which were actively used; 40 undeveloped acres consisting of forest were sold after the facility closed. The property is located in a rural agricultural and residential setting and is bordered to the east, west, and north by forested areas. Some of these areas are classified by the State of Wisconsin as wetlands. With the exception of an eight-acre parcel, Daniels 70 forms the southern property boundary.

The PWP site is situated on a plateau with a 110-foot drop in elevation from the southern boundary to the northern boundary. The site stratigraphy consists of three layers: an upper sand, a glacial till that is not continuous throughout the site, and a lower sand. The depth to groundwater is over 100 feet on the plateau. Groundwater occurs both in a thin unconfined aquifer and within a multi-layered semiconfined aquifer system. The regional groundwater flow direction is to the north. Since the closing of the onsite production well, groundwater flow at the site has been radial, with a strong downward vertical gradient.

A number of surface water bodies are present north and east of the site. Doctor Lake and an unnamed lake are located 2,000 feet east and northeast of the site, respectively. Approximately 2,137 acres of lakes, 94 acres of bogs, and 7,500 acres of wetland are located within a four-mile radius of the site. A wetland is located within 130 feet of the northern property boundary. The Amsterdam Slough Public Hunting area covers 7,233 acres and is located one mile north of the site.

1.2 Site History

PWP operated from 1953 to 1992. Raw timber was cut into posts and telephone poles and treated with either a five to seven percent pentachlorophenol (PCP) solution in a No. 2 fuel oil carrier, or with a water borne salt treatment called Chemonite consisting of ammonia, copper II oxide, arsenate, and zinc (ACZA). During its 39 years of operation, PWP discharged wastewater from an oil/water separator down a gully into a lagoon on the northeast corner of the property (Drawing C-1). Process wastes were also discharged onto a wood chip pile in the northwestern portion of the property. Ash from a boiler was used to berm a cooling pond. Beginning in the 1970s, Wisconsin Department of Natural Resources (WDNR) investigators noted several large spills, stained soils, fires, and poor operating practices.

PWP began an environmental investigation in 1987. In 1988 the onsite production well was closed for potable use when it was found to contain 2,700 µg/L of PCP. The State of Wisconsin Department of Justice (WDOJ) filed a preliminary injunction against PWP in 1991, citing Wisconsin Pollutant Discharge Elimination System (WPDES) violations and violations of other State statutes regarding storage of raw materials, and waste handling practices. The facility voluntarily closed in May 1992 with the promulgation of the Resource Conservation and Recovery Act (RCRA) drip track regulations.

The site was put into the Superfund Accelerated Cleanup Model (SACM) pilot program, and a removal action was conducted from 1994 to 1996. The ACZA treatment building and half of the oil/water separator building were demolished and remaining chemicals and sludges were disposed offsite. Grossly PCP- and metals-contaminated soils were also excavated and disposed offsite, and metals-contaminated soils were excavated and mixed onsite with cement to form a three acre concrete biopad. Emergency erosion control measures were taken in 1998 in an effort to reduce washout of contaminated wood debris from the lagoon wall into the wetlands.

A Remedial Investigation/Feasibility Study (RI/FS) was conducted in 1997-1998, culminating with the issuance of a ROD in September 1998.

1.3 Nature and Extent of Contamination

As a result of spills and past waste handling practices at the site, subsurface soils to a depth of over 100 feet are contaminated with a PCP/oil mixture beneath the gully where wastewater was discharged from an oil/water separator to a lagoon. Over the years, PWP filled erosion gullies with wood debris. This wood debris layer is semi-saturated with the PCP/oil mixture. The PCP/oil mixture, which has traveled to the groundwater and spread horizontally as a light non-aqueous phase liquid (LNAPL) layer, is in equilibrium with pore pressures and is

not expected to continue spreading. A LNAPL of PCP/oil is floating on the water table over an estimated four-acre area.

A dissolved phase PCP plume exists in the groundwater and appears to be stable. PCP concentrations in groundwater have been monitored at the site since 1988, and some of the wells have 11 rounds of sampling data. PCP groundwater concentrations have shown consistent declines at the majority of monitoring wells over time, although many of the wells have only been monitored for three years. There is a general decrease in the size of the PCP plume, and the total contaminant mass of PCP in the saturated zone has declined since 1994. For example, PCP contamination detected at 2,000 µg/L at MW17 in 1994 has declined to non-detect levels in 1997. Contaminated groundwater is not discharging to the wetland, or migrating below the wetland to surface water bodies.

Additional evidence that PCP is biodegrading in groundwater is supported by the natural attenuation parameter data. The groundwater is under anaerobic conditions in both the unconfined and semiconfined aquifer in the LNAPL plume area. The anaerobic plume is not expanding, which is important because aerobic biodegradation has a faster decay rate than anaerobic biodegradation; therefore, biodegradation should be capable of preventing the further expansion of the plume.

The northern lagoon wall is collapsing and overland transport of oil saturated soil and wood debris has resulted in sediment and surface water contamination in an offsite wetland (Drawing C-1).

Wastewater was discharged into a ravine filled with wood chips. Despite elevated levels of PCP and TPH detected in the wood chips, the soil and groundwater below the wood chip pile appear to be minimally impacted. The wood chips may be retaining the contamination.

Surficial soils are contaminated with arsenic. The metals-contaminated soil is mainly around the treatment building and on the eastern portion of the site where ACZA-treated wood was stored. Surficial soil PCP contamination exists along the gully corridor and in hot spots near the rail tracks, treatment cylinder, and areas used to store the treated wood.

1.4 Description of the Selected Remedial Action

The ROD specifies that the selected remedial action for the site consists of soil and sediment consolidation and bioventing, LNAPL collection and disposal, groundwater collection and treatment in the LNAPL area, and monitored natural attenuation for the remainder of the groundwater plume. The selected remedy focuses on removing free phase LNAPL and the grossly contaminated groundwater while slowly drawing down the water table and enhancing natural biodegradation of the soils above the LNAPL by bioventing (adding air to the soils above the water table). PCP/fuel oil contaminated soils and sediments will be consolidated under a cover prior to bioventing. Near-surface arsenic/metals contaminated soil will be segregated where possible; highly contaminated soils will be solidified in cement and placed onsite.

The overland transport of contaminated site materials through a collapsing lagoon wall to an adjacent wetland will be eliminated with reconstruction of the slope, regrading of the site for surface water runoff control, and reestablishing vegetation. The natural degradation of

contaminants that is occurring in the groundwater plume will be monitored. If monitoring detects that offsite receptors are threatened, or if the remedy fails to effectively reduce contaminant mass within a reasonable amount of time, contingency plans will be implemented.

The major components of this remedy include:

- Building demolition
- Segregation, select solidification, and placement of all arsenic soils in an onsite Corrective Action Management Unit (CAMU)
- Consolidation of PCP/fuel oil soils and wood chips under a soil cover
- Bioventing PCP/fuel oil contaminated material
- Biopad removal and backfill onsite
- Erosion control measures
- Revegetation
- LNAPL removal
- Containment, collection, treatment, and discharge of grossly contaminated groundwater (exceeding 1,000 µg/L)
- Monitored natural attenuation
- Institutional controls
- Environmental monitoring/maintenance
- Point-of-entry (POE) carbon treatment, if necessary
- Five-year site reviews

1.5 Preliminary Design Investigation Activities

Field investigation activities were performed in May, 1999 to gather additional data to be used in the preliminary design. These activities included:

- Piezometer installation and well development
- Geotechnical boring
- Aquifer pump test
- Arsenic soil sampling for development of site background concentrations, and confirmation of a clean onsite borrow pit location (see Drawing C-6) and arsenic leachability
- Smear zone soil sampling for PCP, Gasoline Range Organics (GRO), and Diesel Range Organics (DRO)

A survey of the site will be conducted during the preparation of the final design to accomplish the following:

- Document soil sampling and piezometer installation locations
- Obtain a legal definition of the property boundaries
- Gather information for reconstruction of the existing access road and lagoon slope
- Reestablish the 200-foot site grid because may of the grid markers are missing

In an effort to expedite the design schedule, the preliminary design has proceeded without all the results from the additional field investigations performed as part of the design. The

arsenic background, CAMU cover borrow area, and arsenic leachability results were not available for the DCR. This data will be used to refine the quantities of arsenic contaminated soil to be solidified, the quantity of arsenic contaminated soil to be consolidated in the CAMU, and the potential for use of onsite soils for the CAMU cover.

During the pump test an unexpected emulsion resulted in inconclusive data being generated on the treatment system efficiency. Instead, groundwater results from monitoring wells were used to estimate carbon usage. This may effect the carbon bed design and the potential need for metals treatment. When all the analytical results from the pump test are available, they will be incorporated into the prefinal design. Their effect on the design will be discussed with USEPA prior to submittal of the prefinal design.

2 Preliminary Design Approach, Assumptions and Parameters

This section defines the technical parameters upon which the prefinal and final design will be based. Some design parameters cannot been confirmed sufficiently because USEPA input is required. These parameters will be discussed during the Preliminary Design Briefing.

2.1 Site Preparation

2.1.1 Description of Site Preparation

Prior to excavation, consolidation, and placement of contaminated materials in the CAMU, site preparation activities will be performed. These activities are necessary to allow heavy equipment to access all portions of the site that will be involved in this remedial action.

2.1.2 Areas Requiring Site Preparation

The main focus of site preparation will involve gaining vehicular and heavy equipment access to the areas of PCP and PCP/arsenic contaminated soils in the northeastern portion of the site. This includes reestablishing the roadway extending through the wooded area along the eastern property line, for construction and post-construction monitoring purposes, and clearing and grubbing the vegetation to allow excavation of contaminated surficial soils. These areas are shown on Drawing C-6. Other existing roadways will be improved and some new roadways may be constructed if needed.

2.1.3 Construction Details Including Design and Construction Technical Factors

In preparation for construction activities, all required erosion control measures (e.g., straw bales, silt fence, diversion channels, etc.) will be put in place prior to soil disturbance. Once erosion control measures are in place, remaining site preparation activities will commence.

Construction erosion control measures will follow standard erosion and sediment control best management practices (BMPS) and will be based upon the USEPA Summary Guidance *Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.*

Prior to the start of construction, a Notice of Intent (NOI) form for construction site activities will be sent to the WDNR. A stormwater pollution prevention plan will be developed to address construction erosion and sediment control practices at the site. The plan will include instructions for evaluating the effectiveness of implemented erosion control measures and implementing contingency measures, if required, to address observed erosion effects.

Standard erosion control measures such as silt fencing will be located at the down-gradient side of excavation and fill areas to reduce the erosion potential. Ditches may have periodic earth dikes, check dams, or sediment traps to reduce the mobility of sediment. Mulch wood chips resulting from clearing and grubbing or other cost effective mulch will be spread over

sloped barren areas where construction activities have been completed to provide erosion protection.

In order to prevent sediment from being tracked offsite on roads, the construction entrance will be stabilized with crushed rock transition sections between unpaved and paved areas. The Truck Shop (Building No. 10) concrete slab will be used as a truck wash/decontamination area and will be demolished and disposed offsite at the end of the project.

As the construction erosion control practices are implemented, they will be visually evaluated for effectiveness and adjusted as appropriate to limit the erosion potential at the site.

As mentioned in Section 2.1.1.2, the existing roadway extending through the wooded area along the eastern property line will be reconstructed to allow vehicular and heavy equipment access to proposed PCP and PCP/arsenic soil excavation areas.

Clearing and grubbing will be performed, as required, in areas scheduled for soil excavation and/or regrading. An effort will be made to preserve mature trees (i.e., trees with an approximate trunk diameter greater than 21 inches). These trees will be designated for preservation by a CH2M HILL representative prior to commencement of clearing and grubbing activities. Vegetative matter removed during clearing and grubbing activities will be shredded onsite and used as onsite fill and/or erosion control mulch as described in the specifications. Tree stumps will be uprooted, shredded, and placed within designated areas of the CAMU.

One existing inactive groundwater production well, PW-1, as shown on Drawing C-1, will be abandoned, per WDNR requirements, during site preparation activities. It is approximately 175 feet deep and contains a pump that must be removed prior to abandonment.

2.2 Building Demolition and Debris Disposal

2.2.1 Description of Building Demolition

All existing buildings will be demolished to ground level along with removal of all concrete slabs and associated utilities uncovered during the demolition. To the extent possible, demolished buildings and metal scrap piles will be salvaged. Material with no salvage value will be disposed in a nearby solid waste landfill. Buildings, concrete surfaces, etc., will be visually inspected prior to demolition for signs (e.g., staining) of PCP and/or arsenic contamination. Prior to commencement of demolition activities, all existing utilities will be located and designated for either removal or protection.

Material identified during visual inspections will be tested for Toxicity Characteristic Leaching Procedure (TCLP) arsenic and PCP. Uncontaminated concrete and concrete passing the TCLP test will be disposed in the CAMU. Concrete failing the TCLP test will be stabilized prior to disposal in the CAMU. Uncontaminated wood scrap will be salvaged for fuel value, if possible.

2.2.2 Buildings to be Demolished

Table 1 lists structures onsite that will be demolished and Drawing D-1 shows the approximate building locations. Approximate dimensions and construction materials of each structure are also given in Table 1. A total of 16 (at least partially standing) buildings and five additional concrete slabs will be demolished. Also, a ten-foot diameter by 30-foot long steel tank, a ten-foot diameter by 20 feet high steel tank, and a six-foot diameter by 42-foot long retort chamber will require removal, and possibly cleaning prior to removal. One of the buildings onsite (the former treatment building) has two smokestacks approximately 36 inches in diameter standing about 75 and 100 feet high, which will require dismantling.

2.2.3 Treatment Details Including Design and Construction Technical Factors

2.2.3.1 Building Demolition

During demolition activities, nonhazardous materials resulting from the demolition of buildings will be transported to a nearby solid waste landfill, or may be salvaged. Hazardous construction materials may be encountered in the treatment building, such as asbestos insulation and/or lead-based paint. Any such materials will be removed and disposed in an appropriate manner.

2.2.3.2 Concrete Demolition

Concrete that does not appear to be visibly contaminated will be broken up into small pieces (approximately one foot in diameter) prior to removal and placed in the arsenic-contaminated (northern) portion of the CAMU. This one-foot diameter will avoid significant void spaces that may consolidate and cause subsidence in the CAMU following placement.

Visibly stained concrete will be collected and submitted to a laboratory for TCLP analysis. If analytical results indicate the concrete passes the TCLP test, the concrete will be broken into one-foot diameter pieces and placed in the CAMU. If analytical results indicate the concrete does not pass the TCLP test, the concrete will be stabilized prior to placement in the CAMU.

Verification samples will be collected from the soil below every concrete slab that appears visually contaminated. The number of soil samples collected will be based on the *Guidance Document for Verification of Soil Remediation, Michigan Department of Natural Resources, April 1994, Revision 1* (see Table 2).

Excavation of soil below the visibly contaminated concrete area will be performed if samples exceed the performance criteria for PCP or arsenic in soil. The area will be resampled following soil excavation and excavation continued until passing conditions found. Samples for verification of the adequacy of arsenic soil consolidation will be performed using quick turnaround atomic absorption (AA) analysis. PCP analysis will be performed by quick turnaround gas chromatography/mass spectrometry (GC/MS) analysis.

2.2.3.3 Disposal of Debris

Materials remaining from demolition activities will be disposed based upon visual observations and/or comparison of analytical results to screening levels. Metallic materials

such as siding and piping will be cleaned with a high-pressure wash, if visibly contaminated, and salvaged. Uncontaminated wood will be stockpiled and transported offsite for use as fuel, if possible. Contaminated wood will be fed into a chipper/shredder and mixed into the PCP (southern) portion of the CAMU. Concrete will be broken up (and stabilized if necessary) as described in Section 2.2.3.2 and placed in the CAMU. General demolition debris such as glass, plastics, insulation, shingles, and unsalvageable wood and metal will be transported to a nearby solid waste landfill for disposal.

2.3 Solidification of Arsenic Soil

2.3.1 Description of Excavation and Solidification of Arsenic Soil

The objective of this component is to excavate and solidify soils grossly contaminated with arsenic and to consolidate and dispose onsite in a CAMU in accordance with NR 736, of the Wisconsin Administrative Code. The area of solidified arsenic disposal within the CAMU will be separated from the area of organic soil contamination. This is intended as a precaution to limit mobilization of arsenic under reducing conditions that may occur in the organic soil area.

The grossly contaminated arsenic soils will be solidified, if necessary to meet TCLP limits, with cement. The corresponding estimated volume of soil that may require solidification is 6,100 cubic yards. Discrete verification sampling will be conducted to determine actual volumes requiring solidification. Previous investigations at the site have shown that solidification will reduce the leachability of the arsenic-contaminated soil to below the TCLP limit for arsenic (REAC, December 1994).

2.3.2 Soil Requiring Treatment

The ROD does not specify a definition of "grossly contaminated soils" to be solidified, although it does present an estimate of 4,000 cubic yards that may require solidification. The 4,000-cubic yard estimate was presented in the FS as an upper limit and was based on the volume of soil exceeding the 10^{-4} industrial direct contact preliminary remediation goal (PRG) for arsenic of 106 mg/kg. This value was used in the FS because it corresponds closely with the 100 mg/kg minimum arsenic concentration in soil that could cause TCLP exceedance (assuming that all arsenic leaches in the test). Therefore, soil exceeding the 106 mg/kg PRG will be considered grossly contaminated soil.

Predesign sampling of soils within the areas identified for solidification in the ROD (ROD Figure 5) was conducted as part of the preliminary design investigations to determine the potential for leaching of arsenic. Ten soil samples were collected and analyzed for total and synthetic precipitation leaching procedure (SPLP) arsenic. The SPLP test will be used to better simulate the characteristics of infiltration in the CAMU. When all the results are available, they will be evaluated and a criteria for soils requiring solidification will be developed. Based on the revised criteria, soil volumes requiring solidification will be revised during the Prefinal Design.

The areas of arsenic-contaminated soil requiring excavation and solidification are shown on Drawing C-2. These areas correspond to the areas shown in the ROD (ROD Figure 5). The preliminary depth of excavation of each area is also shown on the figure. The preliminary area, depth and in situ soil volumes for the areas to be solidified are summarized on Table 3.

Verification sampling will be conducted as described in Section 2.3.4. If soil exceeding the solidification criteria is found, it will be solidified and verification sampling will be conducted again.

2.3.3 Treatment Details Including Design and Construction Technical Factors

2.3.3.1 Solidification of Arsenic with Cement

Soil solidification will be performed onsite using cement. The solidification method will be at the discretion of the remedial contractor. Performance specifications will include meeting the TCLP limit of 5 mg/L in the extract. Specifications limiting the amount of organic debris and size of stones will also be included. Since the access road leading through the wooded area will be reestablished during site preparation activities (see Section 2.1.2), soil excavated from the roadway construction area, which will be stockpiled on the biopad, will be solidified first, if necessary.

2.3.3.2 Placement of Solidified Arsenic in CAMU

The soil-cement mix will be placed at the base of the lagoon to improve slope stability in the area identified on Drawing C-6. As part of Site Preparation, the area will be cleared and grubbed so that it is clear of wood debris and other organics. The soil-cement mixture will be placed prior to set-up to allow a solidified mass to be placed easily in the required areas. The mix will be contained by excavation of pits or placement of berms. Guidance for the proper placement of the soil-cement mix will be provided in the final specifications and drawings.

2.3.4 Performance Standards

Soil exceeding 106 mg/kg arsenic will be excavated and solidified. The performance criteria will be revised based on the SPLP soil sample results. Solidified soil will be TCLP tested and must meet the TCLP limit of 5 mg/L.

Long-term monitoring of the groundwater below the arsenic area of the CAMU will be performed. The arsenic performance standard for groundwater is the Wisconsin preventative action limit (PAL) of 5 μg/L.

Post-excavation sampling will be conducted in the excavation areas. Remaining soils will be sampled at random locations throughout the bottom of the excavation to determine whether performance standards have been obtained or whether an additional foot of soil should be excavated. Soils will also be sampled at regular intervals around the perimeter of the excavation area to determine whether additional soil requires excavation beyond the horizontal limits of the excavated area. The number of bottom and perimeter soil samples are presented in Table 4. The number of samples was determined based on the methodologies presented in the *Guidance Document for Verification of Soil Remediation, Michigan Department of Natural Resources, April 1994, Revision 1.*

Samples for verification of the arsenic solidification areas will be analyzed using field portable X-ray fluorescence analysis with a detection limit of about 50 mg/kg because the performance standard is 106 mg/kg. These criteria may be revised based on the SPLP soil sample results.

Additional excavation will be performed if the upper 95 percent confidence limit of the mean (UCL) of the samples exceeds the performance standard. If the calculated UCL marginally exceeds the performance standard, additional soil samples will be analyzed and the UCL recalculated. When the UCL exceeds the performance standard, the sample results will be evaluated to determine where additional soil should be excavated. Bottom samples exceeding the performance standard would likely result in a greater depth of excavation, in the area around the exceeding samples. When perimeter samples are the cause of the UCL exceedance, additional excavation outward from the perimeter a distance of one half the distance between perimeter samples will be performed to the depth previously excavated. The area of excavation will be resampled following excavation and the UCL recalculated. Excavation is complete when the UCL is less than the performance standard.

2.3.5 Long-term Performance Monitoring and O&M

The long-term monitoring of the arsenic area of the CAMU is described as part of the groundwater monitoring discussed in Section 2.8.5.

2.4 Biopad Removal and Backfill in CAMU

2.4.1 Description of Biopad Removal and Backfill

The biopad (Drawing C-1) will be broken up into manageable sized blocks and used as backfill for slope stability in the CAMU north of the lagoon. Approximately three inches of soil beneath the biopad will be removed and placed in the CAMU. Concrete and soil debris removed from the biopad will be placed in the northeastern section of the CAMU (i.e., arsenic disposal section). Upon removal of the biopad and underlying soil, an infiltration basin will be constructed within the biopad footprint area to allow infiltration of treated groundwater (see Section 2.8.3.5). The remaining disturbed area will be regraded and revegetated according to the Specifications and Drawings.

2.4.2 Treatment Details Including Design and Construction Technical Factors

2.4.2.1 Biopad Demolition

The biopad measures 295 feet wide by 430 feet long and is approximately 12 inches thick (approximately 4,700 cubic yards) will be demolished into pieces approximately one foot in diameter. These concrete pieces will be removed and placed in the arsenic portion of the CAMU to provide additional stabilization of the regraded slope. A shallow layer of soil (approximately three inches) will be excavated below the concrete to remove arsenic contaminated materials that may be present from the demolition of the biopad. Major regrading of the biopad area (outside of the previously mentioned treated groundwater infiltration basin) is not anticipated due to the shallow depth (approximately 1 to 1.5 feet) of material (concrete and subgrade) removal. After demolition and removal of soil, an infiltration basin will be constructed as described in Section 2.8.3.5.

2.4.2.2 Placement in CAMU

The concrete and soil from the biopad demolition will be placed in the arsenic portion of the CAMU at base of lagoon to provide slope stability. The one-foot maximum diameter of the concrete pieces will reduce the chance of subsidence in the CAMU due to void spaces filling

with soil or collapsing. Additionally, no concrete, either from the biopad or other demolished building foundation, will be placed within five feet of the top of the CAMU to prevent frost action from pushing the concrete through the soil cover.

2.4.3 Performance Standards

A visual verification will be sufficient to ensure all concrete from the biopad has been removed. Previous sampling of flaking concrete and loose sand from the biopad indicated that the arsenic leaching potential is small (CH2M HILL, 1998). Removal of three inches of soil immediately below the concrete will help to provide assurance that arsenic contamination that might have leached or arsenic present in dust and rubble generated during demolition will be removed.

2.4.4 Long-term Performance Monitoring and O&M

Monitoring will be conducted as part of the CAMU monitoring and inspection. The former biopad area will be inspected periodically to verify that the vegetation has taken hold and any other erosion control measures implemented have been successful.

2.5 Excavation and Consolidation of Arsenic Soil and PCP Soil and Wood Chips

2.5.1 Description of Excavation and Consolidation

Areas of arsenic and PCP soil and sediment contamination outside the CAMU area and exceeding the cleanup criteria will be excavated and placed within the CAMU prior to placement of the soil cover. The arsenic area refers to those soils exceeding background concentrations but less than the solidification criteria of 106 mg/kg. Portions of the wood chip pile will also be excavated and consolidated within the gully area. Removal of trees will be necessary in the area north and east of the lagoon prior to excavation. Efforts will be made to save mature trees.

Co-mingling of arsenic and PCP contaminated soils in the CAMU will be avoided to the extent possible. Arsenic contaminated soil will be placed in the slope stabilization area north of the lagoon while PCP contaminated soils will be placed in the lagoon and gully area.

2.5.2 Soil Requiring Excavation

The areas and depths of contaminated soil requiring excavation and consolidation are shown on Drawing C-2. It should be noted that some arsenic-contamination excavation areas include locations where samples indicating no detection of arsenic were collected (such as the eastern portions of Areas 12 and 27). The detection limit for these samples was 49 mg/kg, whereas the removal criterion for this project is expected to be below 5 mg/kg. Therefore, the extent of these excavation areas was based upon historical information of practices at the site.

The areas, depths of excavation and in-situ volumes of soil for consolidation are listed in Table 3. Verification sampling will be performed as described below and additional soil excavated and consolidated if the performance standards are exceeded. For design purposes, it was assumed that the total volume of soil, sediment, and wood chips to be

consolidated within the CAMU was equal to the calculated total plus a 40 percent contingency to account for additional excavation that may be required as result of verification sampling.

The PCP soil areas, depths of excavation and in situ volumes of soil for consolidation (listed separately from the arsenic soil areas in Table 3) will be consolidated in the central and southern portions of the CAMU. The majority of these areas will be excavated to a depth of one foot prior to verification sampling. The PCP wood chip area will be excavated to a depth of ten feet. Verification sampling will be performed as described below and additional soil or wood chips excavated and consolidated if the performance standards are exceeded.

2.5.3 Treatment Details Including Design and Construction Technical Factors

2.5.3.1 Excavation

During excavation activities, soil removal will proceed from the uphill side of the area down the slope to avoid recontamination of exposed clean soils. Excavation in the lower wetland area (northeastern portion of the site) will be conducted in winter, if possible, to allow heavy equipment to operate in the wetland area without the need of support mats to prevent the equipment from sinking. A small berm will be constructed to prevent recontamination of wetlands until all soils are consolidated and the excavation is completed. If excavation cannot be performed during the winter, the excavated sediments will be dewatered, as necessary, and placed in the CAMU. The pore water will be sampled and treated, if necessary.

The area underneath the new roadway will be excavated, stockpiled and covered on the biopad until consolidation in CAMU is possible. Arsenic contaminated soils in the eastern wooded portion of the site will be excavated around mature trees designated by a CH2M HILL representative.

Soil verification sampling will be conducted at the base and around the perimeter of all excavations prior to any final regrading or revegetating of the area.

2.5.3.2 Placement in CAMU

As previously stated, arsenic contaminated soils will be placed in the northern portion of the CAMU along the regraded slope. Erosion control measures, such as diversion berms and sediment traps, will be constructed upgradient of the disposal area prior to the filling of the CAMU to avoid runoff erosion during construction activities.

The PCP contaminated wood chips in the western portion of the site will be excavated, placed in the CAMU and mixed within the CAMU with sand to improve its air and water permeability. This will reduce the potential for perched water conditions in the wood chips and will allow better bioventing system air flow. The volume of wood chips, located on the western edge of the site, is approximately 5,600 cubic yards based on the area (Area 14) shown on Drawing C-2 and a depth of excavation of ten feet. A ratio of approximately three parts wood chips to one part sand will be used based on the availability of PCP contaminated soil to be consolidated.

The PCP contaminated wood debris located within the CAMU in the lagoon and gully area will also be mixed with PCP contaminated sand to improve its air and water permeability

and reduce the potential for perched water conditions that currently occur in portions of the wood debris. Approximately 30,000 cubic yards of wood debris from the lagoon and gully area (refer to Table 5) will be mixed with PCP contaminated soil within the CAMU.

2.5.4 Performance Standards

Areas of arsenic soil contamination above a background concentration of 5.2 mg/kg will be excavated and consolidated within the CAMU. The background performance standard will be revised prior to submittal of the prefinal design. The soil background arsenic criteria will be based on the upper 95 percent of the mean for ten background samples.

Sediments in the wetland (Areas 29 and 30) identified on Drawing C-2 will be excavated for consolidation. In addition, sediments with visible contamination or with washout debris such as pole butts will also be excavated.

The PCP criteria for excavation and consolidation is 2.1 mg/kg for onsite soils and 0.9 mg/kg for offsite soils. These criteria correspond to the 10^{-6} excess lifetime cancer risk values for industrial and residential exposures.

Verification sampling will be conducted as described in Section 2.3. The number of bottom and perimeter verification soil samples are presented in Table 4. Samples for verification of the adequacy of arsenic soil contamination will be performed using quick turnaround AA analysis. PCP analysis will be performed by quick turnaround GC/MS analysis.

2.5.5 Long-term Performance Monitoring and O&M

Long-term performance monitoring and operation and maintenance are described in Section 2.6.

2.6 Soil Cover, Erosion Control Measures and Revegetation

2.6.1 Description of Soil Cover, Erosion Control Measures and Revegetation

Once soil and sediment consolidation is completed, a soil cover will be placed over the treatment, gully, and lagoon source areas (labeled as "arsenic-contaminated materials" and "PCP-contaminated materials" on Drawing C-6). This area will be designated as a CAMU in accordance with NR 736 of the Wisconsin Administrative Code.

The CAMU will initially be covered with six inches of soil from the uncontaminated areas west of the main source area onsite. Following installation of the erosion control measures and the lagoon repair, an additional six inches of soil with sufficient organics to allow revegetation will be placed on the CAMU. A fence will be erected around the CAMU.

The erosion control plan for the PWP site will involve controlling surface water runoff such that the volume and velocity of overland flow is reduced to a level that will not result in the severe erosion of surface soils currently occurring at the site. This goal will be achieved by constructing a system of ditches, diversion berms, downchutes and through revegetation. The Surface Water Control Plan (SWCP) is shown on Drawing C-6

Revegetation of the CAMU and disturbed areas of the site will involve establishment of native grasses and trees. To assist in initial establishment of native grasses, soil amendments

(topsoil, fertilizer, mulch, etc.) may be admixed with the soil. In addition, temporary erosion control features (matting, mulch, etc.) may be implemented to assist with erosion control.

The lagoon repair and recontouring plan will involve stabilizing the existing gully area and diverting the surface water that currently reaches the lagoon to one of the downchutes. The goal of the repair effort north of the lagoon will be to create a uniform slope of about 15 to 20 percent, consistent with the slopes on either side of the existing gully.

2.6.2 Construction Details Including Design and Construction Technical Factors

2.6.2.1 Soil Cover

The following design objectives were identified regarding the design of the CAMU cover:

- Accommodate the estimated volumes of arsenic- and PCP-contaminated soil, sediments, wood chips, and concrete debris (Table 3) to be consolidated within the CAMU,
- Construct the CAMU over the approximate area shown on Drawing C-6 (approximately seven acres).
- Design and construct a one-foot thick soil cover cross section consisting of six inches of onsite soil overlain by six inches of clean soil sufficient for revegetation. The upper six inches may also be onsite soil if sampling verifies that arsenic and PCP are less than cleanup standards and the soil can be used for revegetation.
- Design CAMU cover grades to control surface water runoff,
- "Blend" cover grades into existing topography as much as possible

Utilizing these design objectives, cover grades were developed for the CAMU as shown on Drawing C-6. Given the estimated excavation volumes, the maximum height of the CAMU, given its current areal extent, is approximately eight feet (along the ridgeline). The contours shown on Drawing C-6 indicate that the CAMU dips longitudinally to the northeast at an average slope of six percent (similar to existing grades) with transverse sideslopes ranging from three to eight percent.

An area located within the southwest section of the site is being investigated as a potential borrow source (Drawing C-6). To minimize construction costs and to expedite the schedule, cover material will be obtained from the onsite borrow source where possible. If borrow investigation sampling indicates that the material is not suitable or of sufficient quantity for the cover construction, additional material will be obtained from an offsite source.

Since clay deposits have been observed during preinvestigation sampling within the proposed borrow area, these soils will be used as cover construction material for the northeast portion of the CAMU where arsenic-contaminated debris will be consolidated. Although not required by the ROD, the use of low permeability soils in the arsenic portion of the CAMU will reduce infiltration through the arsenic soils. This is not a goal for the PCP portion of the CAMU because infiltration is necessary to provide moisture for bacterial degradation of the PCP.

2.6.2.2 Erosion Controls

Erosion from the site after implementation of the remedy will be controlled through the stormwater management system and through the revegetation plan.

The soils found on the site are primarily sand. The barren slopes with grades less than ten percent will be protected from erosion by spreading mulch over the barren areas during revegetation. Slopes greater than ten percent will be covered with erosion control mats and vegetation. Erosion control mats will have typical life expectancies of three years, which is expected to be sufficient to allow vegetation to become well established. The mulch and matting will reduce the erosion potential from rainfall and help establish vegetation by maintaining the soil moisture content in the soil. Fertilizer and/or topsoil may be applied to revegetate barren locations. Once the grasses are established, pine seedlings will be planted.

The stormwater management ditches, downchutes, and diversion berms will be designed with erosion resistant linings. The ditches and diversion berms at the site will be designed with mild side slopes to prevent side slope erosion. Ditches will be designed to convey a 25-year return period storm. The ditches will be located along the perimeter of the CAMU to convey runoff to the downchute as well as from the bottom of the downchute to the wetland area. In addition to these ditches, diversion berms will be constructed to prevent runoff from continuing to erode gullies on steep barren slopes resulting from construction. Instead, the diversion berms will funnel the runoff to an erosion-resistant downchute.

Rock check dams and sediment traps will be constructed along the ditches to provide erosion and sediment control during the construction phase. Because the revegetation will occur slowly over several seasons, the rock check dams and sediment traps in the ditches will be left in place and will continue to provide erosion and sediment control benefits after construction has ended.

The downchutes will be constructed on the steepest slopes of the site in order to prevent the gully erosion that is currently occurring. The downchutes will be constructed of rock or rock gabion mattresses. Abrasion and corrosion resistant mesh will be used to construct the gabion mattresses. A geotextile lining will form a boundary between the rock and the underlying soils to prevent the migration and erosion of fines and sands through the rock material. An energy dissipation apron will be located at the end of the downchute to slow the water velocity before the flow continues into the downstream ditch.

2.6.2.3 Revegetation

Barren areas at the site will be revegetated with a combination of grasses and trees. The grass seed mix used at the site will be selected to include quick growing grasses that will provide fast acting soil stabilization as well as slower growing grasses suitable to the site conditions.

Pine seedlings will be planted at the site at 20-foot intervals. Pines provide a suitable tree for the site conditions and a transition to the natural northern hardwood coniferous and deciduous forest surrounding the site.

The nutrient value of the soil will be evaluated to determine if organic material such as topsoil must be added in order to establish vegetation as part of the final design.

2.6.3 Performance Standards

Erosion control during construction will be monitored according to the Stormwater Pollution Prevention Plan (SPPP) developed for the construction activities. The plan will specify periodic visual inspection of the construction erosion control elements and the necessary repair of any elements that have failed since the previous inspection.

After construction, long-term erosion control at the site will be controlled through revegetation. The goal of erosion control is to prevent the reoccurrence of gully erosion along steep slopes and to maintain soil stability throughout the site. Some temporary erosion control measures left over from construction will remain functional long enough in order to establish long-term vegetative erosion control measures. These goals will be measured visually to see if erosion is occurring and if vegetation is growing.

Revegetation performance will be measured for grasses by the percentage of area that does or does not have vegetative growth. The measurement will occur within several months after revegetation. If vegetation is not established over the required percentage of area shown in the plans and specifications, then the area will have to be reseeded. The establishment of trees will be measured in a similar fashion, except a longer duration will be used to evaluate success. The measurement for successful tree planting will occur at least one year after planting. Trees that have died within one year will be replaced.

2.6.4 Long-term Performance Monitoring and O&M

Long-term erosion control at the site will be achieved primarily through vegetation. The site will be visually inspected at the beginning and end of each growing season for locations experiencing increased erosion or decreased vegetation. The primary focus for erosion control will be the downchutes and CAMU areas. Erosion control at the rest of the site will be monitored and repaired only if the erosion will negatively impact the long-term performance of the CAMU or offsite properties at levels beyond what would be expected for the final land use. Subsidence of the CAMU cover will be monitored through visual inspections. Repairs will be made to prevent water from ponding on the CAMU cover.

Erosion control maintenance may require excavation of ditches that fill with sediment and the repair of rill erosion where there is potential for severe gully erosion to develop on the CAMU. Erosion control is expected to be more significant in the first few years after construction while vegetation continues to establish. Long-term maintenance should be minimal as vegetation develops at the site.

Vegetation maintenance functions may include reseeding and the placement of erosion matting if severe erosion occurs. Vegetation maintenance will be also be more significant in the first few years after construction and should be minimal as the vegetation develops.

The downchutes will be visually inspected for damage and functionality on an annual basis. Maintenance activities may include the rock placement as the gabions settle and the gabion mesh deteriorates.

2.7 Bioventing

2.7.1 Treatment System Description

The objective of bioventing is to enhance aerobic degradation of PCP-contaminated soil by injecting air into the unsaturated zone above the groundwater table. Bioventing will be conducted in the CAMU after the soil consolidation and cover is completed. The bioventing system will consist of injection wells, connecting piping, blower, controls, treatment building, and piezometers. The target depth of treatment extends to approximately 102 feet below (the existing) ground surface (bgs), about two feet below the current water table elevation. The groundwater collection system will be used to lower the water table to allow air supply to the LNAPL smear zone at the current water table.

A process flow diagram for the bioventing system is provided on Drawing N-2. The major design criteria for bioventing are the air flowrate and the radius of influence of the bioventing wells. These design criteria were investigated during the FS and summarized in a bioventing treatability study (CH2M HILL, 1998).

2.7.2 Soil Requiring Treatment

The deep soil area of PCP-contaminated soil requiring bioventing is shown on Drawing C-3. It includes the portion of the CAMU shown on Drawing C-6. The depth of contamination in the central area of the CAMU is about 120 feet and extends from the existing surface to about ten feet below the current water table. The southern area of the CAMU near the former treatment building has shallow PCP contaminated soil top a depth of approximately ten feet. The volume of contaminated soil to be biovented is 400,000 cubic yards. The average PCP concentration in the unsaturated zone is 150 mg/kg and in the smear zone is 1,500 mg/kg. The wood debris and buried wood chips placed in the CAMU will be treated with the bioventing system. Placement of this material was described in Section 2.5.3.2.

2.7.3 Treatment Details Including Design and Construction Technical Factors

2.7.3.1 Injection Wells

The injection wells for the full 102-foot thick target depth are designed to deliver 500 scfm at approximately 50 inches H_2O to the subsurface target area, based on the results of the bioventing treatability test. The 125-foot design radius of influence for each bioventing well was determined using the results of the treatability study. The radius of influence has been defined as a soil gas pressure reading of greater than 0.1 inches H_2O (AFCEE, 1992). Soil gas pressures well above 0.1 inches H_2O and oxygen measurements near 20 percent were detected 100 feet from the test well. The data were plotted and a design radius of 125 feet is expected to have soil gas pressures above 0.1 inches H_2O. The radius of influence plot can be found in Attachment 1.

The design air flowrate was also determined using the treatability study results. The treatability study was conducted using a 500-scfm air flowrate at a pressure of 50 inches H_2O. This air flowrate was able to saturate the subsurface soil with oxygen to a depth of 90 feet. The ability of the injection wells to accommodate this air flowrate was confirmed using a mathematical model. The model predicts the air flowrate across the injection well screen. The model predicted the injection well could handle 328 scfm per foot of well screen. This rate is well above the treatability study air flowrate of five scfm per foot. Since the

treatability study achieved oxygen saturation at the 500-scfm flowrate, there is no need to increase the air flowrate. The model results can be found in Attachment 1. The two biovent wells located in the southern end of the CAMU are designed for treatment of the upper ten feet of soil. Given the shallower depth, an air flowrate of 100 to 200 scfm per well was determined to be adequate to saturate the soil with oxygen.

The deep bioventing wells will be constructed with four-inch inner diameter (ID) polyvinyl chloride (PVC) pipe with approximately 110 feet of screen, ten feet of which will be below the groundwater table. The two shallow biovent wells will be constructed with four-inch ID PVC pipe with approximately 15 feet of screen. The wells will be connected to piping that will be located below the frost line. Multiple injection points may be considered to target specific zones of contamination.

2.7.3.2 Header Piping

Air from the blower will be sent to a manifold pipe where it will be sent to each injection well through individual pipes. Each well will be equipped with a flow control valve and flow meter so the actual air flowrate to each well can be determined. The manifold will be located inside the treatment building.

2.7.3.3 Blower

The bioventing blower will be specified to provide a total of 4,000 scfm at 50-inches H_2O in order to provide the required air flowrate to each injection well. The blower is expected to be a 125-hp centrifugal blower and have the capability to deliver 5,000 scfm, with minor modifications, in case additional injection wells are required or higher flowrates are needed in the future.

2.7.3.4 Instrumentation and Controls

The bioventing system will be designed to operate in either a continuous or pulsed operation mode. Pulsed operation refers to an operation mode whereby the blower is turned on for a specified period of time followed by a period of nonoperation (e.g., bring the oxygen concentration up to 20 percent and shut off the system until oxygen concentration drops to five percent). The goal of this type of operation is to reduce the electrical cost associated with operating the blower. This would also lessen the drying of the soil and minimize the potential need to increase soil moisture.

Airflow measurements will be conducted at the site using magnehelic pressure gauges and the air flowrate to each well will be set manually at the site. The blower will be equipped with a flow meter to measure the total output of the blower. This flow meter will be equipped with a preset Low Flow alarm to indicate the blower is not functioning.

The bioventing system will not be equipped with any system redundancy. Based on the results of the treatability study, shutdown of the bioventing system for a short time is not expected to be deprive the target area of oxygen.

2.7.3.5 Bioventing System Startup

In general, startup of the bioventing system will consist of the following steps:

- Initiation of blower operation
- Adjustment of the air flowrate to the injection wells

- Perform soil gas pressure measurements to determine the radius of influence
- Perform oxygen uptake studies to evaluate need for pulse operation
- Additional adjustments of air flowrates

The actual operating conditions will be compared to the bioventing treatability study to determine if the wells are performing as predicted.

2.7.4 Performance Standards

Per the ROD, the soil is considered remediated when it no longer causes groundwater contamination exceeding 0.1 µg/L PCP, the NR 140 PAL (ROD page 41). The soil cleanup goal protective of groundwater presented in the ROD (ROD Table 1) is 4.6 mg/kg. It was developed based on the Sommers Model methodology (Roy F. Weston, 1994) which does not account for the relatively slow leaching rate of PCP. Also it has a relatively high degree of uncertainty because of the assumptions made in the model. Although the bioventing performance standard is set at 4.6 mg/kg, it may be modified in the future if it is found that a differing value is protective of groundwater.

2.7.5 Long-term Performance Monitoring and O&M

The objective of the long-term performance monitoring program is to assess the degree and effectiveness of PCP removal and whether the soil cover and erosion control measures are preventing transport of arsenic and PCP. Monitoring activities for bioventing will include:

- Lysimeter sampling
- Soil gas analyses below bioventing treatment areas
- Soil sampling within bioventing treatment areas
- Routine inspection of cover and sampling if necessary

The existing lysimeter nests LY02 and LY03 will be sampled on an annual basis for the first five years to determine whether observable trends in pore water PCP concentrations are evident, and to determine the amount of electron acceptors and donors and degradation byproducts. Subsequent sampling, if necessary, will be based on these initial results. Analysis will include PCP, chloride, nitrate, sulfate, dissolved iron, hydrogen, oxidation/reduction potential, and pH.

Several new piezometers at varying depths will be installed in discrete locations. The purpose of the piezometers is to allow for the monitoring of soil gas composition to assess effectiveness in delivering air to the affected subsurface regions. Soil gas analyses will be conducted semiannually, at a minimum. Analyses for oxygen, carbon dioxide, methane, temperature, and moisture will be measured in the piezometers and the monitoring wells identified for groundwater sampling. If levels are out of acceptable ranges, process modifications may be proposed. For example, insufficient soil moisture may facilitate the installation of air sparging wells in the bioventing treatment areas to augment the insufficient moisture as well as provide additional oxygen to the more stagnant air near the water table.

Soil samples for PCP and other degradation indicators (i.e., chloride, pH) will be collected one to three times during the operational period. Samples will be collected at discrete locations and at various depths and analyzed for PCP, chloride, nitrate, sulfate, dissolved

iron, hydrogen, oxidation/reduction potential, and pH. Based on the results, a decision to continue bioventing operation and/or implement another treatment alternative will be made at that time.

The effectiveness of the bioventing alternative will be evaluated after five years. The evaluation will be based on analytical results collected from the groundwater and soil environmental monitoring. If the bioventing was unsuccessful in treating the areas highly contaminated with PCP, then either continued bioventing and/or implementation of other treatment alternatives, such as in-situ steam stripping, may be considered.

2.8 Groundwater and LNAPL Collection and Treatment

2.8.1 Treatment System Description

The objectives of the Groundwater and LNAPL Collection and Treatment System are to:

- Remove LNAPL, to the extent practicable, to reduce a source of PCP to the groundwater,
- Lower the water table to the extent practicable to allow bioventing to promote natural degradation of the residual diesel fuel petroleum hydrocarbons and the PCP in the LNAPL smear zone,
- Contain, collect and treat the most concentrated portions (exceeding 1,000 µg/L PCP) of the PCP groundwater plume and reduce the concentrations to a level that allows natural attenuation to achieve the NR 140 standards in a reasonable period of time.

The groundwater extraction wells will be designed to depress the water table and capture the area of PCP groundwater exceeding 1,000 µg/L. LNAPL recovery systems will be installed in the product recovery wells located adjacent to the groundwater extraction wells. The LNAPL and groundwater treatment system will consist of connecting piping, a product recovery tank, (possible) oil/water separator, activated clay treatment, granular activated carbon (GAC) treatment, controls, building, and discharge piping. The treated water discharge will be to an infiltration basin to be constructed north of the treatment building within the footprint of the biopad area. Recovered LNAPL will be managed as F032-listed hazardous waste and is expected to be sent offsite for incineration at a permitted RCRA Subtitle C Treatment, Storage, and Disposal (TSD) Facility. A process flow diagram for the LNAPL and groundwater collection and treatment system is provided on Drawing N-1.

The preliminary groundwater treatment system has been designed to treat the PCP and other organic contaminants to the required discharge standard. A metals removal treatment system for the two metals expected to exceed PALs (iron and manganese) is not included. It is anticipated that these inorganics will oxidize and precipitate in the upper few feet of the infiltration basin. Monitoring within and below the infiltration basin will be performed to evaluate the removal of iron and manganese.

Groundwater contamination exceeding the cleanup goals outside the influence of the groundwater collection system will be allowed to naturally attenuate to the cleanup goals. Also, once the objectives of the groundwater collection and treatment system are met and the system is shut down, the remaining groundwater exceeding the cleanup goals will be allowed to naturally attenuate. Groundwater monitoring will be used to track the progress of natural attenuation.

2.8.2 LNAPL and Groundwater Requiring Collection and Treatment

In addition to the target bioventing area, the following areas are shown on Drawing C-3:

- The area of LNAPL recovery
- The area of groundwater collection (the containment zone defined by the 1997 1,000 µg/L PCP contour)
- The area of groundwater contamination exceeding cleanup goals (defined by the 1997 PCP nondetect contour)

The depth of groundwater contamination is approximately 40 feet below the water table. The average PCP concentration in the unsaturated zone is approximately 15,000 µg/L based on the area weighted mean of the October 1997 groundwater monitoring results for wells within the target remediation area (Table 6). These estimated influent concentrations will be reevaluated once all the pump test water quality analysis results are available. A summary of the estimated influent concentrations and discharge standards are presented in Table 7.

2.8.3 Treatment Details Including Design and Construction Technical Factors

2.8.3.1 LNAPL and Groundwater Extraction Wells

Four aquifer pump tests were completed on the PWP site during the month of May 1999. These tests indicate that approximately 0.2 feet of drawdown (decrease in water level) can be maintained 64 feet from the pumping well at a 15-gpm flowrate. A summary of the original pump test data and model outputs can be found in Attachment 2.

The data gathered during the first step of Test 2, one to two gallons per minute (gpm), were considered unreliable because the pump was too large to steadily maintain a small pumping rate. The remaining data were plotted on a log-log scale to produce a drawdown versus time graph. These graphs were then fit to a Theis curve (Fetter, 1994), Unconfined Aquifer curves, and Leaky Aquifer curves (Lohman, 1989). This analysis resulted in an approximate average hydraulic conductivity of 11 feet per day for the site.

After an initial hydraulic conductivity was estimated, a model was developed to approximate conditions at the site. The model was developed using WinFlow, by estimating the regional gradient and using the previously calculated hydraulic conductivity. Data from the third step of Test 3 was used to test the model. A pumping well was inserted into the model at the approximate location of MW-18 at a pumping rate of 12 gpm. The hydraulic conductivity was varied until a final value of 38 feet per day was reached, and the model simulated the 0.2 feet of drawdown, 64 feet from the well, as observed during Test 3.

The results of the pump testing indicated that a pumping rate of approximately 15 gpm could be maintained at the site. Results of the model indicate at a flowrate of 15 gpm, seven extraction wells would capture groundwater in the containment zone and produce a minimum of one foot of drawdown at the zone boundary. The water extraction wells will be placed in the same area as the bioventing/LNAPL recovery wells. Subsequent model simulations indicate that a 12 gpm flowrate would be adequate to capture the groundwater in the containment zone, but will result in only 0.8 feet of drawdown. A flowrate of less than 11 gpm may result in insufficient containment. The 15 gpm flowrate from each well is expected to lower the water table approximately up to 1.5-2 feet, providing additional drawdown to assist in bioventing the smear zone.

Where appropriate, groundwater extraction wells will be placed in the same borehole as the bioventing/LNAPL recovery wells. The borehole must accommodate a six-inch water extraction well and a four-inch bioventing/LNAPL well. This will result in a 20-inch diameter borehole to a depth of approximately 150 feet. The water extraction strings will be screened at the bottom of the borehole, and extend the entire 150 feet. The product recovery strings and bioventing strings will extend to approximately 110 feet. The shallow bioventing wells will not contain a groundwater extraction string or act as a LNAPL recovery well and there will be one combination groundwater extraction well/LNAPL recovery well located in the middle of the LNAPL recovery area

2.8.3.2 Header Piping

Individual pipes from each well will converge into a manifold pipe and will be sent to the beginning of the treatment system in a single pipe.

2.8.3.3 LNAPL and Groundwater Pumps

Based upon the May, 1999 pump test data, the expected flowrate from each well is approximately 15 gpm. Taking into account the depth to groundwater from the surface (approximately 100 feet), the groundwater pumps are expected to be on the order of a two-hp electrical submersible pump. Pitless adapters will be used to connect the riser pipe to the pipe running to the treatment building.

The LNAPL recovery pumps are pneumatic pumps placed approximately at the elevation of the groundwater table. The pumps are equipped with a sensor to detect the presence of LNAPL. When activated, the pump will send product to the product recovery tank located next to the treatment building. The pump will automatically stop pumping when it no longer senses LNAPL. These pumps will require an air supply (compressor) and individual control units that are used to program the fill/empty cycle times. It is expected that these controls will be located in the treatment building, except for the filter/regulator assembly.

2.8.3.4 Groundwater Treatment System and LNAPL Storage

The GAC groundwater treatment system will be designed to reduce the expected influent PCP concentration of approximately 15,000 µg/L to less than 1 µg/L, the practical analytical quanitation limit for PCP. In order to determine the required amount of carbon to treat groundwater containing 15,000 µg/L of PCP at a 100-gpm flowrate, several carbon adsorption models were run to estimate the carbon usage rate. These results along with the field results generated during the May, 1999 pump test and carbon vendor experience were used to estimate the carbon volume and vessel size. The carbon adsorption models are located in Attachment 2.

In order to treat the expected influent PCP concentration to less than 1 µg/L and minimize carbon vessels exchanges, an estimated 20,000 pounds of GAC will be required. The carbon would be contained in two 10,000-pound capacity vessels connected in series. The estimated carbon exchange frequency for the lead vessel is every 200 days. The GAC treatment system specifications will be performance based and focus on reducing the PCP concentration to less than 1 µg/L. The GAC will be a F032-listed hazardous waste and will be regenerated/disposed at a RCRA Subtitle C TSD facility. An activated clay adsorption vessel will be placed prior to the GAC vessels to extend carbon life by adsorbing emulsified LNAPL and filtering suspended solids from the groundwater. The spent activated clay also

will be managed as F032-listedhazardous waste and will be disposed at a RCRA Subtitle C TSD facility. The groundwater treatment system will be operated under continuous flow conditions with minimal contact with air to prevent oxidation of the iron and manganese prior to discharge to the infiltration basin.

LNAPL collected from the recovery wells and possibly an oil/water separator will be pumped to a storage tank located near the treatment building. LNAPL storage will be in accordance with all applicable RCRA requirements. The contents of the storage tank will need to be pumped out periodically. The LNAPL is considered a F032-listed hazardous waste and will therefore be disposed at a RCRA Subtitle C TSD facility.

The proposed location of the treatment building is near the southeast corner of the biopad area, near the building identified as the Peeler Shed (Building No. 8). The main 480V electrical service is located in a small electrical control building. Electric motors and controls will be specified as 480V to the extent practicable. This service would be disconnected from its current location and moved to the new treatment building.

2.8.3.5 Treated Groundwater Discharge

The infiltration basin will be located on the current biopad site. The infiltration basin is located to minimize the potential for treated water to discharge over the target groundwater collection area and induce gradients away from the groundwater collection system. Removal of the biopad and underlying soil will provide a starting point for construction of the infiltration basin. The infiltration basin will be designed to infiltrate the pumping capacity of the groundwater wells (100 gpm). Direct infiltration measurements have not been taken at the proposed infiltration basin location. Instead, vertical hydraulic conductivity information gathered from monitoring well and infiltration test wells was used to estimate the infiltration capacity of the proposed site.

Several options are under consideration for the final infiltration basin design and operation. Two operational and maintenance issues are driving the design options. The first design issue is how well the infiltration basin will function during winter months when the ground is frozen. If the infiltration basin ground freezes and prevents infiltration, then the treatment system would have to be shutdown until the ground thaws. The value added by operating all year versus eight or nine months out of the year may not warrant scrapping the infiltration basin concept because of the expected low O&M costs. The second design issue is how well an infiltration system will function as iron and manganese oxidize and precipitate from the groundwater. The infiltration basin sand will eventually become clogged with the metal precipitates. The clogged sand layer would be scraped off to maintain the required infiltration capacity.

With these two issues in mind, the following designs are under investigation:

- Design the infiltration basin to be an average of two feet deep. Soil freezing may prevent infiltration during winter months. A clogged sand layer can be easily removed.
- Design the infiltration basin to be an average of two feet deep and include an additional five-foot deep rock layer at the bottom of the basin to allow the water to infiltrate below the frost line. Soil freezing will be less likely with the large pore size of the rock so that infiltration can be continued during winter months. However, a clogged sand layer cannot be removed without first removing the five-foot rock layer.

- Design the infiltration basin to be an average of seven feet deep. Soil freezing may prevent infiltration during winter months, depending upon the water depth in the basin. As the sand layer becomes more clogged, the water depth will increase to provide longer operation times between clogged sand layer removal but will result in deeper water depths in the basin.

- Design the infiltration basin to be an average of two or seven feet deep and include a groundwater injection well for winter operation in the event the infiltration basin freezes. A clogged sand layer can be easily removed from the infiltration basin, but cannot be easily removed from the injection well.

The design investigation will continue to evaluate which groundwater disposal option is most favorable for the site conditions. All of the designs would also incorporate an overflow channel from the infiltration basin to allow a controlled discharge out of the basin to reduce the potential for catastrophic basin failure. A fence will be constructed around the basin if it is designed for a seven-foot depth.

2.8.3.6 Instrumentation and Controls

Each well will be equipped with individual flow control valves and flow meters that will be used to set the flowrate. Transfer pumps used to move the groundwater through the treatment system will be controlled using both level switches and variable frequency drive systems that would receive input signals from various flow meters. The volume of water discharged from the system will be recorded on a totalizer.

The GAC system may be equipped with bag filters; however, the activated clay adsorption vessel preceding the GAC vessels may be used to reduce fouling of the GAC vessels. Pressure indicator transmitters will be located before and after the clay vessel or bag filters. A programmable logic controller (PLC) will receive inputs from the pressure transmitters and shut the system down at a preset pressure differential. This alarm would indicate the clay requires backwashing or the bag filters need replacement.

The PLC described above will be used to monitor all automatic functions of the system and receive all alarm inputs. When an alarm input is received, the PLC will activate an autodialer. The autodialer will be programmed with a series of telephone numbers, with the Operations Contractor being the first number to be called. The autodialer will alert the Operations Contractor to the problem with a verbal message and the Operations Contractor would acknowledge the alarm. If the Operations Contractor does not acknowledge the alarm, the subsequent phone numbers will be dialed until the alarm is acknowledged.

The GAC system will not be equipped with any system redundancy. Shutdown of the groundwater system for a short time is not expected to be detrimental to the bioventing system and may in fact be beneficial by reintroducing moisture to the target LNAPL smear zone.

2.8.4 Startup

Startup of the LNAPL and groundwater recovery system will focus on refining the system operation to meet the remedial objectives and performance standards. The main areas that startup will address are:

- Adjustment of groundwater collection system flowrates to achieve capture of the target collection area, optimize drawdown while avoiding excessive groundwater extraction flows. Emphasis will be on measurement of groundwater elevations and LNAPL thickness at variable flow rates.
- Adjustment of flow rates to improve LNAPL removal in the LNAPL recovery wells while preventing LNAPL emulsions or free product in the groundwater collection wells.
- Operation of the groundwater treatment system to minimize the potential for oxidation of iron and manganese in the activated clay and carbon vessels. If necessary addition of polyphosphates to sequester iron and manganese would be considered.
- Optimization of carbon grade to minimize total carbon replacement and disposal costs. Because of high disposal cost of carbon as a hazardous waste, it is important to optimize adsorption of PCP relative to carbon cost.
- Optimizing discharge configurations and infiltration basin dimensions to minimize plugging of the basin from precipitates and minimize freezing problems during cold weather.

2.8.5 Performance Standards

The performance standard for the LNAPL recovery system is to remove the pumpable LNAPL. Once the water table has been depressed and pumpable LNAPL is no longer being removed, the LNAPL recovery will be considered complete. The LNAPL recovery system will remain operable for one year after shutdown in the event that measurable LNAPL reappears during monitoring.

The groundwater collection system will continue operating during the bioventing operational period to continue depressing the water table to allow bioremediation of the smear zone. In addition, it will operate for sufficient time to reduce the PCP contaminant mass in groundwater by at least 90 percent from 1998 concentrations.

The groundwater treatment system will be operated to meet discharge requirements. The discharge requirements are the cleanup goals listed in the ROD (ROD Table 2). They were presented earlier in Table 7.

2.8.6 Long-term Performance Monitoring and O&M

It is anticipated that the system will be operated for ten years to remove the majority (90 percent) of the PCP contaminant mass. Routine maintenance items would include:

- Bag filter replacement (if bag filters are used)
- Backwashing or replacement of the activated clay
- Carbon changeouts (10,000 pounds approximately every 200 days)
- Mechanical preventative maintenance tasks
- LNAPL storage and handling requirements
- Well maintenance tasks

Environmental monitoring will be used to assess the effectiveness of LNAPL removal and groundwater treatment and to assess the degree of natural attenuation. If monitoring data

indicate further spreading of the plume above remedial goals, treatment process modifications, such as the installation of additional extraction wells, may be necessary.

The groundwater monitoring network will include the following wells:

- Unconfined monitoring wells 1, 2, 6S, 9, 10S, 13, 16, and 19
- Semiconfined monitoring wells 3, 4, 5, 7, 8, 10, 11, 12, 14, 15, 17
- Two residential wells

The monitoring wells will be sampled annually and analyzed for PCP and TAL metals and for the following natural attenuation indicator parameters:

- Dissolved Oxygen (DO)
- pH, temperature, and specific conductance
- Oxidation/reduction potential (ORP)
- Alkalinity
- Nitrate-and nitrite-nitrogen
- Sulfate-and sulfide-sulfur
- Total iron, ferrous iron, and ferric iron
- Manganese
- Carbon dioxide (CO_2)
- Chloride

A smaller set of five monitoring wells (MW 3, 10, 10S, 13, 15) will be sampled and analyzed for the parameters listed above on a quarterly basis. Water level elevations will be taken in all wells on a quarterly basis. LNAPL thickness will be measured in unconfined wells in the LNAPL area on a quarterly basis.

2.9 Institutional Controls

2.9.1 Description of Institutional Controls

Institutional controls will consist of land use restrictions for the areas below the soil covers and groundwater use restrictions for the entire site. Deed restrictions in the form of an enforceable restrictive covenant will be used to specify:

1. The CAMU area.
2. That the area is contaminated with PCP, Fuel Oil and arsenic.
3. That excavation within the site boundaries must comply with Occupational Safety and Health Administration (OSHA) requirements for health and safety protection.
4. That any excavated soils will be managed as hazardous waste in accordance with applicable laws.
5. That buildings are not permitted within the CAMU area.
6. That activities which threaten the long-term integrity of the CAMU or its soil cover are not permitted.
7. That installation of wells other than monitoring wells within the plume of groundwater contamination or within proximity to the plume that could effect plume migration are restricted until the groundwater has been restored to compliance with NR 140 standards.

2.9.2 Implementation of Controls

USEPA will implement the restrictive convenant on the PWP site property deed.

2.10 Point-of-Entry Groundwater Treatment

2.10.1 Treatment System Description

Point-of-entry (POE) carbon treatment will be implemented for the residential wells bordering the site if PCP exceeds the NR 140 groundwater quality standards at these wells. The USEPA will determine the remedy based on the preference of the well owner, aesthetic water quality, and expected well life.

Replacement of the residential wells with a deeper well was deemed not feasible because there is no assurance a deeper well within the same sand and gravel aquifer will remain contaminant-free. According to a local well driller, the underlying bedrock aquifer is not suitable for residential use.

2.10.2 Residents Potentially Requiring POE Treatment

The Brethorst, Crosby and Skold residential wells on Daniels 70 are the residents potentially affected by migration of the plume. These wells will be monitored semiannually, and more frequently if there are indications of plume movement toward these wells during remediation.

2.10.3 Treatment Details Including Design and Construction Technical Factors

2.10.3.1 POE Carbon Adsorption Treatment

If POE treatment is selected, the treatment system would be installed downstream from the well and before distribution in the house. This prevents all exposure pathways, i.e., ingestion, inhalation, and dermal contact, related to water use in the house. Sizing of the treatment unit would be based on the assumptions of 100 gallons per day per person in the house and an average of six persons per household. The design treatment capacity would be 600 gallons per day. The system would consist of two carbon vessels installed in series. The upstream vessel will be replaced on a schedule that will prevent exceedance of safe drinking water standards. This schedule will be calculated using conservative carbon adsorption chemical-specific modeling and the assumption that the lead vessel would be changed at least every six months to avoid biological fouling. It is expected that the systems would have a total of approximately 150 to 200 pounds of activated carbon in the two vessels. The treatment system will meet the substantive requirements of Wisconsin plumbing codes for POE treatment systems.

Design of the system will not be included in this design of the remedial action remedy because the influent characteristics are not known. Also it is possible that the POE treatment system may not be needed, either because the wells do not become contaminated or because only new wells may be installed. If needed, a home carbon treatment system supply vendor would conduct the design. A sample of the well water would be submitted to the vendor for the determination of the adsorption rate and the sizing of the carbon vessels. Because USEPA and WDNR have determined the groundwater to be a F032-listed hazardous waste, the carbon will be disposed at a RCRA Subtitle C TSD facility.

2.10.4 Performance Standards

The performance standard for PCP in the water supply system of the house is the NR 140 PAL of 0.1 µg/L.

2.10.5 Long-term Performance Monitoring and O&M

Sampling of the POE treatment system would be performed after installation and at the first change out interval. Additional sampling may be needed if PCP has been found to breakthrough the first carbon vessel.

3 Recommended Project Delivery Strategy and Scheduling

This section presents the project delivery strategy and subsequent scheduling plans for both the remedial design (RD) and remedial action (RA) for the PWP selected remedial action. The primary components of the RD and RA, as discussed in the preceding Sections, are summarized below. Key project delivery strategies, relative to a specific RD or RA component, are noted below in their respective section.

3.1 Remedial Design

In order to streamline the development of the remedial design, preparation and subsequent delivery of the remedial design will be accomplished in two phases: (1) Preparation and submittal of the Preliminary Design and (2) Preparation and submittal of the Prefinal/Final Design.

3.1.1 Preliminary Design

The primary objective of the Preliminary Design (of which this report is a component of), as specified in the SOW is to "...define in detail the technical parameters upon which the design will be based." It is also the intent of the preliminary design to develop all conceptual strategies/ideas that compose the framework of the RD/RA, review these strategies/ideas with the stakeholders, and finalize them so prefinal/final design can proceed with minimal changes (i.e., minimal cost and schedule impacts).

As discussed earlier not all preliminary investigation data was available for inclusion in this preliminary design. Once this data becomes available and is evaluated, a meeting will be held with USEPA to discuss the impacts on the preliminary design.

3.1.2 Prefinal/Final Design

Once the RD/RA conceptual strategies/ideas and supporting technical detail are developed, reviewed, and finalized, Prefinal/Final Design will commence. The conceptual strategies/ideas developed during the Preliminary Design will be expanded into a set of final design documents, consisting of the following:

- Specifications
- Drawings
- Basis of Design Report
- Cost Estimate
- Subcontract Award Documents
- Biddability, Operability, and Constructability Reviews
- Revised Project Delivery Strategy
- Incorporation of Value Engineering Comments
- Draft O&M Manual

- Construction Quality Assurance (CQA) Plan

Detailed design drawings and specifications will be prepared for the majority of the selected remedial action components. However, design details are being structured to allow several of the remedial action components to be performed by the remedial action contractor or subcontractor based on a performance specification. The remedial components that will consist primarily of performance specifications are as follows:

- Arsenic soil solidification. The method of solidification and the ratio of cement to soil will be left to the discretion of the contractor. The remedial design documents will specify meeting the TCLP limit for arsenic in the solidified soil. A performance specification is used here to reduce costs by allowing the contractor flexibility to use available equipment and minimize the cost of cement while meeting the remedial objectives.

- Biopad and building demolition. The methods of demolition are not specified to allow the contractor flexibility. The performance specification includes maximum rubble size for concrete demolition.

- Groundwater treatment system. The detailed design of the groundwater treatment system will be performed by the treatment system subcontractor. The performance based specifications will require meeting specific discharge standards at a flow rate of 100 gpm. The performance based specifications will also include a groundwater treatment system process flow diagram and a process and instrumentation diagram. This will provide flexibility to the treatment system vendor to minimize the capital cost of the treatment system while also providing enough requirements to minimize the long-term operation and maintenance costs of the system.

- Cover construction/soil backfill. Although cover and soil backfill performance objectives will be required, the method of cover and backfill compaction will not be specified to allow the contractor flexibility in choosing methods and equipment for achieving these performance requirements.

3.2 Remedial Action

The primary components of the RA, as discussed in the preceding Sections, are presented below in their expected construction sequence. Key project delivery strategies, relative to a specific RD component, are noted below in their respective section.

- Establishment of Erosion Control Measures: In order to minimize further erosional effects to the site due to existing conditions and/or scheduled construction activities, erosion control measures will be implemented immediately after mobilization of the contractor and before any additional site disturbance.
- Site Preparation: Select clearing and grubbing of vegetated areas will be completed in areas designated for soil excavation and removal. Efforts will be made to minimize impacts to existing vegetation, and select trees will be left in place.
- Building Demolition: In order to better integrate the site into the existing surroundings and minimize risks to potential receptors, all existing buildings will be demolished. To minimize demolition costs, efforts will be made to salvage materials and dispose others onsite within the CAMU.

- Biopad Removal and Backfill Onsite: The existing biopad will be demolished and disposed onsite within the CAMU in an area immediately north of the lagoon.
- Excavation, Segregation, Select Solidification, and Placement of Arsenic Soils in an Onsite CAMU: To minimize the potential development of reducing conditions and subsequent mobilization of arsenic, arsenic-contaminated soils, sediment, and debris will be segregated from the PCP-contaminated wastes and placed in the northeastern portion of the CAMU. The Remedial Contractor will be instructed, via the plans and specifications, to start excavations in upgradient areas to minimize potential for recontamination of excavated areas due to surface water runoff and/or vehicle traffic.
- Excavation and Consolidation of PCP/Fuel Oil Oils and Wood Chips Under a Soil Cover: The PCP contaminated wood chip pile in the western portion of the site will be excavated, mixed with other PCP contaminated materials, and placed in the CAMU. Additional PCP contaminated wood debris currently within the CAMU boundaries will be excavated and mixed with PCP soil prior to placement in the CAMU. This will provide better air distribution for a more rapid degradation rate during bioventing and reduce the seepage of PCP contaminated water from the wood debris. As with arsenic-contaminated material excavation, the Remedial Contractor will be instructed, via the plans and specifications, to start excavations in upgradient areas to minimize potential for recontamination of excavated areas due to surface water runoff and/or vehicle traffic.
- Revegetation: To minimize erosional impacts, disturbed areas will be revegetated in a timely manner. Additional erosion controls (e.g., erosion matting, mulch, etc.) will be implemented where required. To integrate the site into its surroundings, native grasses and pine saplings will be planted across the disturbed areas.
- Bioventing, and Groundwater Collection and Treatment: The building housing the bioventing blowers and groundwater treatment system and controls will be located outside the CAMU area to allow construction to proceed simultaneous with the soil consolidation in the CAMU. Once the soil cover is in place over the CAMU, the bioventing and groundwater collection system wells and piping will be installed. The groundwater collection system will be operated initially to lower the water table slowly to allow LNAPL recovery with minimal smearing to depths currently without LNAPL residual. Once LNAPL is no longer being recovered in substantial quantities, the bioventing system will be placed in operation. This will minimize the effects of positive pressure from the bioventing system on recovery of LNAPL.
- Monitored natural attenuation: The groundwater will be routinely sampled for the site COCs and natural attenuation parameters throughout the entire PCP plume. The effects of the groundwater collection and treatment system and natural attenuation mechanisms will be evaluated through contaminant trend analysis and evaluation of natural attenuation parameters. Details of the monitoring and data evaluation will be presented in the site Operations and Maintenance Manual.
- Institutional controls: Institutional controls in the form a restrictive covenant on the property deed for the PWP site will be established by USEPA to limit site land and groundwater use. Activities necessary to secure institutional controls are not currently anticipated to be performed as part of the remedial design.
- Environmental monitoring/maintenance: Environmental monitoring of soil, groundwater and surface water will be performed to determine the effectiveness of the remedy. A groundwater flow and contaminant transport model will be developed to assist in the evaluation of the groundwater remediation and natural attenuation. The

details of environmental monitoring and modeling will be established in the site Operations and Maintenance Manual.

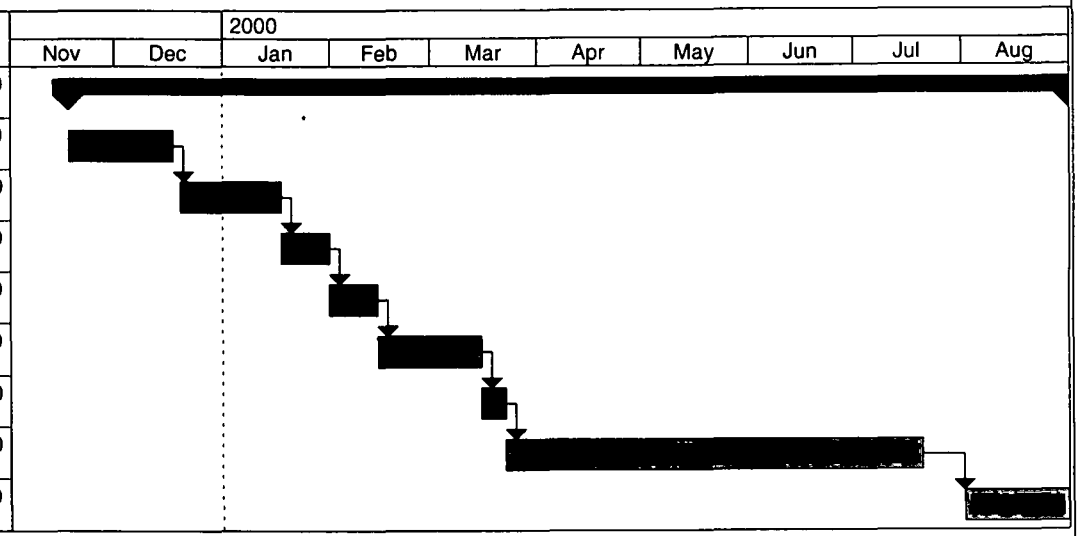
- Point-of-use carbon treatment, if necessary: If monitoring shows consistent exceedances of Wisconsin PALs at residential wells, an activated carbon treatment system will be installed for the house water supply.
- Five-year site reviews: Data collected under the monitoring program will be reviewed on five-year intervals to determine whether human health and the environment continue to be protected and to determine whether additional remedial action is warranted. Alternate remedial technologies will be considered if it is determined that remedial objectives will not be obtained within 30 to 40 years from the start of the remedial action.

4 Preliminary Construction Schedule

A preliminary construction schedule follows this page.

Conceptual Remedial Action Project Schedule
Penta Wood Products

ID	Task Name	Duration	Start
1	**Conceptual RA Schedule**	**288 days**	**Thu 11/18/99**
2	Prepare RA Work Plan	30 days	Thu 11/18/99
3	Agency Review RA WP	29 days	Mon 12/20/99
4	Negotiate/Revise WP	14 days	Tue 1/18/00
5	Agency Approval WP	14 days	Tue 2/1/00
6	Award Bid/Subs plans	30 days	Tue 2/15/00
7	Notice to Proceed	7 days	Thu 3/16/00
8	Construction	120 days	Thu 3/23/00
9	Final Inspection/Closeout	30 days	Wed 8/2/00



Project: PWDCR
Date: Fri 6/11/99

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary

5 Specifications Outline

The proposed specifications required for the remedial action are listed in Table 8. The specifications will be CH2M HILL specifications which conform to the U.S. Army Corps of Engineers (USACE) Construction Specification Institute (CSI) format.

6 Preliminary Drawings

The proposed list of drawings and details is shown in Table 9. Final engineering drawings will be submitted in full size (22 inches by 34 inches) and half size (11 inches by 17 inches) reproductions.

7 Basis of Design

The SOW lists the following elements as part of the Basis of Design:

1. Detailed descriptions of the evaluations conducted to select the design approach
2. Calculations supporting the assumptions
3. A draft process flow diagram
4. A detailed evaluation of how all ARARs will be met
5. A plan for minimizing environmental and public impacts
6. A plan for satisfying permitting requirements

The first three items have been included in Section 2 under each of the remedial components. They are not repeated here to avoid redundancy.

7.1 Compliance with ARARs

7.1.1 Groundwater Regulations

Chemical-specific ARARs for site groundwater include regulations and criteria promulgated under the Safe Drinking Water Act (SDWA), Clean Water Act (CWA), and State of Wisconsin statutes. Under the Wisconsin Groundwater Quality Rules, found in NR 140 of the Wisconsin Administrative Code (WAC), the state has adopted PALs that are more stringent than federal maximum contaminant levels (MCLs). The National Contingency Plan (NCP), 300.430(e)(2)(I)(B) and (C), requires that MCLs be attained for groundwater sources that are current or potential sources of drinking water. The Wisconsin PAL for PCP is 0.1 µg/L and the federal MCL is 1 µg/L. Several other contaminants also exceed their PALs. These are listed in Table 7.

The selected remedy will be complete when PALs have been achieved throughout the groundwater plume. The selected remedy uses a combination of active groundwater collection and treatment and natural attenuation to achieve the PALs. Use of the PWP Site aquifer will be restricted by implementing a groundwater use restriction until PALs are reached.

If a PAL is exceeded in the nearby residential wells, either a new well or a POE treatment system will be installed. If used, the POE system will be maintained until the well water no longer exceeds the PAL.

7.1.2 Effluent Limits

The substantive elements of the WPDES permit process will be used to establish the effluent limits for discharge of the treated water to groundwater (WAC NR 200, NR 207, and NR 220 and NR 283). Infiltration of treated groundwater must meet WAC NR 140 groundwater standards in the groundwater below the infiltration basin unless an exemption under WAC NR 140.28(5) is obtained.

Any dust or emissions from treatment systems, grading or other earthwork must meet the ambient air standards for particulates in WAC NR 404, fugitive dust standards in

WAC NR 415, control of organic compound emissions in WAC NR 419, control of hazardous pollutant emissions in WAC NR 445, and visible emissions standards in WAC NR 431. It is anticipated that only occasional use of water sprays will be necessary to meet the WAC NR 400 requirements for emissions from the earthwork.

7.1.3 Soil Residual Concentrations

The chemical-specific ARARs for residual soils were presented in Section 2. They were developed in accordance with Wisconsin procedures and risk assumptions for determining the soil cleanup standards presented in WAC NR 720.

7.1.4 Hazardous Waste Regulations

The most significant ARAR that affects alternatives involving excavation and treatment of soil is whether or not the contaminated soils to be managed are considered to be hazardous waste. The USEPA and WDNR have determined that the PCP-contaminated soils and groundwater are F032-listed hazardous wastes, and likely D037-TC (toxicity characteristic) hazardous wastes. The arsenic-contaminated soils are F035-listed hazardous waste, and may be D004-TC hazardous waste. The RCRA requirements, as established in the WAC NR 600 rule series, are applicable if the activity being considered as part of the remedial alternative constitutes treatment, storage, or disposal as defined by RCRA. The RCRA requirements are considered an ARAR, and the excavation and disposal activities will require compliance with RCRA waste management standards including, accumulation, storage, transportation, and land disposal restrictions.

LNAPL recovered in the groundwater collection and treatment system will be considered a F032-listed waste and will be treated, stored and disposed in accordance with RCRA requirements. The treatment system will be constructed to comply with the standards for owners and operators of hazardous waste facilities outlined in 40CFR265. The groundwater treatment system will be designed to shut down the flow of water in the event of a drop in pressure from a system leak. The treatment system building will be designed to provide containment of ten percent of the volume of the tanks/containers or 100 percent of the volume of the largest container, whichever is greater.

In addition, storage of the F032 LNAPL waste removed from the groundwater will meet the hazardous waste accumulation requirements outlined in 40CFR262.34. Hazardous wastes will be stored onsite for no longer than 90 days in containers that comply with Subpart I of 40CFR265 within either a drip pad or a containment building that meets the appropriate requirements of 40CFR265. The main requirement of the LNAPL storage area is that it provides secondary containment in the event of a leak or spill. Other requirements include:

- Tank corrosion protection
- Spill prevention controls
- Overfill prevention controls
- Inspections
- Leak detection system
- Possible air emission controls

Should precipitated iron need to be removed from the infiltration cell, this material will not be considered a hazardous waste. The infiltration cell will be used for reinfiltration of environmental media that 1) no longer contains a listed hazardous waste and 2)

concentrations of the hazardous constituents in the environmental media in the infiltration cell are below RCRA toxicity characteristic levels and other health-based levels. At the point that the treated groundwater is discharged into the infiltration cell it will no longer be considered a hazardous waste, thus any precipitate derived from that groundwater could not be considered a hazardous waste. This interpretation is consistent with the U.S. EPA OSWER Guidance Document No. EPA530-F-98-026 dated October 1998, "if contaminated media contain a hazardous waste they are subject to all applicable RCRA requirements until they no longer contain hazardous waste".

Compliance with RCRA will also be achieved by establishing a CAMU in the center of the site for consolidation of the contaminated soil. The CAMU rule within RCRA (40CFR264 Subpart S [264.552]) and WAC NR 636 allows movement of contaminated material within an area of contamination without triggering the requirements for "generated" hazardous waste. In essence it allows consolidation of contaminated soils and sediments containing listed or characteristic waste without triggering the land disposal restriction requirements. This concept is needed for alternatives involving consolidation followed by containment under a cover or otherwise the alternative would not comply with RCRA ARARs. The criteria for establishing a CAMU are given in NR 636.40(3)(b), which states that waste management activities associated with the CAMU may not create unacceptable risk to humans and environment from exposure to the hazardous waste or hazardous constituents. These criteria will be met by covering the CAMU to prevent direct contact and minimize erosion solidifying arsenic contaminated soil that might leach to the groundwater and bioventing the PCP-contaminated soil.

7.1.5 Wetlands

The most important location-specific ARARs for the PWP site are the requirements for protection of wetlands (Executive Order 11990). This ARAR requires that actions at the site be conducted in ways that minimize the destruction, loss, or degradation of wetlands. The requirements evaluation of remediation impacts for wetland areas are included in WAC NR 103.

The site remedy includes excavation of about 0.4 acres and 620 cubic yards of PCP contaminated wetland sediments. Wetlands will not be lost as a result of the excavation but will be degraded. The degradation will be reversed by reestablishing wetland plant species following the excavation.

7.1.6 Air Regulations

The need for control or treatment of air emissions was evaluated based on requirements on the WAC NR 400 series regulations (NR 404, NR 415, NR 419, NR 431, NR 440, and NR 445) for particulate matter and fugitive dust emissions that may result during soil consolidation. Emissions are not predicted to exceed the emissions standards. Reasonable work practices such as use of water sprays to control fugitive dust will be included in the remedial action.

7.1.7 OSHA Requirements

A health and safety plan for construction activities that is in accordance with the Occupational Health and Safety Act requirements listed in 29CFR1910 and 29CFR1926 will be required.

7.2 Minimizing Environmental and Public Impacts

Environmental and public health and welfare impacts will be minimized through:

- Site access control
- Soil erosion control
- Groundwater pollution control
- Air pollution control

7.2.1 Site Access Control

Access control to the site during remediation is necessary to prevent exposure of trespassers to contaminated soil during excavation, treatment or consolidation. Also access control is necessary because of the physical hazard presented by the unstable north lagoon embankment. Access will be controlled by the current fencing and a locked gate. During working hours the gate will be unlocked but kept in the closed position. A sign will be posted at the entrance to notify visitors that they are required to sign in at the office. The gate area will be monitored by personnel in the office area adjacent to the gate. After hours the gate will be locked.

7.2.2 Soil Erosion Control

Soil erosion is presently occurring on the site because of the lack of vegetation. Eroded soils generally are expected to erode downslope in a northerly direction to the area between the lagoon and the wetland. Several embankments have been erected in this area as well as at other areas onsite to minimize runoff.

Soil erosion control will be a significant task during site remediation. Soil excavation will generally begin in the most elevated areas of the site and proceed downslope to avoid recontaminating remediated areas as a result of storm runoff erosion. Silt fencing or hay bales will be used along the downslope portions of the CAMU while soils are in the process of being consolidated on the surface. Silt fencing or hay bales will also be used along the downslope portion of the excavation areas during excavation and following excavation until the area has been regraded and revegetated. Construction of embankments may also be needed to control erosion during remediation.

7.2.3 Groundwater Pollution Control

Well installation and development, dewatering of wetland sediments and decontamination of equipment may generate PCP contaminated water. This water will be collected and analyzed for PCP. If PCP exceeds the PAL, the water will be containerized in holding tanks and treated using the onsite GAC treatment system.

7.2.4 Air Pollution Control

Earthwork during remediation will generate dust. Impacts on workers will be minimized through implementation of a worker health and safety plan specifying a photoionization detector and a dust monitor. These instruments will also be used to monitor the air along the site boundaries to determine whether excessive emissions are occurring to offsite areas. Action levels for dust will be specified and, if exceeded, the area will be sprayed with clean water to reduce dust emissions.

7.3 Compliance with Permitting Requirements

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions do not need to comply with the administrative requirements, such as permitting, of applicable or relevant and appropriate environmental laws and regulations. The substantive requirements however, must be met.

The substantive requirements of a WPDES Permit will be met by requesting the WDNR to provide discharge standards for reinfiltration of treated water to groundwater.

The substantive requirements for impacts to wetlands required under Section 404 of the CWA will be followed. The requirements of the CWA for minimizing impacts and restoration will be followed.

Burnett County requires no permits or requirements for building or erosion control activities for onsite construction. Similarly, the Town of Daniel does not have any permitting requirements.

A WDNR Storm Water Discharges Associated with Construction Activities Permit will be required for construction at the site.

8 Preliminary Cost Estimate

The estimated cost for the remedial action was calculated to be approximately 8.2 million dollars. This cost will be further refined prior to the Preliminary Design Briefing meeting. The preliminary estimated cost in the M-CACES Gold format is attached (Attachment 3). The value engineering (VE) screening task will be performed using this DCR.

9 Variances with the ROD

There are no significant variations between the preliminary design and the ROD. Several minor variations are described below.

9.1 Soil Cover Details

The ROD states that following installation of the erosion control measures and the site regrading, an additional six inches of soil with sufficient organics to allow revegetation will be placed on the CAMU (ROD page 27). The need for addition of organics is being evaluated and it is possible that only fertilizer addition may be necessary. Also soil from onsite may be used for the final six-inch cover instead of soil from an offsite location. Results of the onsite borrow area sampling will be evaluated to determine the suitability of using onsite soils.

9.2 Soil Consolidation Areas

Two excavation areas, Areas 7 and 9 (see Drawing C-2), were modified based on reevaluation of analytical data. Area 7, an arsenic solidification area, was shown at N1000 E2000 in the ROD Figure 5. This is 200 feet north of its actual location at N800 E2000.

Area 9 (coordinates N1900 E700) was shown on ROD Figure 5 as a kidney shaped area based on exceedance of the background arsenic at two locations. After further review, it was found that sample location N1861 E822 had a nondetect for arsenic. As a result the area to be consolidated has been reduced in size.

9.3 Residential Well Carbon Treatment

The ROD specified that either point-of-use (POU) carbon treatment or well replacement would be used in the event of a residential well becoming contaminated with PCP. The variation from the ROD is substitution of point-of-entry (POE) carbon treatment for POU treatment.

POU carbon systems are small canisters that are placed under the counters of the sinks in the kitchen and the bathrooms. This approach would eliminate the ingestion exposure pathway during drinking and cooking and dermal contact during hand washing at the sink. This approach would not reduce the inhalation exposure or dermal contact during showering or bath use. Also changeout of the canisters is more tedious because of the number of locations in the house and introduces the potential for exceeding the changeout period.

POE treatment systems are installed downstream from the well and before distribution in the house. This prevents all exposure pathways, i.e., ingestion, inhalation, and dermal contact, related to water use in the house. Also changeout could be provided by the vendor on a routine basis, thus ensuring the carbon replacement interval is not exceeded. Because of

its greater protectiveness and ease of carbon replacement, it was substituted for the POU system.

10 Land Acquisition and Easement Requirements

Acquisition of land is not required to implement the remedial action. USEPA currently has access to the PWP site through the Consent Agreement. This agreement is expected to remain in force during the site remediation construction and operation period. The Penta Wood Products company was dissolved and the land is tax-forfeit and in Burnett County's jurisdiction.

A temporary easement will be necessary for the property east and north of the site where soil and sediment will be excavated. This land is owned by Orma Crosby, Lee and Suzanne Helene and Jeffery Helene. It is anticipated that an access agreement will suffice provided that it includes language that the land surface and wetland will be restored and revegetated following excavation.

A temporary easement will also be necessary for the excavation of soils within the Old State Route 70 right-of-way (ROW) where soil will be excavated. The area of soil contamination to be excavated from the ROW is estimated to be 1.1 acres. This land is owned by the Wisconsin Department of Transportation (WDOT). It is anticipated that the temporary easement will be obtained, provided that it includes language that the land surface will be restored and revegetated following excavation.

11 References

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TABLES

TABLE 1
Structures To Be Demolished
Penta Wood Products

Number	Building	Approximate Dimensions	Structural Material	Floor
1	Office	20' x 50' x 12'	Wood	6" Concrete
2	Garage	20' x 45' x 15'	Wood frame & tin shell	6" – 1' concrete with 3' high concrete berm on sides.
3	Treatment[a, b]	80' x 100' x 15'	Wood, tin shell, & concrete block	Concrete
4	Storage Shed[c]	25' x 50' x 6"	None	Concrete slab
5	O/W Separator	20' x 30' x 15'	Wood frame & tin shell	Partial concrete slab
	Tank near O/W Separator	10' diameter	Steel	Unknown
6	Shaving Vault[c]	25' x 50' x 6"	None	Concrete slab
	Tank near Shaving Vault	10' diameter	Steel	Unknown
7	Mission Control	10' x 12' x 12'	Wood frame & tin shell	6" concrete
8	Peeler Shed	20' x 30' x 12'	Wood frame & tin shell	6" concrete
9	Unknown[c]	10' x 10' x 6"	None	6" concrete slab
10	Truck Shop	30' x 60' x 15'	Wood frame & tin shell	1' concrete slab
11	Garage	36' x 42' x 15'	Wood frame & tin shell	1' concrete slab
12	Sawmill	20' x 30' x 6'	Wood frame & tin shell (trusses only)	Dirt
13	Sawmill	10' x 60' x 12'	Wood frame & tin shell	Dirt
14	Unknown	12' x 30' x 15'	Wood frame & tin shell	Dirt
15	Unknown	12' x 20' x 10'	Wood	Dirt
16	Sawmill	30' x 60' x 15'	Wood frame & tin shell	Partial 6" concrete (10' x 35')
17	Slasher Control House	10' x 15' x 12'	Wood	6" concrete slab
18	Sawmill[c]	20' x 45' x 6"	None	Concrete slab
19	Sawmill	10' x 15' x 12'	Concrete block & tin roof	1' concrete slab with two 10' x 30' x 6" concrete slabs on north and south sides.
20	Scale House[c]	10' x 25' x 1'	None	6" – 1' concrete
21	Unknown	6' x 6' x 10'	Wood frame & tin shell	1' concrete slab

[a]Two smoke stacks are present. One is roughly 100' high x 36" diameter, the other 75' high x 36" diameter.
[b]Approximate dimensions of retort chamber are 42' length x 6' diameter.
[c]These buildings have been demolished, the materials have been removed, and only the concrete slab remains.

TABLE 2
Excavation Floor Samples
Penta Wood Products

Area of Floor (ft^2)	Number of Samples
<500	2
500 < 1,000	3
1,000 < 1,500	4
1,500 < 2,500	5
2,500 < 4,000	6
4,000 < 6,000	7
6,000 < 8,500	8
8,500 < 10,890	9

TABLE 3
Areas and In Situ Volumes of Soil for Excavation and Consolidation in CAMU
Penta Wood Products

	Location (structures #s on Drawing D-1)	Site Plan Coordinates	Notes	Approximate Dimensions[a] Diameter (ft)	Length (ft)	Width (ft)	Drawing C-2 Area (ft^2)	Thickness (ft)	In Situ Volume (yd^3)
Areas of Arsenic Contamination to be Solidified and Consolidated in Arsenic CAMU Area									
1	ACZA Treatment area of CAMU	N800 E1100	Re-evaluate based on SPLP Results		100	210	18,100	5	3,352
2	SW area of CAMU	N1000 E1200	Re-evaluate based on SPLP Results		100	190	15,100	1	559
3	Biopad Drainage Area	N1400 E1200	Re-evaluate based on SPLP Results	70			3,400	1	126
4	Central area of CAMU	N1200 E1300	Re-evaluate based on SPLP Results		110	220	22,500	1	833
5	East of Retort	N800 E1400	Re-evaluate based on SPLP Results	90			6,100	1	226
6	NE wooded area	N1300 E1900	Re-evaluate based on SPLP Results		180	150	23,700	1	878
7	East wooded area	N800 E2000	Re-evaluate based on SPLP Results	80			3,900	1	144
								Subtotal	6,119
Concrete to be Consolidated in Arsenic CAMU Area									
	Biopad	N1400 E900	Concrete average 1 foot thick		295	430	126,850	1.00	4,698
	#1 -- Office	N600 E800	6" thick concrete		20	50	1,000	0.50	19
	#2 -- Garage	N800 E800	Building has 3' high wall around perimeter (assumed 8 in. thick: (20+20+45+45) x 8/12=87cf=3.2 cy)		20	45	900	1.00	36
	#3 -- Treatment Building	N800 E1000	Assume 8" thick concrete		80	100	8,000	0.67	199
	#4 -- Former Storage Shed	N700 E1500	6" thick concrete		25	50	1,250	0.50	23
	#5 -- O/W Separator	N900 E1200	Assume 8" thick concrete		20	30	600	0.67	15
	#6 -- Former Shaving Vault	N1100 E1100	6" thick concrete		25	50	1,250	0.50	23
	#7 -- Mission Control	N1100 E1000	6" thick concrete		10	12	120	0.50	2
	#8 -- Peeler Shed	N1100 E1000	6" thick concrete		20	30	600	0.50	11
	#9 -- Unknown (concrete slab)	N1100 E1100	6" thick concrete		10	10	100	0.50	2
	#10 -- Truck Shop	N900 E900	1' thick concrete		30	60	1,800	1.00	67
	#11 -- Garage	N850 E800	1' thick concrete		36	42	1,512	1.00	56
	#16 -- Sawmill	N1900 E500	6" thick concrete		10	35	350	0.50	6
	#17 -- Slasher Control House	N1700 E600	6" thick concrete		10	15	150	0.50	3
	#18 -- Sawmill	N1800 E700	6" thick concrete		20	45	900	0.50	17
	#19 -- Sawmill	N1300 E500	1' thick concrete		10	45	450	1.00	17
	#19 -- Sawmill (add'l concrete slabs)	N1300 E500	6" thick concrete		20	30	600	0.50	11
	#20 -- Scale House	N600 E1500	1' thick concrete		10	25	250	1.00	9
	#21 -- Unknown	N300 E1000	1' thick concrete		6	6	36	1.00	1
								Subtotal	5,215
Areas of Arsenic Contamination to be Consolidated in Arsenic CAMU Area									
8	NW of Biopad	N1600 E700			180	410	64,600	1	2,393
8A	Below Biopad	N 1400 E900	Upper 3 " of soil from below biopad		295	430	126,850	0.25	1,175
9	North site perimeter	N1900 E700	Re-check sample 1861N 822E		140	90	12,600	1	467

TABLE 3
Areas and In Situ Volumes of Soil for Excavation and Consolidation in CAMU
Penta Wood Products

	Location (structures #s on Drawing D-1)	Site Plan Coordinates	Notes	Approximate Dimensions[a] Diameter (ft)	Length (ft)	Width (ft)	Drawing C-2 Area (ft^2)	Thickness (ft)	In Situ Volume (yd^3)
10	Biopad Drainage Area	N1400 E1200	Area= Area of 10 minus area 3				3,700	1	137
11	SE of CAMU	N900 E1500					118,000	1	4,370
12	NE wooded area	N1300 E1800					162,000	1	6,000
								Subtotal	14,541
								Arsenic CAMU Area Subtotal	**25,875**
Areas of PCP and Arsenic Contamination to be Consolidated in PCP CAMU Area									
13	Lagoon washout area	N1500 E1900	Remove washed out soils to native soil-assumed at 1.5 ft average depth				114,400	1.5	6,356
								Subtotal	6,356
Areas of PCP Contamination to be Consolidated in PCP CAMU Area									
14	Wood Chip Pile	N1400 E200	Wood chips to be mixed with PCP soil		100	150	19,500	10	7,222
15	Area around "stained area 6"	N800 E400			110	150	16,000	1	593
16	"Stained Area 7"	N900 E450			65	60	3,500	1	130
17	"Stained Area 8"	N1000 E500	Sample SS-20 had 21.4 ppm @ 3'		30	60	1,800	3	200
18	"Stained Area 10"	N950 E550			70	40	2,600	1	96
19	"Stained Area 11"	N850 E550			60	50	3,000	1	111
20	"Stained Area 12"	N800 E600	370 ppm @ 1' bgs		80	90	8,100	2	600
21	"Stained Area 14"	N650 E600			30	60	1,800	1	67
22	"Stained Area 15"	N700 E700			50	70	3,200	1	119
23	NW of "Stained Area 20 "	N850 E700			40	40	1,400	1	52
15-23	Combined Excavation Area	N800 E600	Added excavtion between Areas 15-23						2,000
24	"Stained Area 18"	N950 E850			60	50	2,300	1	85
25	North of Biopad	N1600 E1000			100	150	14,200	1	526
26	East of sawdust pile	N1000 E200			40	30	1,200	1	44
27	North side of Old State Route 70	N600 E1200	All samples were < 0.5'bgs.		60	830	40,400	0.5	748
28	South side of Old State Route 70	N550 E900	Single sample was surface sample		50	130	6,300	0.5	117
29	Wetland sediment	N2300 E1900	Remove visible washout soil and wood debris at a minimum		120	140	16,800	1	622
30	Lagoon washout area south of wetland	N2000 E1900	Remove visible washout soil and wood debris at a minimum		330	150	52,400	1	1,941
								Subtotal	15,272
								PCP CAMU Area Subtotal	**21,628**
								Total for All Areas	**47,502**

[a]Approximate dimensions are not used in calculation of areas.

TABLE 4
Soil Verification Samples
Penta Wood Products

	Location	Site Plan Coordinates	Approximate Dimensions[a] (ft)					Verification Samples			
			Diameter	Length	Width	Perimeter	Area[a]	Bottom Samples	Perimeter Samples	Distance Between Perimeter Samples	Total Samples
Areas of Arsenic Contamination to be Solidified and Consolidated in Arsenic CAMU Area											
1	ACZA Treatment area of CAMU	N800 E1100		100	210	450	18,100	6	4	113	10
2	SW area of CAMU	N1000 E1200		100	190	410	15,100	5	4	103	9
3	Biopad Drainage Area	N1400 E1200	70			240	3,400	2	4	60	6
4	Central area of CAMU	N1200 E1300		110	220	460	22,500	6	4	115	10
5	East of Retort	N800 E1400	90			283	6,100	3	4	71	7
6	NE wooded area	N1300 E1900		180	150	580	23,700	6	4	145	10
7	East wooded area	N800 E2000	80			251	3,900	2	4	63	6
								Subtotal for arsenic field screening analysis			**59**
Areas of Arsenic Contamination to be Consolidated in Arsenic CAMU Area											
8	NW of Biopad	N1600 E700		180	410	810	64,600	8	5	170	13
9	North site perimeter	N1900 E700		140	90	400	12,600	5	4	100	9
10	Biopad Drainage Area	N1400 E1200				310	3,700	2	4	78	6
11	SE of CAMU	N900 E1500				1,150	118,000	7	6	203	13
12	NE wooded area	N1300 E1800				1,570	162,000	8	6	242	15
									Subtotal for arsenic AA analysis		**55**
Areas of PCP and Arsenic Contamination to be Consolidated in PCP CAMU Area											
13	Lagoon washout area	N1500 E1900				1,260	114,400	8	6	213	14
								Subtotal for As AA and PCP GCMS analysis			**14**
Areas of PCP Contamination to be Consolidated in PCP CAMU Area											
14	Wood Chip Pile	N1400 E200		100	150	440	19,500	6	4	110	10
15-23	Combined Areas 15 to 23	N800 E600				1,250	97,200	8	6	212	13
24	"Stained Area 18"	N950 E850		60	50	220	2,300	2	4	55	6
25	North of Biopad	N1600 E1000		100	150	400	14,200	5	4	100	9
26	East of sawdust pile	N1000 E200	40	40	30	126	1,200	2	4	31	6
27	North side of Old State Route 70	N600 E1200		60	830	1,710	40,400	5	7	254	11
28	South side of Old State Route 70	N550 E900		50	130	310	6,300	3	4	78	7
29	Wetland sediment	N2300 E1900		120	140	300	16,800	6	4	75	10
30	Lagoon washout area south of wetland	N2000 E1900		330	150	1,200	52,400	6	6	207	12
								Subtotal for PCP GCMS analysis			**85**
										Total for All Areas	**212**

[a]Area based on CAD system calculation from drawing of site excavation areas.

TABLE 5
Wood Debris Volumes To Be Mixed With PCP Soil
Penta Wood Products

	Location	Site Plan Coordinates	Notes	In Situ Wood Debris Length (ft)	Width (ft)	Area (ft^2)	Thickness (ft)	Volume (yd^3)	PCP Soil for Mixing[a] (yd)
14	Wood Chip Pile	N1400 E200	Wood chips to be mixed with PCP soil	100	150	15,000	10	5,556	1852
	Lagoon Area	N1400 E1500	Wood debris to be mixed with PCP soil	130	170	22,100	15	12,278	4093
	Gully Area	N1200 E1400	Wood debris to be mixed with PCP soil	170	250	42,500	8	12,593	4198
							Total	**30,426**	**10,142**
			PCP Soil Volume to be Consolidated (from Soil Excavation Table)[b]						**14,406**

[a]Mix ratio is 3 parts wood debris to 1 part PCP soil.

[b]PCP soil volume from Table 2, Soil Excavation Volumes. It is the sum of PCP soil to be consolidated minus the wood chip volume.

TABLE 6

Estimate of Groundwater Treatment Sytem Influent Concentrations

Penta Wood Products

		Contaminant Concentration (µg/l)												
		Unconfined Subareas						Semiconfined Subareas						
	Subarea	A- MW 5	B- MW10S	C- MW 20[e]	D- MW 18	E- MW 6S	F- MW 19	A- MW 12	B- MW10	C- MW 10	D- MW 14	E- MW 6[d]	F- MW 4	Total
	Area (ft^2)	110,000	46,200	46,200	81,000	37,500	96,000	110,000	46,200	46,200	81,000	37,500	96,000	
	Aquifer Volume[a] (ft^3)	880,000	369,600	369,600	648,000	300,000	768,000	880,000	369,600	369,600	648,000	300,000	768,000	6,670,400
Contaminant	PAL (µg/L)													Volume Weighted Concentration (µg/L)
PCP	0.1	28,000	30,000	29,000	27,000	1	19,000	13,000	8,200	8,200.0	1	4,300	1	**14,591**
Arsenic	5	3.2	1.0	1.0	8.2	1.0	1.0	1.0	1.4	1.4	1.0	1.4	1.0	2.1
Benzene	0.5	0.05	0.40	0.05	0.05	0.05	0.05	1.00	0.20	0.20	0.05	0.20	2.00	0.4
Chloride	125,000[b]	50,000	38,000	38,000	49,000	57,400	47,000	50,000	35,000	35,000	8,000	35,000	7,300	37,227
Copper	130	24	11	11	44	1	3	5	3	3	1	3	1	10
Ethylbenzene	140	3.0	0.9	0.5	2.0	0.5	0.5	2.0	2.0	2.0	0.5	2.0	3.0	1.7
Iron	150[b]	4,860	45	45	32,000	10	5	267	2,190	2,190	10	2,190	36	**4,137**
Manganese[c]	25[b]	12,900	10,300	10,300	10,600	4,720	2,690	1,660	2,330	2,330	4	2,330	56	**4,984**
Toluene	69	5.0	1.0	0.5	16.0	0.5	0.5	3.0	3.0	3.0	0.5	3.0	1.0	3.4
Xylene	124	21.0	8.0	0.1	19.0	0.5	0.2	14.0	17.0	17.0	0.5	17.0	3.0	10
Zinc	2,500[b]	1	8	8	26	2	2	11	9	9	1	9	1	7.0

Note: All data are from groundwater sampling in October 1997.

[a]Aquifer thickness of unconfined and semiconfined estimated at 20 feet for each. Porosity =0.4.

[b]PAL based on public welfare concerns (taste and odor).

[c]Data is for total manganese. Dissolved manganese may be much lower.

[d]BTEX and inorganic data unavailable for MW 6. Data from MW10 used.

[e]Inorganic data unavailable for MW20. Data from MW10S used.

TABLE 7

Treatment System Influent Concentrations and Discharge Standards (PALs)
Penta Wood Products

Chemical of Concern	Estimated Influent Concentration [a] (µg/L)	PAL Discharge Standard (µg/L)
Arsenic	2	5
Benzene	1	0.5
Chloride	37,000	125,000 [b]
Copper	10	130
Ethylbenzene	2	140
Iron	4,100	150 [b]
Manganese	5,000 [c]	25 [b]
Naphthalene	NA	8
Pentachlorophenol	15,000	0.1
Toluene	3	69
Xylene	10	124
Zinc	7	2,500 [b]

[a] Influent concentrations based on area weighted mean concentrations of October 1997 groundwater monitoring results (see Table 6).

[b] Discharge standard based on public welfare concerns (taste and odor aesthetics).

[c] Estimated influent concentration is based on total manganese and is likely an overestimate.

TABLE 8

Proposed Specification Outline

Penta Wood Products

Division	Description	Section
00	General	
01	General Requirements	01001
01	Summary of Work	01010
01	Of Prop.	01016
01	Measurement & Payment	01025
01	Coordination	01040
01	Abbreviations	01092
01	Project Meetings	01200
01	Submittals	01300
01	Progress Schedules	01310
01	Downtime	01312
01	Operations and Maintenance Data	01430
01	Temporary Controls	01500
01	Mobilization & Cleanup (drilling)	01505
01	Decon. of Personnel & Equipment	01722
01	Contract Closeout	01780
01	Materials and Equipment	01600
01	Manufacturer's Services	01640
01	Facility Startup	01810
02	Demolition	02050
02	Disposal	02082
02	Site Preparation	02100
02	Dewatering	02140
02	Excavation Support Systems	02160
02	Excavation	02205
02	Borrow Pits	02210
02	Subgrade Preparation	02215
02	Fill & Backfill	02220
02	Soil Erosion Stabilization	02240
02	Geotextiles	02246
02	Riprap & Riprap Bedding	02271
02	Gabion Wall Construction	02272
02	Reinforce Earth Wall	02274
02	Disposal	02330
02	Drilling Methods	02581
02	(Drilling) Surface Closure	02591
02	Disinfection of Water Systems	02683
02	Drainage Piping	02700
02	Fittings	02700-02
02	Soil Preparation	02920
02	Lawns & Grasses	02930
02	Trees, Plants, & Ground Covers	02950
03	Reinforcing Steel	03210
03	Doweling for Concrete	03215
03	Control joints	03251
03	Cast-In-Place Concrete	03300
03	Concrete Curing	03370
03	Grout	03600
05	Metal Buildings	05410
05	Metal Fabrications and Casting	05500
07	Vapor Retarders	07260
08	Metal Doors and Frames	08100
08	Windows	08520
09	Lathe and Plaster (Drywall)	09200
09	Painting	09900
10	Louvers	10200
10	Casework	10300
11	Submersible Well Pumps	11300
11	Hydrocarbon Pump	11301
11	Pitless Adapters	11302
11	Transfer Pumps	11312
11	Blower	11371
11	Tanks	11950
11	Oil/Water Separator	11951
11	Carbon Adsorption Vessels	11952
13	Controls Systems	13400
15	Piping	15060
15	Valves	15100
15	Piping Specialties	15120
15	Piping Supports	15140
15	Plumbing and Building Services	15420
15	Heat Generation	15550
15	Air Handling	15850
15	Pipe Leakage Testing	15992
16	Basic Electrical Requirements	16010
16	methods	16050
16	Raceways	16110
16	Conductors	16120
16	AC Induction Motors	16405
16	Grounding	16450
16	Low Voltage motor Control	16480
16	Lighting	16500
16	Electrical Testing	16950

TABLE 9
Proposed Drawing Outline
Penta Wood Products

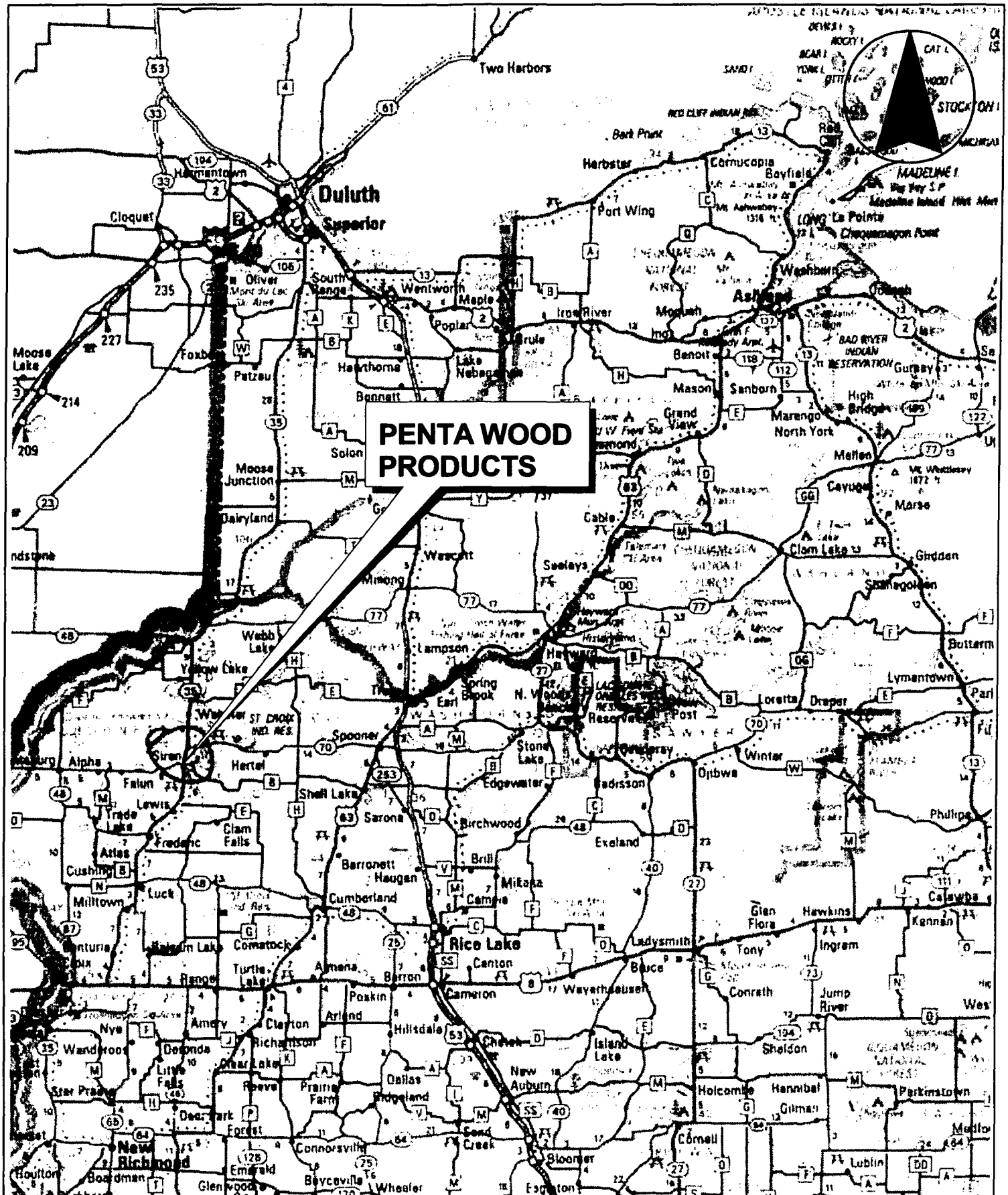
Drawing Number	Description
General	
G-1	**Site Location Map**
G-2	Abbreviations
G-3	Civil/Arch/Struct Legend
G-4	Mechanical Legend
G-5	I&C Legend
G-6	I&C Legend
G-7	Electrical Legend
G-8	Standard Details
G-9	Standard Details
Civil	
C-1	**Site Plan**
C-2	**Soil Excavation and Cover Areas**
C-3	**Site Plan, Bioventing Injection, Groundwater Extraction, and LNAPL Recovery Wells**
C-4	Groundwater Well Sections/Details/Pump Table
C-5	Injection Well Section and Details
C-6	**Conceptual Site Grading and Surface Water Control Plan**
C-7	Site Grading Plans and Details
C-8	Site Grading Plans and Details
C-9	Access Road Plan and Details/Site Utilities
C-10	Access Road Plan and Details/Site Utilities
C-11	Slope Stabilization Plan and Details
C-12	Slope Stabilization Plan and Details
C-13	Slope Stabilization Plan and Details
C-14	Cover Details
C-15	Surface Water Control Plan and Details
C-16	Surface Water Control Plan and Details
C-17	Surface Water Control Plan and Details
C-18	Surface Water Control Plan and Details
C-19	Surface Water Control Plan and Details
C-20	Surface Water Control Plan and Details
C-21	Surface Water Control Plan and Details
C-22	Surface Water Control Plan and Details
Demolition	
D-1	**Site Demolition Plan**
D-2	Building Demolition Details
D-3	Building Demolition Details
Architectural	
A-1	**Process Building General Arrangement**
Structural	
S-1	Building Floor Plan

TABLE 9
Proposed Drawing Outline
Penta Wood Products

Drawing Number	Description
Electrical	
E-1	Electrical One-line, Control Schematics
E-2	Electrical Plan and Details
E-3	Electrical Site Plan
Instrumentation & Controls	
N-1	**Process Flow Diagram - Groundwater System**
N-2	**Process Flow Diagram - Bioventing System**
N-3	Process and Instrumentation Diagram - Groundwater System
N-4	Process and Instrumentation Diagram - Bioventing System
Total Sheets	**43**

Note: Drawings designated in bold are included with the DCR

DRAWINGS



DRAWING G-1

SITE LOCATION MAP

PENTA WOOD PRODUCTS SITE
TOWN OF DANIELS, WISCONSIN

C:\TEMP\PENTA.APR

CH2MHILL

I:/141158/CAD/DRAWINGS/PD/pwpd02.dgn 11-JUN-1999

N

0 100' 200'

WOODED AREA

WETLANDS AREA

SAWMILL

WOOD SCRAP PILE

WOODED AREA

MW13

MW8

MW11

WOOD CHIP PILE

MW17

MW9 MW23

SAWMILL

MW16 MW12

MW24

CONCRETE BIOPAD

FORMER WASTEWATER LAGOON

WOODED AREA

ACCESS ROAD (PARTIALLY WASHED OUT)

SAWMILL

SG-09

SG-08

SG-07

MW2

MW5

MW18

MW25

MW10

MW10S

SG-03

SG-02

SG-01

SG-06

SG-05

SG-04

MW7

PEELER SHED

SHAVING VAULT

FORMER WASTEWATER DISHARGE GULLY

SAWMILL

MW20

EW-01

MW14

MW1

TRUCK SHOP

MW6 MW06S

MW19

OIL-WATER SEPARATOR

MW4

WOODED AREA

GARAGE

BOILER

MW22

TREATMENT BUILDING

GARAGE

PRODUCTION WELL PW-1

MW21

WOODED AREA

MW3

OFFICE

DANIELS 70

SOUTHERN AREA

MW15

N 2200

N 2000

N 1800

N 1600

N 1400

N 1200

N 1000

N 800

N 600

N 400

E 200 E 400 E 600 E 800 E 1000 E 1200 E 1400 E 1600 E 1800 E 2000 E 2200 E 2400 E 2600

LEGEND

- UNCONFINED MONITORING WELL LOCATION
- SEMICONFINED MONITORING WELL LOCATION
- SOIL GAS MONITORING WELL LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- CONCRETE SLAB ONLY

DRAWING C-1

SITE PLAN

PENTA WOOD PRODUCTS SITE
TOWN OF DANIELS, WISCONSIN

CH2MHILL

I:/141158/CAD/DRAWING/PD/pwpd08.dgn 11-JUN-1999

LEGEND

MAXIMUM PCP IN SOIL (0'-10')
- ○ ND @ 4 mg/kg
- ● 5 TO 49 Mg/kg
- ▲ 50-499 mg/kg
- ■ > 500 mg/kg

BOUNDARY OF STAINED SOIL

2' AREA AND DEPTH OF SOIL PREVIOUSLY REMOVED

2 STAINED AREA NUMBER CORRESPONDING TO SITE CHARACTERIZATION REPORT (TABLE 37)

MAXIMUM ARSENIC IN SOILS TO 5' BGS
- ○ ND @ 49 mg/kg, UNLESS VALUE IS GIVEN
- ● 50 TO 100 Mg/kg
- ▲ 101 TO 380 mg/kg
- ■ > 380 mg/kg

CAMU AREA TO BE COVERED

AREA TO BE REVEGETATED AND GRADED AS NECESSARY

APPROXIMATE PROPERTY BOUNDARY

2 EXCAVATION AREA NO.

(P) DEPTH OF EXCAVATION

ARSENIC-CONTAMINATED MATERIAL TO BE CONSOLIDATED BELOW COVER

ARSENIC-CONTAMINATED MATERIAL TO BE SOLIDIFIED

PCP-CONTAMINATED MATERIAL TO BE CONSOLIDATED BELOW COVER

COMBINED EXCAVATION AREAS 15 - 23 (P)

N 0 100' 200'

N 2400 N 2200 N 2000 N 1800 N 1600 N 1400 N 1200 N 1000 N 800 N 600

E -200 E 0 E 200 E 400 E 600 E 800 E 1000 E 1200 E 1400 E 1600 E 1800 E 2000 E 2200 E 2400 E 2600

CONCRETE BIOPAD

LAGOON

WASTE WOOD DISPOSAL AREA

SAWDUST AREA

WEST PCP WOOD STORAGE AREA

EAST PCP WOOD STORAGE AREA

WOOD HANDLING AREA

SOUTHWEST DRAIN AREA

TREATMENT AREA

SOUTHERN AREA

OLD STATE ROUTE 10

DRAWING C-2
SOIL EXCAVATION AND COVER AREAS
PENTA WOOD PRODUCTS SITE
TOWN OF DANIELS, WISCONSIN

CH2MHILL

I:/141158/CAD/DRAWINGS/PD/pwpd07.dgn 11-JUN-1999

N

0 100' 200'

N 2200
N 2000
N 1800
N 1600
N 1400
N 1200
N 1000
N 800
N 600
N 400

E 200 E 400 E 600 E 800 E 1000 E 1200 E 1400 E 1600 E 1800 E 2000 E 2200 E 2400 E 2600

NORTHWEST DRAIN AREA
SAWMILL AREA
WOOD CHIP AREA
SAWDUST AREA
WASTE WOOD DISPOSAL AREA
SOUTHWEST DRAIN AREA
WEST PCP WOOD STORAGE AREA
TREATMENT AREA
SOUTHERN AREA
EAST PCP WOOD STORAGE AREA
EAST DRAIN AREA
CONCRETE BIO PAD
PROPOSED TREATMENT BUILDING
APPROXIMATE LOCATION OF INFILTRATION BASIN

1997 ND
1000 ug/L 1997

TARGET GROUNDWATER COLLECTION AREA

TARGET LNAPL RECOVERY AREA

TARGET BIOVENTING AREA

LEGEND

- PROPOSED DEEP BIOVENTING INJECTION/ GROUNDWATER EXTRACTION/LNAPL RECOVERY WELLS
- PROPOSED GROUNDWATER EXTRACTION/ LNAPL RECOVERY WELL
- PROPOSED SHALLOW BIOVENTING INJECTION WELL
- APPROXIMATE PROPERTY BOUNDARY
- TARGET LNAPL RECOVERY AREA
- 1997 ND — 1997 PCP NON-DETECT CONTOUR
- 1000 ug/L 1997 — TARGET GROUNDWATER COLLECTION AREA
- TARGET BIOVENTING AREA

DRAWING C-3

SITE PLAN, BIOVENTING INJECTION, GROUNDWATER EXTRACTION AND LNAPL RECOVERY WELLS

PENTA WOOD PRODUCTS SITE
TOWN OF DANIELS, WISCONSIN

CH2MHILL

:/141158/CAD/DRAWINGS/PD/pwpd06.dgn 11-JUN-1999

LEGEND

- CAMU AREA TO BE COVERED
- AREA TO BE REVEGETATED AND GRADED AS NECESSARY
- DITCH
- STORMWATER RUNOFF DIRECTION
- AREAS TO BE CLEARED AND GRUBBED
- APPROXIMATE PROPERTY BOUNDARY

N

0 100' 200'

SEDIMENT BASIN

STORMWATER DOWNCHUTE

DIVERSION BERM

SEDIMENT BASIN

ARSENIC CONTAMINATED MATERIALS

APPROXIMATE LOCATION OF INFILTRATION BASIN

1040 1050 1060 1070 1080

SEDIMENT BASIN

ACCESS ROAD TO BE RE-ESTABLISHED

PROPOSED TREATMENT BUILDING

1090

PCP-CONTAMINATED MATERIALS

DIVERSION BERM

POTENTIAL CAMU COVER BORROW AREA

1100 1110 1120

ROCK DIKE (TYP)

N 2400 N 2200 N 2000 N 1800 N 1600 N 1400 N 1200 N 1000 N 800 N 600

E -400 E -200 E 0 E 200 E 400 E 600 E 800 E 1000 E 1200 E 1400 E 1600 E 1800 E 2000 E 2200 E 2400 E 2600

DRAWING C-6

CONCEPTUAL SITE GRADING AND SURFACE WATER CONTROL PLAN

PENTA WOOD PRODUCTS SITE
TOWN OF DANIELS, WISCONSIN

CH2MHILL

I:/141158/CAD/DRAWING/PD/pwpd01.dgn 11-JUN-1999

LEGEND

- AREA TO BE REVEGETATED AND GRADED AS NECESSARY
- APPROXIMATE PROPERTY BOUNDARY
- CONCRETE SLAB ONLY

NOTES:

NUMBERS CORRESPOND WITH BUILDING NUMBERS IN TABLE 1

N

0 100' 200'

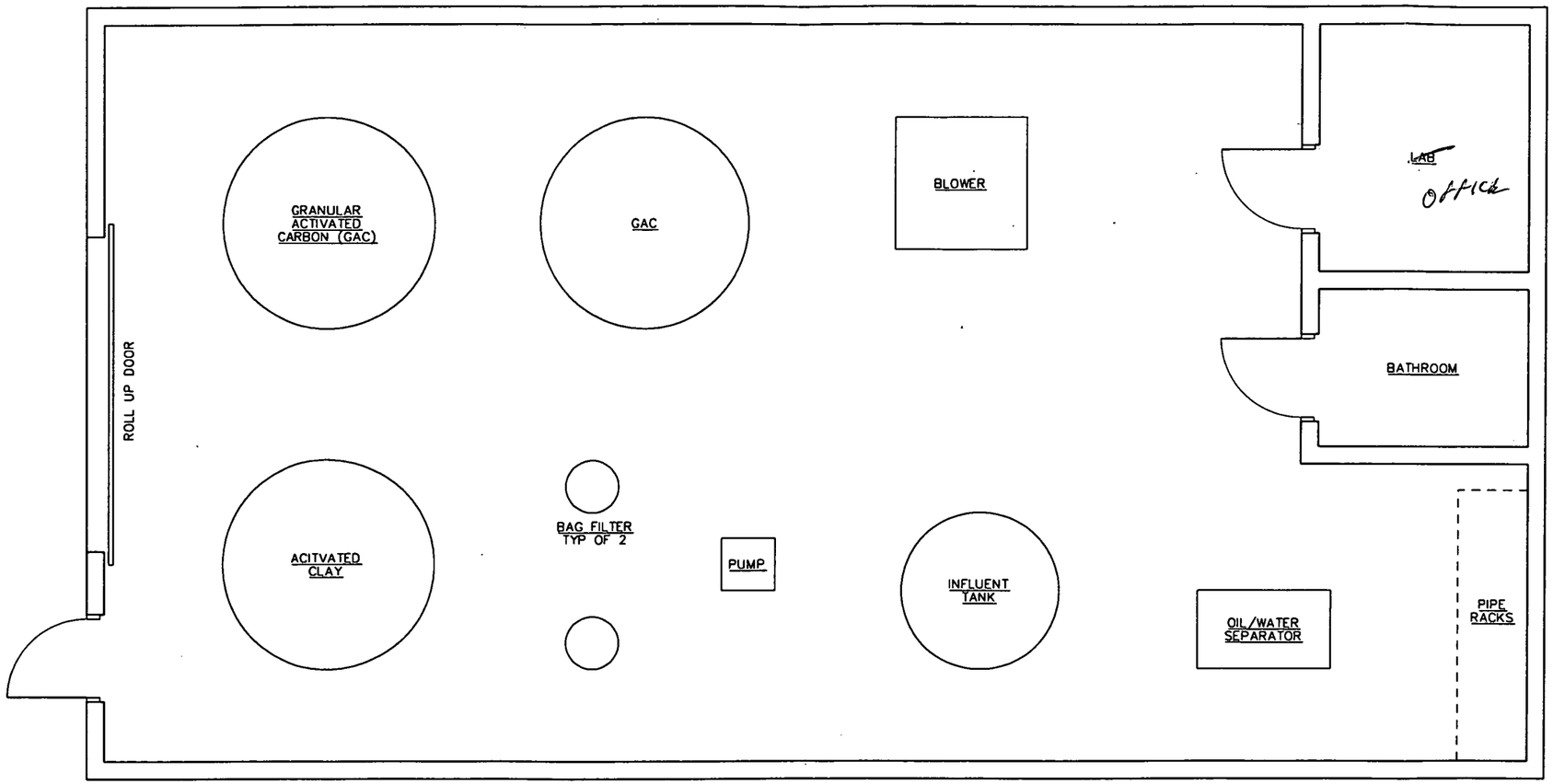
N 2400
N 2200
N 2000
N 1800
N 1600
N 1400
N 1200
N 1000
N 800
N 600

E -200 E 0 E 200 E 400 E 600 E 800 E 1000 E 1200 E 1400 E 1600 E 1800 E 2000 E 2200 E 2400 E 2600

SAWMILL 16
FORMER SAWMILL 18
17
15
SAWMILL 14
SAWMILL 19
SAWMILL 13
SAWMILL 12
PEELER SHED 8
7
9
FORMER SAWING VAULT 6
TRUCK SHOP 10
GARAGE 11
5 OIL-WATER SEPARATOR
BOILER
TREATMENT BUILDING 3
2 PW-OI GARAGE
1 OFFICE
FORMER STORAGE SHED 4
FORMER SCALE HOUSE 20
21

DRAWING D-1
SITE DEMOLITION PLAN
PENTA WOOD PRODUCTS SITE
TOWN OF DANIELS, WISCONSIN

CH2MHILL



FLOOR PLAN
3/16"=1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

DSGN	L.A. AMUNDSON
DR	J.M. ZAFFKE
CHK	
APVD	

NO.	DATE	REVISION	BY	APVD

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

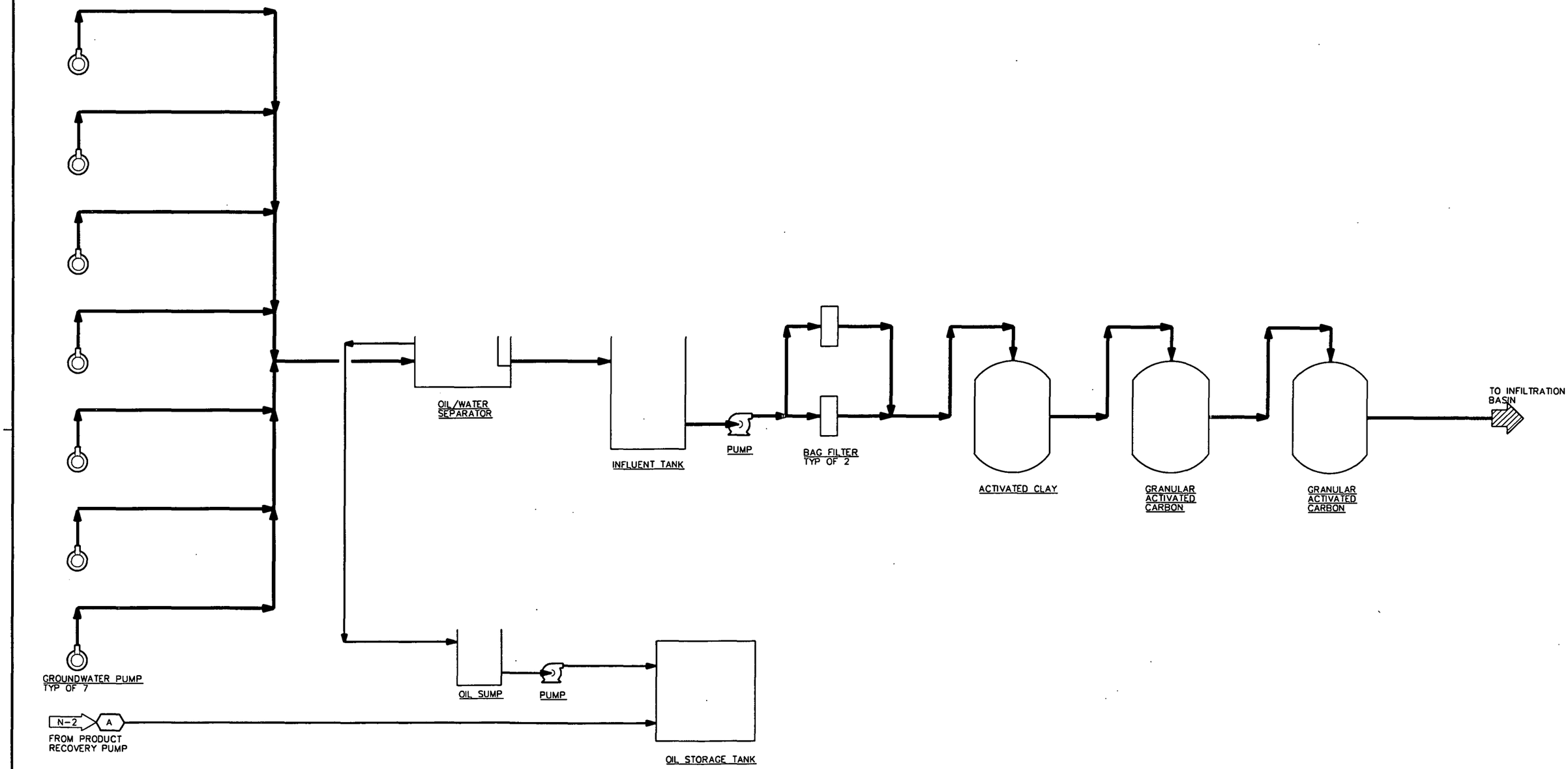
CH2MHILL

PENTAWOOD

PROCESS BUILDING
GENERAL ARRANGEMENT

SHEET	
DWG	A-1
DATE	JUNE 1999
PROJ	151745.PD

FILENAME: I:\PENTAWOOD\CAD\DRAWINGS\1745_03.dlv PLOT DATE: 09-JUN-1999 PLOT TIME: 13:25:05



PRELIMINARY

NOT FOR CONSTRUCTION

DSGN	L.A.AMUNDSON
DR	J.M.ZAFFKE
CHK	
APVD	

NO.	DATE	REVISION	BY	APVD

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

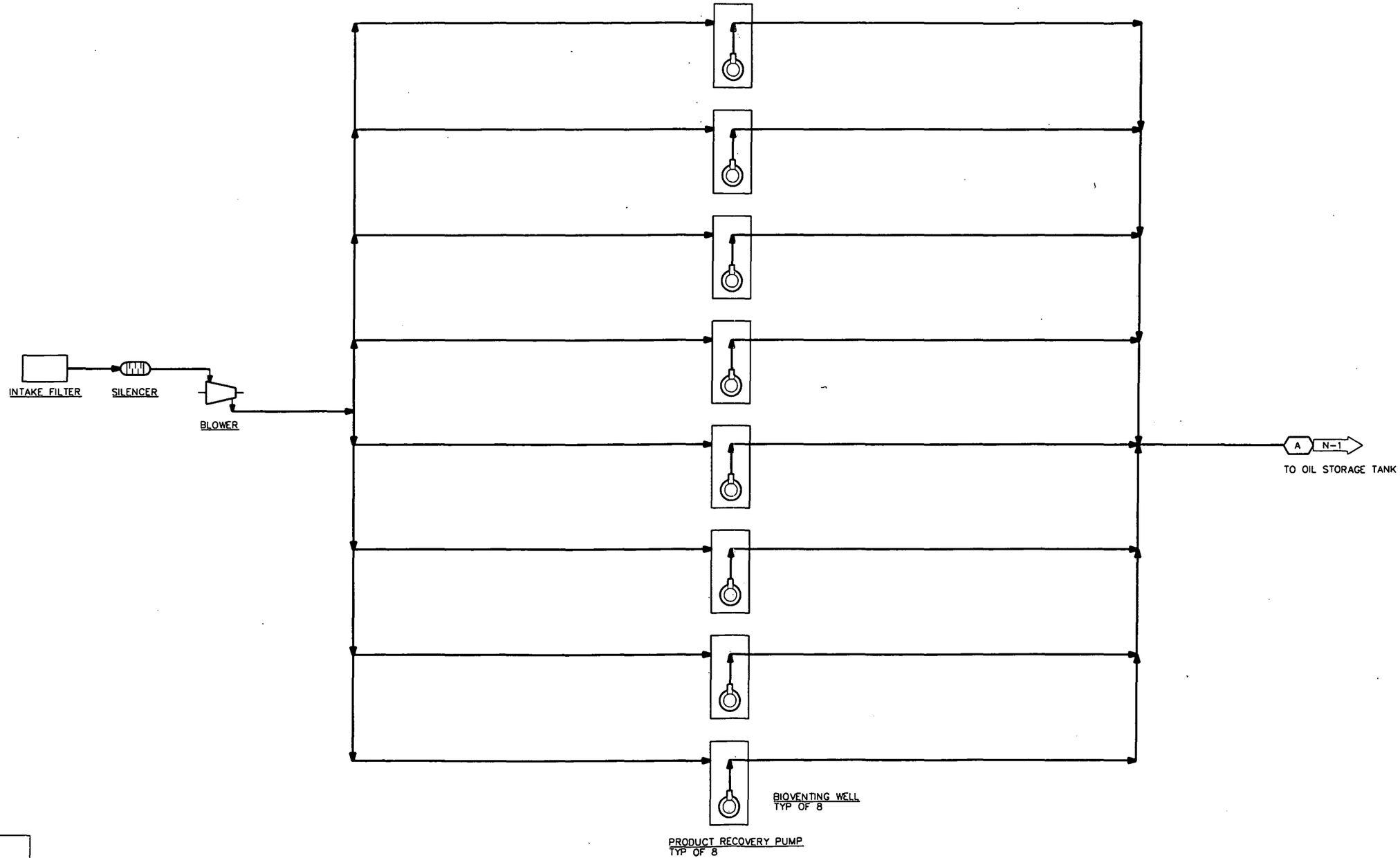
CH2MHILL

PENTAWOOD

PROCESS FLOW DIAGRAM
GROUNDWATER SYSTEM

SHEET	
DWG	N-1
DATE	JUNE 1999
PROJ	151745.PD

FILENAME: I:\PENTAWOOD\CAD\DRAWINGS\1745_01.dlv PLOT DATE: 09-JUN-1999 PLOT TIME: 10:43:24



PRELIMINARY

NOT FOR CONSTRUCTION

DSGN L.A.AMUNDSON	NO.	DATE	REVISION	BY	APVD	VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.	CH2MHILL
DR J.M.ZAFFKE							
CHK							
APVD							

PENTAWOOD

PROCESS FLOW DIAGRAM
BIOVENTING SYSTEM

SHEET
DWG N-2
DATE JUNE 1999
PROJ 151745.PD

FILENAME: I:\PENTAWOOD\CAD\DRAWINGS\1745_02.dlv PLOT DATE: 09-JUN-1999 PLOT TIME: 11:44:55

ATTACHMENT 1

SUPPORTING INFORMATION-BIOVENTING SYSTEM

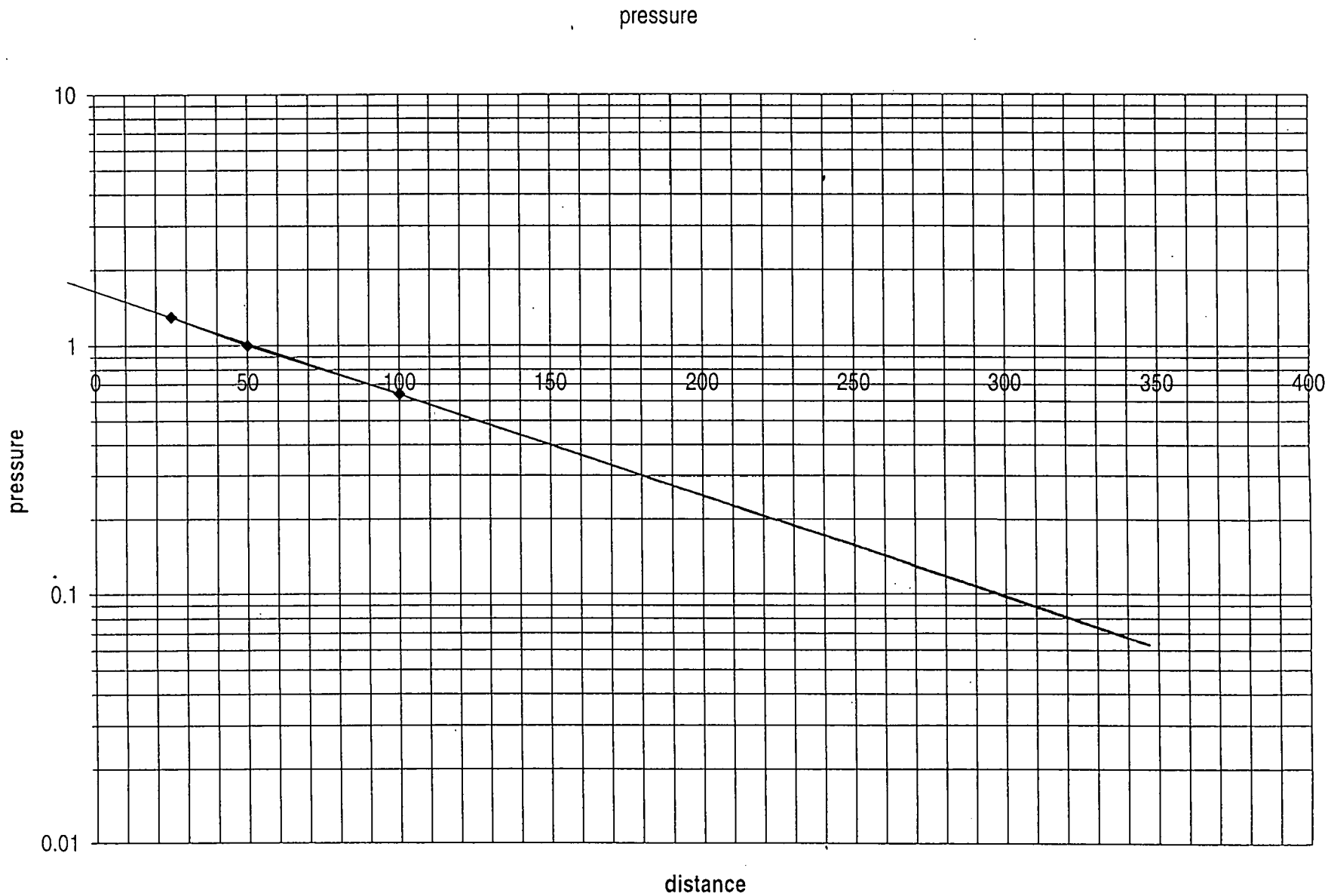
$$\frac{Q}{H} = \pi \frac{k}{\mu} P_w \frac{\left[1 - \left(Patm / P_w\right)^2\right]}{\ln\left(Rw / Ri\right)}$$

k = soil permeability to air flow [cm^2] or [darcy]
u = viscosity of air = 1.8E-04 g/cm-s or 0.018cp
Pw = absolute pressure at extraction well [g/cm-s^2] or [atm]
Patm = absolute ambient pressure ~1.01E06 g/cm/s^2 or 1 atm
Rw = radius of vapor extraction well [cm]
Ri = radius of influence of vapor extraction well [cm]

H	0.305	m
H	30.5	cm
k	2.32E-07	cm^2
u	1.80E-04	g/cm-s
Pw	121200	g/cm/s^2
Patm	1.01E+06	g/cm/s^2
Rw	2	in
Rw	5.08	cm
Ri	38.1	m
Ri	3810	cm

Q= 154676.0233 cm^3/s
9.280561395 m^3/min
327.6038172 ft^3/min

Pg 175 Johnson et al, 1990


pressure
10
1
0.1
0.01
pressure
0
50
100
150
200
250
300
350
400
distance

SUBJECT: Penta Wood Bioventing TS Design SHEET NO. 1 of ' DATE 9-4-97
PROJECT NO. 14158.TT.02

Objective: CALCULATE intrinsic permeability k in darcies

Given: $K \equiv$ hydraulic conductivity = 49.3 ft/day in saturated zone. (From pre-RI)
Temp of water = 10°C
At 10°C, ρ_w = density = 999.7 kg/m^3
μ_w = viscosity = 1.308×10^{-3} $kg/m \cdot s$
g = 9.81 m/s^2

Assume: Soil characteristics same in unsaturated zone.

Solve: Using $K = \frac{k \rho_w g}{\mu_w}$ ← Freeze + Cherry Ch. 2.

$$K = \frac{49.3 \text{ ft}}{\text{day}} \cdot \frac{\text{day}}{86{,}400 \text{ sec}} \cdot \frac{\text{m}}{3.281 \text{ ft}} = 1.74 \times 10^{-4} \text{ m/s}$$

$$k = \frac{K \mu_w}{\rho_w g} = \frac{(1.74 \times 10^{-4} \text{ m/s})(1.308 \times 10^{-3} \text{ kg/m} \cdot \text{s})}{(999.7 \text{ kg/m}^3)(9.81 \text{ m/s}^2)}$$

$$k = 2.32 \times 10^{-11} \text{ m}^2 \cdot \left(\frac{100 \text{ cm}^2}{\text{m}^2}\right) = 2.32 \times 10^{-7} \text{ cm}^2$$

$$k = 2.32 \times 10^{-7} \text{ cm}^2 \cdot \frac{1.01 \times 10^{+8} \text{ darcies}}{\text{cm}^2}$$

$$\boxed{k = 23.43 \text{ darcies}}$$

∴ Use k = 20 darcies for design

→ R.O.T. for 20 darcies, 5 scfm/ft of screen

For injection well, 4-inch well to 90 foot depth with 85 feet of screen.

Therefore, design flowrate = (5 scfm/ft)(85 feet) = 425 scfm

Use blower capable of injecting 500 scfm of air.

ATTACHMENT 2

SUPPORTING INFORMATION-GROUNDWATER SYSTEM

TABLE A2

Drawdown in Feet Recorded During Aquifer Testing

Penta Wood Products

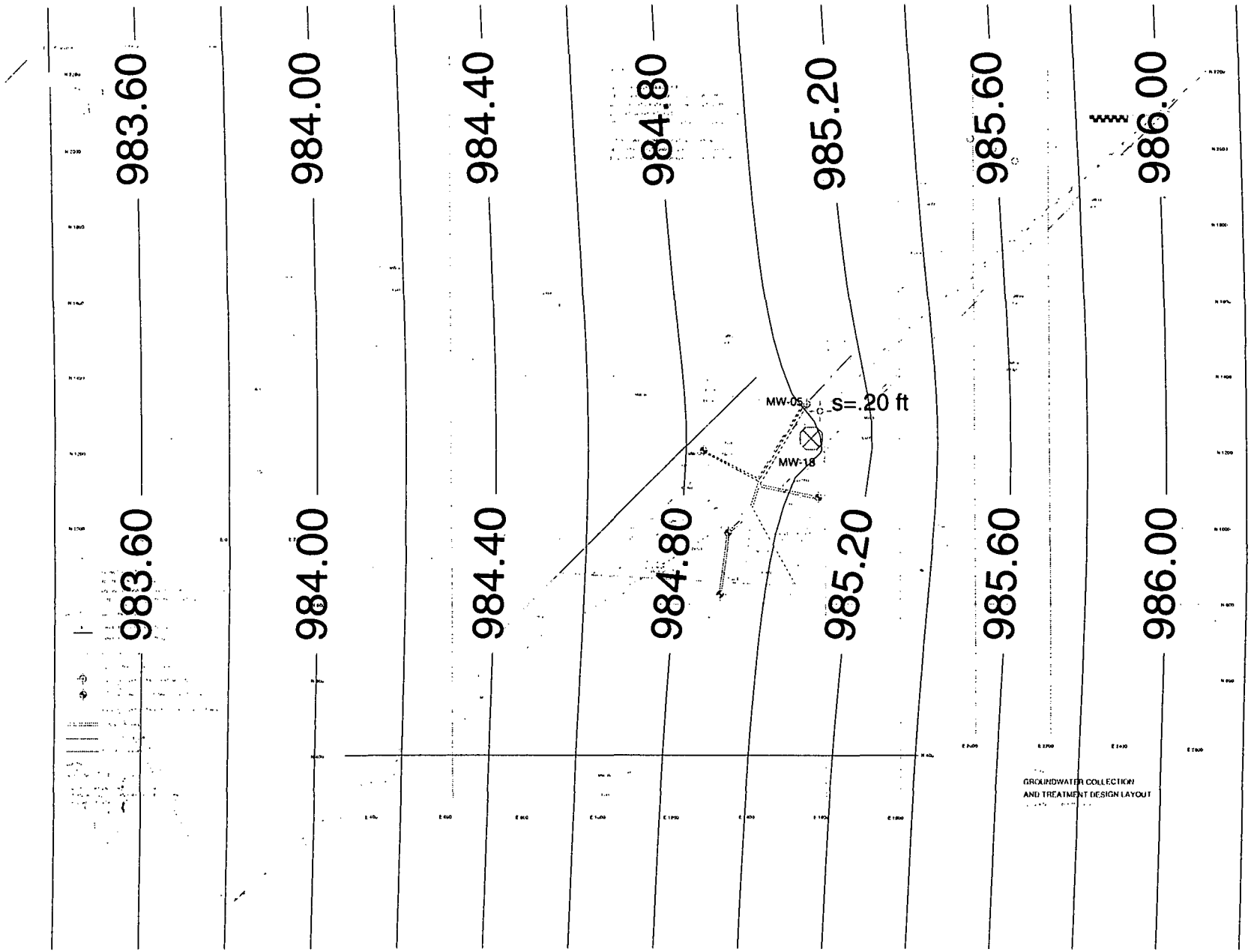
Test #	Pumping Well (PW)	Monitoring Well (MW)	Distance Between PW and MW (ft)	1–2 gpm	4 gpm	6 gpm	9 gpm	12 gpm
Test 0	EW-01	MW-20	27	Unfinished Due to Cracked Housing				
Test 1	EW-01	MW-20	27			0.1		
Test 2	EW-01	MW-20	27	0	0.075			
Test 3	MW-18	MW-05	64		0.038	0.07	0.1	0.2

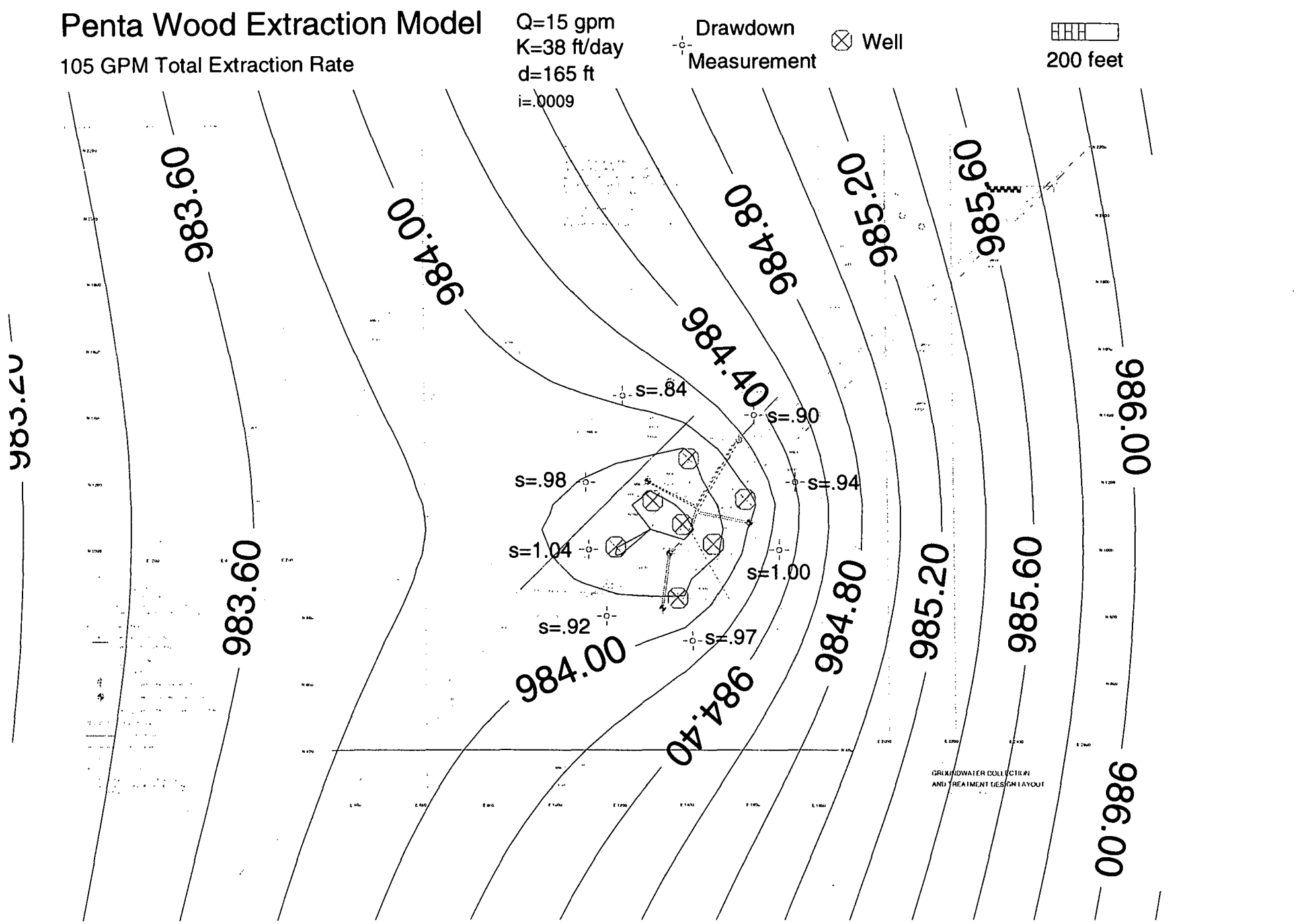
Penta Wood Calibration Model

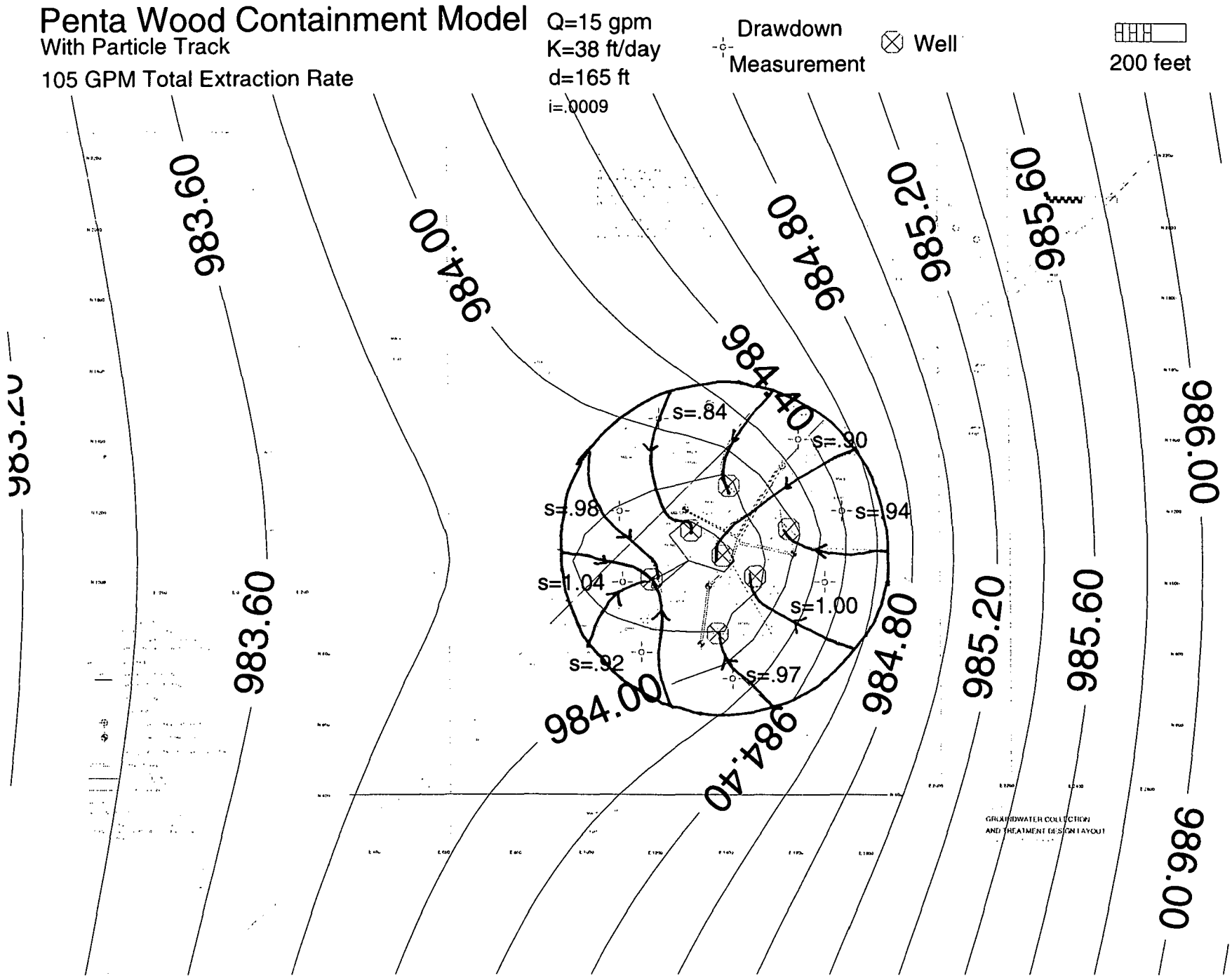
Calibrated by Pump Test 3 Step 3

Q=12 gpm d=65 ft
K=75 ft/day i=.0009

200 feet

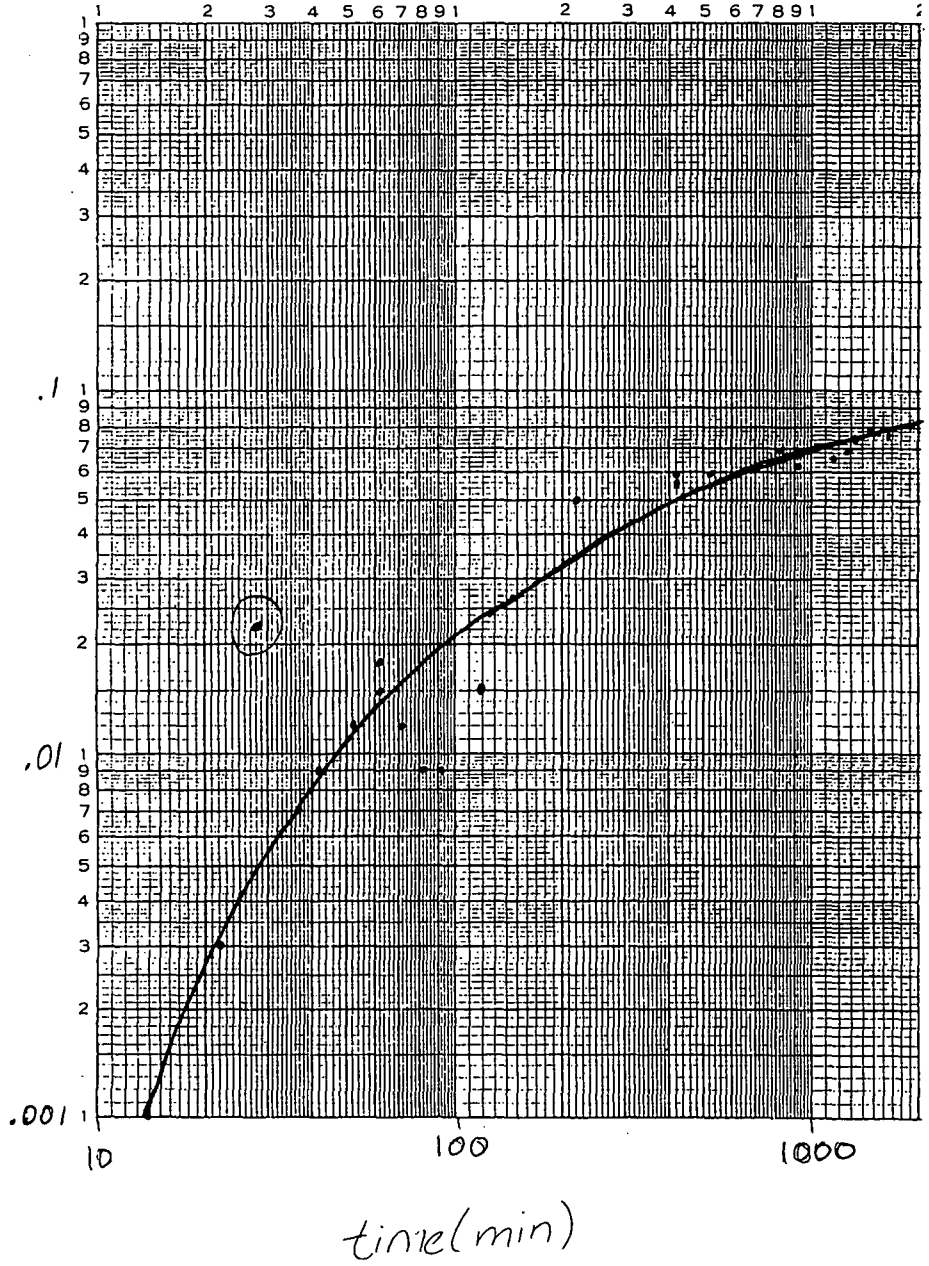



Penta Wood Extraction Model
105 GPM Total Extraction Rate
Q=15 gpm
K=38 ft/day
d=165 ft
i=.0009
Drawdown Measurement
Well
200 feet
983.60
984.00
984.40
984.80
985.20
985.60
986.00
s=.84
s=.90
s=.98
s=.94
s=1.04
s=1.00
s=.92
s=.97
GROUNDWATER COLLECTION AND TREATMENT DESIGN LAYOUT


Penta Wood Containment Model
With Particle Track
105 GPM Total Extraction Rate
Q=15 gpm
K=38 ft/day
d=165 ft
i=.0009
Drawdown
Measurement
Well
200 feet
983.60
984.00
984.80
985.20
985.60
986.00
984.40
s=.84
s=.90
s=.98
s=.94
s=1.04
s=1.00
s=.92
s=.97
GROUNDWATER COLLECTION
AND TREATMENT DESIGN LAYOUT

[redacted] Wood Products Site
Aquifer Test Analysis
Test 2, Step 1, MW-20

11 Logarithmic, 3 x 5



$Q = 4\ gpm = .537\ ft^3/min$

$T = \frac{Q}{4\pi s} W(u)$ $\quad S = \frac{4Tut}{r^2}$

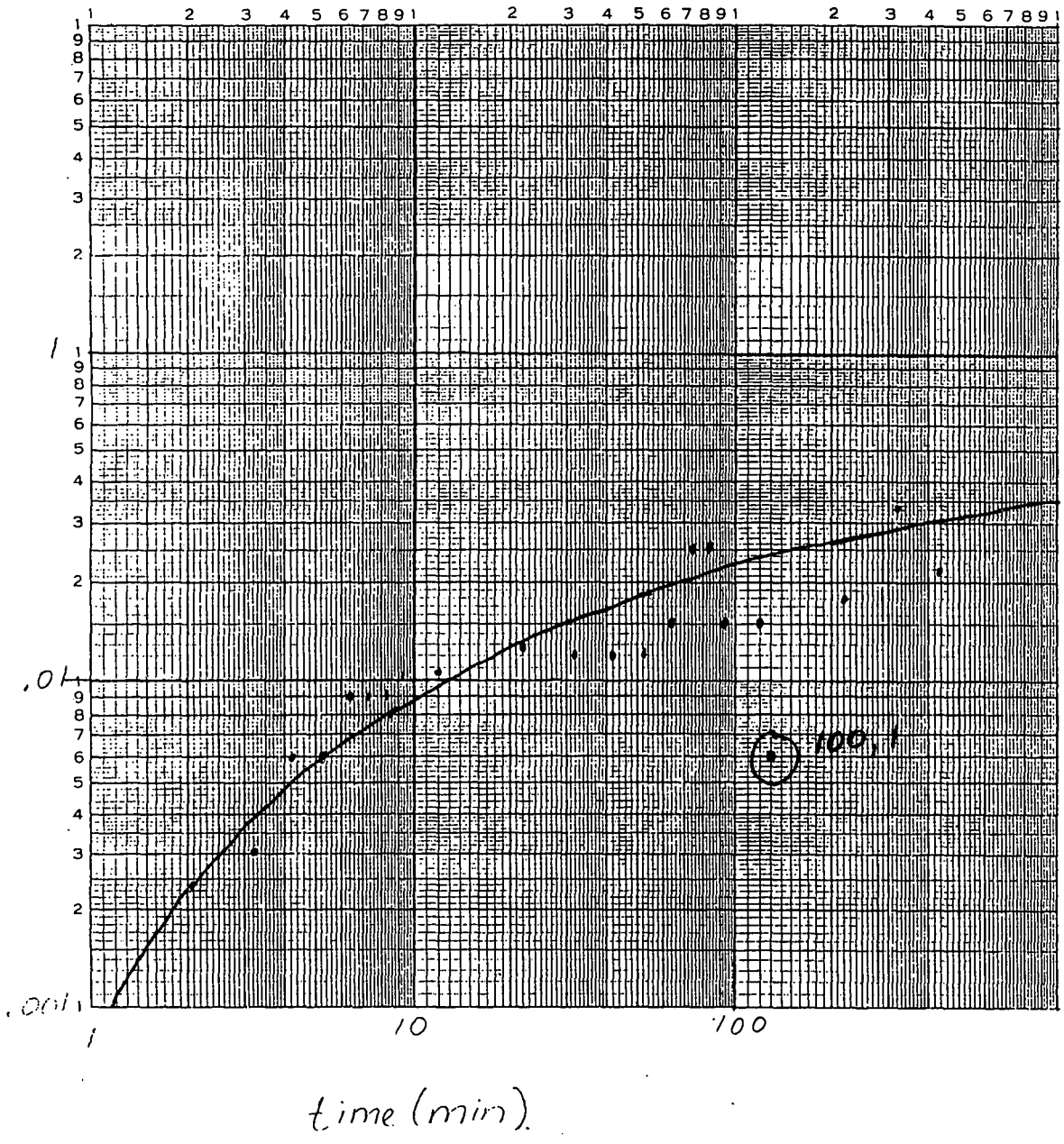
$r = 27\ ft$ $\quad t = 28\ min$ $\quad W(u) = 1$

$s = .023\ ft$ $\quad 1/u = 1$

$$T = \frac{(.537\ \frac{ft^3}{min})(1)}{4\pi\ (.023\ ft)} = 1.86\ \frac{ft^2}{min}$$

$$S = \frac{4(1.86\ \frac{ft^2}{min})(1)(28\ min)}{(27\ ft)^2} = .286$$

Penta Wood Products Site
Aquifer Test Analysis
Test 2, Step 0, MW-20



Full Logarithmic, 3 x 5

$Q = 1.5 \text{ gpm} = .201 \text{ ft}^3/\text{min}$

$T = \frac{Q}{4\pi s} W(u) \quad S = \frac{4Tut}{r^2}$

$r = 27 \text{ ft} \quad t = 130 \text{ min}$

$W(u) = 1 \quad 1/u = 100$

$s = .006 \text{ ft}$

$$T = \frac{\left(.201 \frac{\text{ft}^3}{\text{min}}\right)(1)}{4\pi\ (.006 \text{ ft})} = 2.67 \frac{\text{ft}^2}{\text{min}}$$

$$S = \frac{4\left(2.67 \frac{\text{ft}^2}{\text{min}}\right)(.01)(130 \text{ min})}{(27 \text{ ft})^2}$$

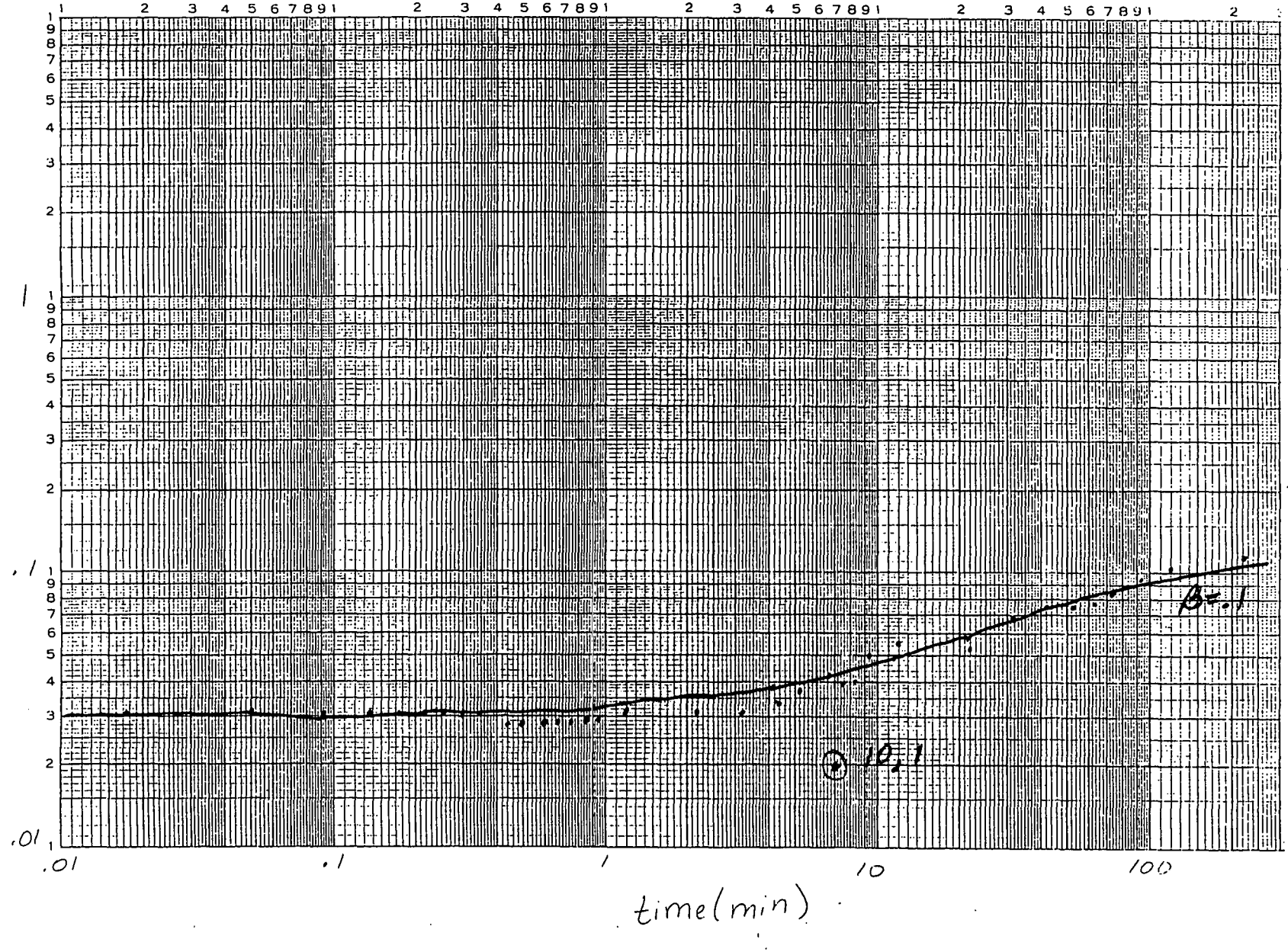
$S = .019$

Full Logarithmic, 3 x 5

Penta Wood Products Site
Aquifer Test Analysis
Test 1, Step 0, MW-20

$Q = 6\ gpm = .805369\ \frac{ft^3}{min}$

$T = \frac{Q}{4\pi S} W(u_A, u_B, \beta)$ $S_y = \frac{4Tt}{r^2} u_B$



$r = 27\ ft$
$S = .02\ ft$
$t = 7\ min$
$W(u_A, u_B, \beta) = 1$
$1/u_B = 10.$

$T = \frac{(.805\ \frac{ft^3}{min})(1)}{4\pi(.02\ ft)}$

$T = 3.2\ \frac{ft^2}{min}$

$S_y = \frac{4(3.2\ \frac{ft^2}{min})(7.}{(27ft)^2} * \frac{1}{10}$

$S_y = .0123$

SE2000

Environmental Logger
5/25/99 10:29

Unit# PENTAWOO Test 0

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	PZ-02	PZ-03	EW-01	MW-20
Reference	0	0	0	0
PSI at Ref.	3.521	3.96	8.65	2.928
SG	1	1	1	1
Linearity	0.11	0.129	0	0.003
Scale factor	14.922	14.944	10.009	9.99
Offset	-0.05	0.038	-0.011	-0.02
Delay mSEC	50	50	50	50

Step 0 5/17/99 11:00 19:07

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	-0.023	-0.056	0.74	0.003
0.0083	-0.023	-0.056	0.768	0.003
0.0166	-0.023	-0.051	0.803	0.003
0.0250	-0.023	-0.056	0.916	0.003
0.0333	-0.023	-0.056	0.919	0.003
0.0416	-0.023	-0.051	0.976	0.003
0.0500	-0.023	-0.056	1.033	0.003
0.0583	-0.023	-0.056	1.08	0.003
0.0666	-0.023	-0.056	1.134	0.003
0.0750	-0.023	-0.056	1.197	0.003
0.0833	-0.023	-0.056	1.235	0.003
0.0916	-0.023	-0.056	1.279	0.003
0.1000	-0.023	-0.056	1.316	0.003
0.1083	-0.023	-0.056	1.354	0.003
0.1166	-0.023	-0.056	1.383	0.003
0.1250	-0.023	-0.056	1.439	0.003
0.1333	-0.023	-0.056	1.465	0.003
0.1416	-0.023	-0.056	1.499	0.003
0.1500	-0.023	-0.056	1.505	0.003
0.1583	-0.023	-0.056	1.534	0.003
0.1666	-0.023	-0.056	1.546	0.003
0.1750	-0.023	-0.056	1.565	0.003
0.1833	-0.023	-0.056	1.524	0.003
0.1916	-0.023	-0.056	1.572	0.003
0.2000	-0.023	-0.056	1.55	0.003
0.2083	-0.023	-0.056	1.581	0.003

0.2166	-0.023	-0.056	1.568	0.003
0.2250	-0.023	-0.056	1.565	0.003
0.2333	-0.023	-0.056	1.556	0.003
0.2416	-0.023	-0.056	1.553	0.003
0.2500	-0.023	-0.056	1.546	0.003
0.2583	-0.023	-0.056	1.543	0.003
0.2666	-0.023	-0.056	1.546	0.003
0.2750	-0.023	-0.056	1.553	0.003
0.2833	-0.023	-0.056	1.543	0.003
0.2916	-0.023	-0.056	1.556	0.003
0.3000	-0.023	-0.056	1.55	0.003
0.3083	-0.023	-0.056	1.556	0.003
0.3166	-0.023	-0.056	1.54	0.006
0.3250	-0.023	-0.056	1.543	0.003
0.3333	-0.023	-0.056	1.54	0.003
0.3500	-0.023	-0.056	1.546	0.003
0.3666	-0.023	-0.056	1.553	0.003
0.3833	-0.023	-0.056	1.55	0.003
0.4000	-0.023	-0.056	1.553	0.003
0.4166	-0.023	-0.056	1.559	0.006
0.4333	-0.023	-0.056	1.553	0.006
0.4500	-0.023	-0.056	1.546	0.006
0.4666	-0.023	-0.056	1.559	0.006
0.4833	-0.023	-0.056	1.568	0.006
0.5000	-0.023	-0.056	1.581	0.006
0.5166	-0.023	-0.056	1.591	0.006
0.5333	-0.023	-0.056	1.581	0.006
0.5500	-0.023	-0.056	1.581	0.006
0.5666	-0.023	-0.056	1.568	0.006
0.5833	-0.023	-0.056	1.581	0.006
0.6000	-0.023	-0.056	1.584	0.006
0.6166	-0.023	-0.056	1.6	0.006
0.6333	-0.023	-0.056	1.609	0.006
0.6500	-0.023	-0.056	1.6	0.006
0.6666	-0.023	-0.056	1.597	0.006
0.6833	-0.023	-0.056	1.619	0.006
0.7000	-0.023	-0.056	1.606	0.006
0.7166	-0.023	-0.056	1.616	0.006
0.7333	-0.023	-0.056	1.6	0.006
0.7500	-0.023	-0.056	1.606	0.006
0.7666	-0.023	-0.056	1.622	0.006
0.7833	-0.023	-0.056	1.613	0.009
0.8000	-0.023	-0.056	1.609	0.006
0.8166	-0.023	-0.056	1.616	0.009
0.8333	-0.023	-0.056	1.6	0.009
0.8500	-0.023	-0.056	1.594	0.009
0.8666	-0.023	-0.056	1.606	0.006
0.8833	-0.023	-0.056	1.584	0.009
0.9000	-0.023	-0.056	1.6	0.009
0.9166	-0.023	-0.056	1.6	0.009

0.9333	-0.023	-0.056	1.568	0.009
0.9500	-0.023	-0.056	1.597	0.009
0.9666	-0.023	-0.056	1.572	0.009
0.9833	-0.023	-0.056	1.584	0.009
1.0000	-0.023	-0.056	1.572	0.006
1.2000	-0.023	-0.056	1.553	0.009
1.4000	-0.023	-0.056	1.546	0.009
1.6000	-0.023	-0.056	1.553	0.009
1.8000	-0.023	-0.056	1.556	0.009
2.0000	-0.023	-0.056	1.562	0.012
2.2000	-0.023	-0.056	1.534	0.012
2.4000	-0.023	-0.056	1.496	0.012
2.6000	-0.023	-0.056	1.477	0.012
2.8000	-0.023	-0.056	1.502	0.009
3.0000	-0.023	-0.056	1.48	0.009
3.2000	-0.023	-0.056	1.483	0.009
3.4000	-0.023	-0.056	1.48	0.009
3.6000	-0.023	-0.056	1.477	0.009
3.8000	-0.023	-0.056	1.499	0.012
4.0000	-0.023	-0.056	1.499	0.012
4.2000	-0.023	-0.056	1.499	0.012
4.4000	-0.023	-0.056	1.509	0.012
4.6000	-0.023	-0.056	1.509	0.012
4.8000	-0.023	-0.056	1.505	0.012
5.0000	-0.023	-0.056	1.493	0.015
5.2000	-0.023	-0.056	1.499	0.015
5.4000	-0.023	-0.056	1.461	0.015
5.6000	-0.023	-0.056	1.477	0.015
5.8000	-0.023	-0.056	1.458	0.012
6.0000	-0.023	-0.056	1.487	0.012
6.2000	-0.023	-0.056	1.49	0.015
6.4000	-0.023	-0.056	1.483	0.012
6.6000	-0.023	-0.056	1.483	0.012
6.8000	-0.023	-0.056	1.49	0.015
7.0000	-0.023	-0.056	1.499	0.015
7.2000	-0.023	-0.056	1.509	0.015
7.4000	-0.023	-0.056	1.521	0.015
7.6000	-0.018	-0.056	1.515	0.015
7.8000	-0.023	-0.056	1.48	0.015
8.0000	-0.023	-0.056	1.48	0.015
8.2000	-0.018	-0.056	1.474	0.018
8.4000	-0.023	-0.056	1.477	0.018
8.6000	-0.023	-0.056	1.477	0.018
8.8000	-0.018	-0.051	1.48	0.022
9.0000	-0.018	-0.051	1.483	0.018
9.2000	-0.018	-0.051	1.449	0.018
9.4000	-0.018	-0.051	1.458	0.018
9.6000	-0.018	-0.051	1.455	0.018
9.8000	-0.018	-0.051	1.449	0.018
10.0000	-0.018	-0.051	1.458	0.022

12.0000	-0.014	-0.051	1.446	0.022
14.0000	-0.014	-0.051	1.477	0.022
16.0000	-0.014	-0.047	1.446	0.025
18.0000	-0.009	-0.047	2.687	0.034
20.0000	-0.009	-0.047	1.965	0.037
22.0000	-0.009	-0.042	1.758	0.04
24.0000	-0.004	-0.047	1.761	0.037
26.0000	-0.004	-0.047	1.77	0.04
28.0000	-0.004	-0.042	1.764	0.04
30.0000	-0.004	-0.047	1.773	0.044
32.0000	-0.004	-0.047	1.789	0.044
34.0000	-0.004	-0.047	1.795	0.047
36.0000	-0.004	-0.042	1.795	0.047
38.0000	0	-0.042	1.821	0.05
40.0000	0	-0.042	1.805	0.05
42.0000	0	-0.042	1.83	0.05
44.0000	0	-0.042	1.855	0.05
46.0000	0	-0.042	1.88	0.053
48.0000	-0.004	-0.042	1.896	0.053
50.0000	-0.004	-0.042	1.884	0.053
52.0000	0	-0.042	1.909	0.056
54.0000	0	-0.042	1.918	0.056
56.0000	0	-0.042	1.909	0.053
58.0000	-0.004	-0.042	1.896	0.053
60.0000	-0.004	-0.047	1.915	0.053
62.0000	-0.004	-0.042	1.912	0.056
64.0000	0	-0.042	1.928	0.056
66.0000	0	-0.042	1.937	0.053
68.0000	0	-0.042	1.947	0.059
70.0000	0	-0.042	1.937	0.059
72.0000	0	-0.042	1.947	0.059
74.0000	0	-0.042	1.953	0.059
76.0000	0	-0.042	1.969	0.059
78.0000	-0.004	-0.042	1.975	0.062
80.0000	0	-0.042	1.962	0.062
82.0000	-0.004	-0.042	1.981	0.062
84.0000	-0.004	-0.042	2	0.062
86.0000	0	-0.042	1.984	0.062
88.0000	0	-0.042	1.997	0.066
90.0000	0	-0.037	2.003	0.069
92.0000	0	-0.042	2.019	0.069
94.0000	0	-0.042	2.01	0.069
96.0000	-0.004	-0.042	2.01	0.069
98.0000	0	-0.042	2.019	0.072
100.0000	0	-0.042	2.019	0.072
120.0000	0.004	-0.037	2.063	0.075
140.0000	0	-0.042	2.148	0.075
160.0000	0	-0.037	2.18	0.081
180.0000	0.004	-0.033	2.224	0.084
200.0000	0.004	-0.033	2.277	0.091

220.0000	0.004	-0.028	2.287	0.088
240.0000	0.004	-0.033	2.309	0.088
260.0000	0.009	-0.028	2.325	0.091
280.0000	0.014	-0.023	2.356	0.091
300.0000	0.018	-0.018	2.4	0.1
320.0000	0.023	-0.018	2.419	0.1
340.0000	0.028	-0.014	2.57	0.103
360.0000	0.028	-0.009	2.574	0.106
380.0000	0.023	-0.018	2.567	0.1
400.0000	0.023	-0.018	2.592	0.1
420.0000	0.023	-0.018	2.643	0.1
440.0000	0.023	-0.023	2.671	0.094
460.0000	0.018	-0.023	2.659	0.094
480.0000	0.018	-0.023	2.693	0.091
500.0000	0.028	-0.014	2.715	0.103
520.0000	0.032	-0.009	2.797	0.106
540.0000	0.047	0	2.816	0.113
560.0000	0.042	-0.004	2.838	0.116
580.0000	0.047	0	2.87	0.116
600.0000	0.042	-0.009	2.876	0.11
620.0000	0.037	-0.014	2.885	0.106
640.0000	0.047	-0.004	2.952	0.113
660.0000	0.042	-0.009	2.911	0.11
680.0000	0.047	-0.009	2.684	0.106
700.0000	0.042	-0.009	2.132	0.094
720.0000	0.037	-0.009	1.657	0.081
740.0000	0.037	-0.009	1.42	0.075
760.0000	0.037	-0.009	1.43	0.072
780.0000	0.032	-0.009	1.502	0.066
800.0000	0.037	-0.009	1.502	0.062
820.0000	0.023	-0.009	-2.766	0.003
840.0000	0.018	-0.014	0.475	0.025
860.0000	0.018	-0.018	0.674	0.022
880.0000	0.023	-0.014	0.727	0.022
900.0000	0.023	-0.014	0.749	0.022
920.0000	0.018	-0.014	0.73	0.018
940.0000	0.014	-0.018	0.743	0.018
960.0000	0.018	-0.018	0.759	0.015
980.0000	0.018	-0.018	0.73	0.015
1000.0000	0.014	-0.018	0.752	0.012
1030.0000	0.014	-0.018	0.721	0.015
1060.0000	0.014	-0.018	0.734	0.012
1090.0000	0.018	-0.014	0.708	0.015
1120.0000	0.018	-0.014	0.727	0.015
1150.0000	0.018	-0.014	0.746	0.022
1180.0000	0.018	-0.014	0.724	0.022
1210.0000	0.018	-0.014	20.034	0.018
1240.0000	0.023	-0.004	20.075	0.025

END

SE2000
Environmental Logger
5/25/99 10:50

Unit# PENTAWOO Test 1

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	PZ-02	PZ-03	EW-01	MW-20
Reference	0	0	0	0
PSI at Ref.	3.539	3.964	8.809	2.933
SG	1	1	1	1
Linearity	0.11	0.129	0	0.003
Scale factor	14.922	14.944	10.009	9.99
Offset	-0.05	0.038	-0.011	-0.02
Delay mSEC	50	50	50	50

Step 0 5/18/99 16:00 56:59:00

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0	0.042	0.009	2.388	0.031
0.0083	0.042	0.009	2.353	0.031
0.0166	0.042	0.009	2.356	0.031
0.0250	0.042	0.009	2.334	0.031
0.0333	0.042	0.009	2.337	0.031
0.0416	0.042	0.009	2.325	0.031
0.0500	0.042	0.009	2.303	0.031
0.0583	0.042	0.009	2.299	0.034
0.0666	0.042	0.009	2.293	0.034
0.0750	0.042	0.009	2.29	0.031
0.0833	0.042	0.009	2.265	0.031
0.0916	0.042	0.009	2.274	0.031
0.1000	0.042	0.004	2.255	0.031
0.1083	0.042	0.009	2.246	0.031
0.1166	0.042	0.009	2.227	0.031
0.1250	0.042	0.009	2.243	0.031
0.1333	0.042	0.009	2.202	0.031
0.1416	0.042	0.009	2.195	0.031
0.1500	0.042	0.009	2.183	0.031
0.1583	0.042	0.009	2.202	0.031
0.1666	0.047	0.009	2.199	0.031
0.1750	0.042	0.009	2.186	0.031
0.1833	0.047	0.009	2.189	0.031
0.1916	0.042	0.009	2.167	0.031
0.2000	0.042	0.009	2.151	0.031

0.2083	0.042	0.009	2.161	0.031
0.2166	0.042	0.009	2.145	0.031
0.2250	0.042	0.009	2.145	0.031
0.2333	0.042	0.009	2.117	0.031
0.2416	0.042	0.009	2.11	0.031
0.2500	0.042	0.004	2.11	0.031
0.2583	0.042	0.009	2.091	0.031
0.2666	0.042	0.004	2.095	0.031
0.2750	0.042	0.009	2.098	0.031
0.2833	0.042	0.009	2.088	0.031
0.2916	0.042	0.004	2.085	0.031
0.3000	0.042	0.004	2.073	0.031
0.3083	0.042	0.004	2.073	0.031
0.3166	0.042	0.004	2.047	0.031
0.3250	0.042	0.009	2.051	0.031
0.3333	0.042	0.009	2.032	0.031
0.3500	0.042	0.004	2.016	0.031
0.3666	0.042	0.009	2.025	0.031
0.3833	0.042	0.009	2	0.031
0.4000	0.042	0.004	1.991	0.031
0.4166	0.042	0.004	1.988	0.028
0.4333	0.042	0.004	1.959	0.028
0.4500	0.042	0.004	1.959	0.028
0.4666	0.042	0.004	1.959	0.028
0.4833	0.042	0.004	1.937	0.028
0.5000	0.042	0.004	1.912	0.028
0.5166	0.042	0.004	1.902	0.028
0.5333	0.042	0.004	1.884	0.028
0.5500	0.042	0.004	1.893	0.028
0.5666	0.042	0.004	1.896	0.028
0.5833	0.042	0.004	1.871	0.028
0.6000	0.042	0.004	1.865	0.028
0.6166	0.042	0.004	1.849	0.028
0.6333	0.042	0.004	1.833	0.028
0.6500	0.042	0.004	1.843	0.028
0.6666	0.042	0.009	1.827	0.028
0.6833	0.042	0.009	1.802	0.028
0.7000	0.042	0.004	1.798	0.028
0.7166	0.042	0.009	1.792	0.028
0.7333	0.042	0.009	1.792	0.028
0.7500	0.042	0.009	1.789	0.028
0.7666	0.042	0.009	1.789	0.028
0.7833	0.042	0.009	1.78	0.028
0.8000	0.042	0.009	1.767	0.028
0.8166	0.042	0.009	1.745	0.028
0.8333	0.042	0.009	1.745	0.028
0.8500	0.042	0.009	1.732	0.028
0.8666	0.042	0.009	1.739	0.028
0.8833	0.042	0.009	1.72	0.028
0.9000	0.042	0.009	1.72	0.028

0.9166	0.042	0.009	1.717	0.028
0.9333	0.047	0.009	1.701	0.028
0.9500	0.042	0.009	1.707	0.028
0.9666	0.042	0.009	1.691	0.028
0.9833	0.042	0.009	1.704	0.028
1.0000	0.042	0.009	1.698	0.031
1.2000	0.047	0.009	1.66	0.031
1.4000	0.047	0.009	1.735	0.034
1.6000	0.042	0.009	1.802	0.034
1.8000	0.047	0.009	1.877	0.034
2.0000	0.047	0.009	1.947	0.034
2.2000	0.047	0.009	1.975	0.031
2.4000	0.047	0.009	2.054	0.028
2.6000	0.047	0.009	2.088	0.031
2.8000	0.047	0.009	2.101	0.025
3.0000	0.042	0.009	2.129	0.028
3.2000	0.047	0.009	2.148	0.031
3.4000	0.047	0.009	2.158	0.028
3.6000	0.047	0.009	2.17	0.031
3.8000	0.047	0.009	2.192	0.031
4.0000	0.047	0.009	2.189	0.034
4.2000	0.047	0.009	2.208	0.034
4.4000	0.047	0.009	2.221	0.034
4.6000	0.047	0.009	2.224	0.034
4.8000	0.051	0.009	2.24	0.034
5.0000	0.051	0.014	2.233	0.034
5.2000	0.051	0.014	2.249	0.037
5.4000	0.051	0.014	2.243	0.034
5.6000	0.051	0.014	2.243	0.037
5.8000	0.051	0.014	2.265	0.037
6.0000	0.051	0.014	2.255	0.04
6.2000	0.051	0.014	2.271	0.044
6.4000	0.051	0.014	2.281	0.044
6.6000	0.051	0.014	2.268	0.044
6.8000	0.051	0.014	2.268	0.04
7.0000	0.051	0.014	2.271	0.04
7.2000	0.051	0.014	2.284	0.04
7.4000	0.051	0.014	2.281	0.044
7.6000	0.051	0.014	2.29	0.047
7.8000	0.051	0.014	2.287	0.044
8.0000	0.051	0.009	2.293	0.04
8.2000	0.051	0.014	2.284	0.04
8.4000	0.051	0.014	2.309	0.04
8.6000	0.056	0.014	2.47	0.044
8.8000	0.051	0.014	2.655	0.044
9.0000	0.051	0.014	2.803	0.047
9.2000	0.051	0.014	2.939	0.05
9.4000	0.051	0.014	3.03	0.05
9.6000	0.051	0.014	3.112	0.053
9.8000	0.051	0.014	3.163	0.053

10.0000	0.051	0.014	3.263	0.053
12.0000	0.056	0.014	3.629	0.056
14.0000	0.051	0.009	2.394	0.047
16.0000	0.051	0.014	2.044	0.047
18.0000	0.056	0.014	1.965	0.053
20.0000	0.056	0.014	1.931	0.05
22.0000	0.056	0.014	2.277	0.053
24.0000	0.056	0.014	2.599	0.056
26.0000	0.056	0.018	2.693	0.056
28.0000	0.051	0.014	2.728	0.053
30.0000	0.056	0.018	2.753	0.059
32.0000	0.056	0.018	2.794	0.059
34.0000	0.056	0.018	2.838	0.062
36.0000	0.061	0.023	2.857	0.062
38.0000	0.061	0.018	2.848	0.062
40.0000	0.061	0.018	2.863	0.066
42.0000	0.061	0.018	2.873	0.062
44.0000	0.061	0.018	2.904	0.066
46.0000	0.061	0.023	2.923	0.069
48.0000	0.061	0.018	2.939	0.072
50.0000	0.061	0.018	2.964	0.069
52.0000	0.061	0.018	2.983	0.066
54.0000	0.056	0.018	2.983	0.069
56.0000	0.056	0.018	2.996	0.069
58.0000	0.061	0.018	3.027	0.069
60.0000	0.061	0.018	3.046	0.072
62.0000	0.056	0.018	3.04	0.069
64.0000	0.056	0.018	3.052	0.072
66.0000	0.056	0.018	3.043	0.075
68.0000	0.056	0.018	3.018	0.072
70.0000	0.056	0.018	4.089	0.075
72.0000	0.056	0.018	4.562	0.081
74.0000	0.056	0.018	4.713	0.078
76.0000	0.061	0.018	4.71	0.078
78.0000	0.061	0.023	4.732	0.081
80.0000	0.061	0.023	4.754	0.084
82.0000	0.061	0.023	4.801	0.088
84.0000	0.061	0.023	4.848	0.088
86.0000	0.065	0.023	4.918	0.094
88.0000	0.065	0.028	4.974	0.091
90.0000	0.065	0.023	5.037	0.091
92.0000	0.061	0.023	5.1	0.091
94.0000	0.065	0.023	5.176	0.094
96.0000	0.061	0.023	5.226	0.097
98.0000	0.061	0.023	5.289	0.094
100.0000	0.065	0.028	5.39	0.094
120.0000	0.061	0.023	7.734	0.103
140.0000	0.065	0.028	8.169	0.11
160.0000	0.061	0.028	9.24	0.113
180.0000	0.061	0.028	8.771	0.113

200.0000	0.061	0.028	8.812	0.113
220.0000	0.061	0.028	9.946	0.113
240.0000	0.065	0.028	10.746	0.119
260.0000	0.065	0.028	11.417	0.116
280.0000	0.065	0.033	12.063	0.119

END

SE2000
Environmental Logger
5/25/99 11:14

Unit# PENTAWOO Test 2

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	MW-05	MW-18	PZ-05	MW-20
Reference	0	0	0	0
PSI at Ref.	3.539	2.598	8.809	2.933
SG	1	1	1	1
Linearity	0.11	0.003	0	0.003
Scale factor	14.922	9.99	10.009	9.99
Offset	-0.05	-0.02	-0.011	-0.02
Delay mSEC	50	50	50	50

Step 0 5/19/99 9:00 13:16

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	0	-0.006	0.916	-0.006
0.0083	0	-0.006	1.112	-0.006
0.0166	0	-0.003	1.313	-0.006
0.0250	0	-0.003	1.505	-0.006
0.0333	0	-0.006	1.694	-0.006
0.0416	0	-0.003	1.887	-0.006
0.0500	0	-0.003	2.057	-0.006
0.0583	0	-0.006	2.214	-0.006
0.0666	0	-0.003	2.388	-0.006
0.0750	0	-0.003	2.539	-0.006
0.0833	0	-0.006	2.681	-0.006
0.0916	0	-0.003	2.838	-0.003
0.1000	0	-0.006	2.948	-0.006
0.1083	0	-0.006	3.078	-0.006
0.1166	0	-0.003	3.182	-0.003
0.1250	0	-0.003	3.289	-0.006
0.1333	0	-0.003	3.374	-0.003
0.1416	0	-0.003	3.459	-0.003
0.1500	0	-0.003	3.509	-0.003
0.1583	0	-0.003	3.556	-0.006
0.1666	0	-0.006	3.579	-0.003
0.1750	0	-0.003	3.619	-0.003
0.1833	0	-0.003	3.619	-0.006
0.1916	0	-0.006	3.616	-0.006
0.2000	0	-0.003	3.613	-0.003

0.2083	0	-0.003	3.594	-0.006
0.2166	0	-0.006	3.575	-0.003
0.2250	0	-0.006	3.541	-0.006
0.2333	0	-0.003	3.534	-0.006
0.2416	-0.004	-0.003	3.5	-0.006
0.2500	0	-0.006	3.481	-0.003
0.2583	-0.004	-0.003	3.449	-0.003
0.2666	0	-0.003	3.418	-0.003
0.2750	0	-0.003	3.402	-0.003
0.2833	0	-0.003	3.352	-0.003
0.2916	0	-0.003	3.355	-0.003
0.3000	0	-0.003	3.314	-0.003
0.3083	0	-0.003	3.301	-0.003
0.3166	0	-0.003	3.279	-0.003
0.3250	0	-0.003	3.248	-0.003
0.3333	0	-0.003	3.219	-0.003
0.3500	0	-0.003	3.172	-0.003
0.3666	0	-0.003	3.125	-0.003
0.3833	0	-0.003	3.068	-0.003
0.4000	0	-0.003	3.015	-0.003
0.4166	0	-0.003	2.961	-0.003
0.4333	0	-0.003	2.93	-0.003
0.4500	0	-0.003	2.873	-0.003
0.4666	0	-0.006	2.826	-0.003
0.4833	0	-0.003	2.763	-0.003
0.5000	0	-0.003	2.715	-0.003
0.5166	-0.004	-0.003	2.7	-0.003
0.5333	0	-0.003	2.649	0
0.5500	0	-0.003	2.618	-0.003
0.5666	0	-0.003	2.558	0
0.5833	0	-0.006	2.514	0
0.6000	0	-0.006	2.466	0
0.6166	0	-0.003	2.441	0
0.6333	0	-0.006	2.419	0
0.6500	0	-0.006	2.413	-0.003
0.6666	0	-0.003	2.4	0
0.6833	0	-0.003	2.41	0
0.7000	0	-0.003	2.425	0
0.7166	0	-0.006	2.435	0
0.7333	0	-0.006	2.457	0
0.7500	0	-0.003	2.47	0
0.7666	0	-0.006	2.492	0
0.7833	0	-0.006	2.504	0
0.8000	0	-0.003	2.529	0
0.8166	0	-0.003	2.539	0
0.8333	0	-0.006	2.555	0
0.8500	0	-0.006	2.592	0
0.8666	0	-0.003	2.614	0
0.8833	0	-0.003	2.605	0
0.9000	0	-0.006	2.633	0

0.9166	0	-0.006	2.602	0
0.9333	0	-0.003	2.577	0
0.9500	0	-0.003	2.564	0
0.9666	0	-0.003	2.539	0
0.9833	0	-0.006	2.542	0
1.0000	0	-0.006	2.52	0
1.2000	0	-0.006	2.126	0
1.4000	0	-0.006	1.802	0
1.6000	0	-0.006	1.55	0
1.8000	0	-0.006	1.342	0
2.0000	0	-0.006	1.168	0
2.2000	0	-0.006	1.077	0
2.4000	0	-0.006	1.099	0
2.6000	0	-0.003	1.222	0
2.8000	0	-0.003	1.543	0
3.0000	0	-0.003	1.906	0
3.2000	0	-0.003	2.318	0
3.4000	0	-0.003	2.674	0.003
3.6000	0	-0.003	2.939	0.003
3.8000	0.004	-0.003	2.989	0.003
4.0000	0	-0.003	2.936	0.003
4.2000	0.004	-0.003	2.835	0.006
4.4000	0	-0.003	2.763	0.006
4.6000	0	-0.003	2.687	0.006
4.8000	0.004	-0.003	2.627	0.006
5.0000	0.004	-0.003	2.548	0.006
5.2000	0.004	-0.003	2.51	0.006
5.4000	0.004	-0.003	2.479	0.006
5.6000	0.004	-0.003	2.438	0.006
5.8000	0.004	-0.003	2.432	0.006
6.0000	0.004	-0.003	2.429	0.006
6.2000	0.004	-0.003	2.422	0.009
6.4000	0.004	-0.003	2.391	0.009
6.6000	0.004	-0.003	2.388	0.009
6.8000	0.004	-0.003	2.356	0.009
7.0000	0.004	-0.003	2.306	0.009
7.2000	0.004	-0.003	2.243	0.009
7.4000	0.004	-0.003	2.195	0.009
7.6000	0.004	-0.003	2.132	0.009
7.8000	0.004	-0.003	2.104	0.009
8.0000	0.004	-0.003	2.063	0.009
8.2000	0.004	-0.003	2.038	0.009
8.4000	0.004	-0.003	2.016	0.009
8.6000	0.004	-0.003	1.978	0.009
8.8000	0.004	-0.003	1.912	0.009
9.0000	0.004	-0.003	1.739	0.012
9.2000	0.004	-0.003	1.575	0.012
9.4000	0.004	-0.003	1.471	0.012
9.6000	0.004	-0.003	1.335	0.009
9.8000	0.009	-0.003	1.206	0.012

10.0000	0.004	-0.003	1.134	0.012
12.0000	0.009	0	0.589	0.012
14.0000	0.009	0	0.315	0.009
16.0000	0.004	-0.003	0.626	0.012
18.0000	0.009	-0.003	1.033	0.009
20.0000	0.009	0	0.989	0.012
22.0000	0.009	0	0.989	0.015
24.0000	0.009	0	0.992	0.012
26.0000	0.009	0	1.005	0.015
28.0000	0.009	0	1.017	0.012
30.0000	0.004	-0.003	1.008	0.012
32.0000	0.009	-0.003	1.02	0.012
34.0000	0.004	-0.003	1.068	0.015
36.0000	0.004	-0.003	1.03	0.012
38.0000	0	-0.006	1.042	0.012
40.0000	0.004	-0.003	1.049	0.012
42.0000	0.004	-0.003	1.074	0.012
44.0000	0.004	-0.003	1.077	0.012
46.0000	0.004	-0.003	1.064	0.012
48.0000	0.009	-0.003	1.077	0.015
50.0000	0.009	-0.003	1.083	0.012
52.0000	0.009	-0.003	1.08	0.012
54.0000	0.009	-0.003	1.058	0.018
56.0000	0.004	-0.003	1.042	0.015
58.0000	0.009	-0.003	1.036	0.015
60.0000	0.004	-0.003	1.036	0.012
62.0000	0.004	-0.003	1.027	0.015
64.0000	0.004	-0.006	1.042	0.015
66.0000	0.004	-0.006	1.042	0.015
68.0000	0.004	-0.006	1.071	0.012
70.0000	0.004	-0.006	1.064	0.012
72.0000	0.004	-0.003	1.052	0.025
74.0000	0.004	-0.003	1.064	0.012
76.0000	0.004	-0.003	1.058	0.012
78.0000	0.004	-0.003	1.083	0.012
80.0000	0.009	-0.003	1.074	0.022
82.0000	0.004	-0.003	1.093	0.025
84.0000	0	-0.006	1.08	0.009
86.0000	0.004	-0.003	1.074	0.015
88.0000	0.004	-0.003	1.086	0.025
90.0000	0.004	-0.003	1.08	0.009
92.0000	0.009	-0.003	1.099	0.015
94.0000	0.009	0	1.09	0.025
96.0000	0.009	0	1.096	0.018
98.0000	0.009	-0.003	1.09	0.009
100.0000	0.009	-0.003	1.099	0.018
120.0000	0.009	-0.003	1.131	0.015
140.0000	0.004	-0.006	1.184	0.012
160.0000	0	-0.009	1.216	0.009
180.0000	0	0	1.247	0.025

200.0000	-0.004	-0.003	1.279	0.022
220.0000	-0.018	-0.006	1.307	0.018
240.0000	-0.023	-0.006	1.348	0.015
260.0000	-0.032	-0.006	1.348	0.012
280.0000	-0.042	-0.003	1.335	0.003
300.0000	-0.051	-0.009	1.364	-0.006
320.0000	-0.032	0.006	1.383	0.034
340.0000	-0.037	0.003	1.395	0.028
360.0000	-0.042	0	1.427	0.028
380.0000	-0.056	-0.006	1.43	0.015
400.0000	-0.051	-0.003	0.901	0.018
420.0000	-0.047	0	0.904	0.022
440.0000	-0.056	-0.003	0.964	0.015
460.0000	-0.07	-0.012	1.02	0
480.0000	-0.084	-0.018	0.97	-0.015
500.0000	-0.075	-0.012	0.942	-0.006
520.0000	-0.065	-0.006	0.979	0.006
540.0000	-0.08	-0.012	0.957	-0.006
560.0000	-0.07	-0.003	0.91	0.003
580.0000	-0.07	-0.003	0.882	0.003
600.0000	-0.065	0	0.885	0.009
620.0000	-0.065	0	0.897	0.009
640.0000	-0.07	-0.003	0.919	0.003
660.0000	-0.08	-0.006	0.825	0
680.0000	-0.07	-0.003	0.649	0.003
700.0000	-0.065	0	0.658	0.009
720.0000	-0.075	-0.006	0.705	-0.003
740.0000	-0.075	-0.003	0.708	0
760.0000	-0.08	-0.006	0.708	0
780.0000	-0.08	-0.006	0.699	0
800.0000	-0.08	-0.006	0.759	-0.003
820.0000	-0.075	-0.003	0.746	0
840.0000	-0.08	-0.006	0.752	-0.003
860.0000	-0.08	-0.006	0.756	-0.003
880.0000	-0.084	-0.009	0.762	-0.003
900.0000	-0.084	-0.006	0.756	-0.006
920.0000	-0.089	-0.009	0.749	-0.009
940.0000	-0.089	-0.012	0.614	-0.009
960.0000	-0.094	-0.009	0.589	-0.012
980.0000	-0.094	-0.009	0.62	-0.012
1000.0000	-0.094	-0.009	0.611	-0.012
1030.0000	-0.094	-0.009	0.592	-0.012
1060.0000	-0.094	-0.012	0.608	-0.015
1090.0000	-0.103	-0.015	0.626	-0.025
1120.0000	-0.103	-0.015	0.611	-0.022
1150.0000	-0.103	-0.012	0.63	-0.022
1180.0000	-0.098	-0.012	0.639	-0.018
1210.0000	-0.108	-0.015	0.649	-0.022
1240.0000	-0.108	-0.015	0.639	-0.028

SE2000
Environmental Logger
5/25/99 11:27

Unit# PENTAWOO Test 2

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	MW-05	MW-18	PZ-05	MW-20
Reference	0	0	0	0
PSI at Ref.	3.539	2.598	8.809	2.933
SG	1	1	1	1
Linearity	0.11	0.003	0	0.003
Scale factor	14.922	9.99	10.009	9.99
Offset	-0.05	-0.02	-0.011	-0.02
Delay mSEC	50	50	50	50

Step 1 5/20/99 8:00 5:14

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	-0.108	-0.012	0.586	-0.022
0.0083	-0.108	-0.012	0.608	-0.022
0.0166	-0.108	-0.012	0.592	-0.022
0.0250	-0.108	-0.012	0.586	-0.022
0.0333	-0.108	-0.012	0.573	-0.022
0.0416	-0.108	-0.012	0.601	-0.022
0.0500	-0.108	-0.012	0.617	-0.022
0.0583	-0.108	-0.012	0.592	-0.018
0.0666	-0.108	-0.012	0.592	-0.022
0.0750	-0.108	-0.012	0.586	-0.018
0.0833	-0.108	-0.012	0.611	-0.018
0.0916	-0.108	-0.012	0.614	-0.022
0.1000	-0.108	-0.012	0.595	-0.022
0.1083	-0.108	-0.012	0.576	-0.022
0.1166	-0.108	-0.012	0.598	-0.022
0.1250	-0.108	-0.012	0.595	-0.022
0.1333	-0.108	-0.012	0.601	-0.022
0.1416	-0.108	-0.012	0.608	-0.018
0.1500	-0.108	-0.012	0.614	-0.022
0.1583	-0.108	-0.012	0.586	-0.022
0.1666	-0.108	-0.012	0.626	-0.018
0.1750	-0.108	-0.012	0.595	-0.022
0.1833	-0.108	-0.012	0.601	-0.022
0.1916	-0.108	-0.012	0.611	-0.022
0.2000	-0.108	-0.012	0.604	-0.018

0.2083	-0.108	-0.012	0.604	-0.018
0.2166	-0.108	-0.012	0.589	-0.022
0.2250	-0.108	-0.012	0.586	-0.022
0.2333	-0.108	-0.012	0.598	-0.022
0.2416	-0.108	-0.012	0.582	-0.022
0.2500	-0.108	-0.012	0.614	-0.018
0.2583	-0.108	-0.012	0.589	-0.018
0.2666	-0.108	-0.012	0.611	-0.018
0.2750	-0.108	-0.012	0.598	-0.022
0.2833	-0.108	-0.012	0.601	-0.018
0.2916	-0.108	-0.012	0.604	-0.018
0.3000	-0.108	-0.012	0.608	-0.018
0.3083	-0.108	-0.012	0.608	-0.018
0.3166	-0.108	-0.012	0.586	-0.022
0.3250	-0.108	-0.012	0.598	-0.022
0.3333	-0.108	-0.012	0.617	-0.022
0.3500	-0.108	-0.012	0.614	-0.022
0.3666	-0.108	-0.012	0.623	-0.022
0.3833	-0.108	-0.012	0.636	-0.018
0.4000	-0.108	-0.012	0.655	-0.018
0.4166	-0.108	-0.012	0.674	-0.018
0.4333	-0.108	-0.012	0.686	-0.022
0.4500	-0.108	-0.012	0.715	-0.018
0.4666	-0.108	-0.015	0.749	-0.018
0.4833	-0.108	-0.012	0.749	-0.018
0.5000	-0.108	-0.012	0.752	-0.022
0.5166	-0.108	-0.012	0.762	-0.022
0.5333	-0.108	-0.012	0.781	-0.018
0.5500	-0.108	-0.012	0.778	-0.018
0.5666	-0.108	-0.012	0.787	-0.018
0.5833	-0.108	-0.012	0.797	-0.018
0.6000	-0.108	-0.012	0.803	-0.022
0.6166	-0.108	-0.012	0.8	-0.018
0.6333	-0.108	-0.012	0.806	-0.018
0.6500	-0.108	-0.012	0.841	-0.018
0.6666	-0.108	-0.012	0.828	-0.018
0.6833	-0.108	-0.012	0.844	-0.018
0.7000	-0.108	-0.012	0.834	-0.018
0.7166	-0.108	-0.012	0.853	-0.018
0.7333	-0.108	-0.012	0.866	-0.018
0.7500	-0.108	-0.012	0.872	-0.018
0.7666	-0.108	-0.012	0.875	-0.022
0.7833	-0.108	-0.012	0.882	-0.022
0.8000	-0.108	-0.012	0.897	-0.018
0.8166	-0.108	-0.012	0.888	-0.018
0.8333	-0.108	-0.012	0.907	-0.022
0.8500	-0.108	-0.012	0.907	-0.018
0.8666	-0.108	-0.012	0.916	-0.018
0.8833	-0.108	-0.012	0.932	-0.018
0.9000	-0.108	-0.012	0.945	-0.018

0.9166	-0.108	-0.012	0.948	-0.018
0.9333	-0.108	-0.012	0.942	-0.018
0.9500	-0.108	-0.012	0.954	-0.018
0.9666	-0.108	-0.012	0.951	-0.018
0.9833	-0.108	-0.012	0.957	-0.018
1.0000	-0.108	-0.012	0.976	-0.018
1.2000	-0.108	-0.012	1.052	-0.018
1.4000	-0.108	-0.012	1.118	-0.018
1.6000	-0.108	-0.012	1.162	-0.018
1.8000	-0.108	-0.012	1.212	-0.022
2.0000	-0.108	-0.015	1.272	-0.022
2.2000	-0.108	-0.012	1.335	-0.022
2.4000	-0.108	-0.012	1.367	-0.022
2.6000	-0.108	-0.015	1.405	-0.022
2.8000	-0.108	-0.012	1.455	-0.022
3.0000	-0.108	-0.015	1.559	-0.022
3.2000	-0.108	-0.012	1.717	-0.018
3.4000	-0.108	-0.012	1.843	-0.018
3.6000	-0.108	-0.015	1.969	-0.018
3.8000	-0.108	-0.015	2.085	-0.018
4.0000	-0.108	-0.015	2.208	-0.018
4.2000	-0.108	-0.015	2.306	-0.018
4.4000	-0.108	-0.015	2.451	-0.018
4.6000	-0.108	-0.012	2.57	-0.018
4.8000	-0.108	-0.015	2.671	-0.018
5.0000	-0.108	-0.015	2.781	-0.018
5.2000	-0.108	-0.012	2.904	-0.015
5.4000	-0.108	-0.012	3.027	-0.015
5.6000	-0.103	-0.012	3.112	-0.012
5.8000	-0.103	-0.012	3.21	-0.012
6.0000	-0.103	-0.012	3.273	-0.015
6.2000	-0.108	-0.012	3.298	-0.015
6.4000	-0.108	-0.012	3.311	-0.015
6.6000	-0.103	-0.012	3.336	-0.015
6.8000	-0.103	-0.012	3.333	-0.015
7.0000	-0.103	-0.012	3.317	-0.012
7.2000	-0.103	-0.012	3.311	-0.012
7.4000	-0.103	-0.012	3.295	-0.012
7.6000	-0.103	-0.012	3.282	-0.012
7.8000	-0.103	-0.015	3.254	-0.012
8.0000	-0.108	-0.012	3.251	-0.012
8.2000	-0.103	-0.012	3.241	-0.012
8.4000	-0.103	-0.012	3.213	-0.012
8.6000	-0.103	-0.015	3.213	-0.012
8.8000	-0.103	-0.015	3.194	-0.009
9.0000	-0.103	-0.012	3.182	-0.009
9.2000	-0.103	-0.012	3.175	-0.012
9.4000	-0.103	-0.012	3.175	-0.009
9.6000	-0.103	-0.012	3.15	-0.006
9.8000	-0.103	-0.012	3.156	-0.009

10.0000	-0.103	-0.012	3.15	-0.006
12.0000	-0.098	-0.009	3.119	-0.003
14.0000	-0.098	-0.009	3.09	-0.006
16.0000	-0.098	-0.009	3.081	0
18.0000	-0.103	-0.012	3.09	-0.003
20.0000	-0.103	-0.012	3.134	0
22.0000	-0.098	-0.009	3.137	0.003
24.0000	-0.098	-0.006	3.194	0.006
26.0000	-0.098	-0.009	3.216	0.006
28.0000	-0.094	-0.009	3.226	0.006
30.0000	-0.094	-0.009	3.238	0.006
32.0000	-0.094	-0.009	3.248	0.009
34.0000	-0.094	-0.009	3.267	0.012
36.0000	-0.094	-0.009	3.273	0.012
38.0000	-0.094	-0.009	3.282	0.012
40.0000	-0.089	-0.009	3.279	0.012
42.0000	-0.094	-0.009	3.295	0.012
44.0000	-0.094	-0.009	3.292	0.015
46.0000	-0.094	-0.009	3.317	0.015
48.0000	-0.098	-0.009	3.33	0.015
50.0000	-0.098	-0.009	3.345	0.015
52.0000	-0.098	-0.009	3.345	0.018
54.0000	-0.098	-0.012	3.355	0.012
56.0000	-0.098	-0.012	3.374	0.015
58.0000	-0.098	-0.012	3.418	0.015
60.0000	-0.103	-0.012	3.443	0.015
62.0000	-0.098	-0.009	3.481	0.015
64.0000	-0.103	-0.012	3.538	0.012
66.0000	-0.103	-0.015	3.648	0.012
68.0000	-0.108	-0.015	3.711	0.009
70.0000	-0.103	-0.018	3.72	0.009
72.0000	-0.108	-0.015	3.705	0.012
74.0000	-0.108	-0.018	3.711	0.009
76.0000	-0.113	-0.018	3.72	0.009
78.0000	-0.108	-0.022	3.723	0.006
80.0000	-0.113	-0.022	3.723	0.009
82.0000	-0.108	-0.018	3.746	0.009
84.0000	-0.108	-0.015	3.739	0.012
86.0000	-0.103	-0.018	3.742	0.009
88.0000	-0.108	-0.015	3.749	0.018
90.0000	-0.108	-0.015	3.714	0.015
92.0000	-0.108	-0.015	3.686	0.009
94.0000	-0.108	-0.015	3.686	0.015
96.0000	-0.108	-0.018	3.689	0.012
98.0000	-0.108	-0.022	3.676	0.012
100.0000	-0.108	-0.018	3.682	0.015
120.0000	-0.108	-0.018	3.799	0.015
140.0000	-0.103	-0.009	3.834	0.028
160.0000	-0.098	-0.006	3.884	0.037
180.0000	-0.098	-0.006	3.947	0.05

200.0000	-0.094	-0.003	3.979	0.053
220.0000	-0.098	-0.006	4.064	0.05
240.0000	-0.103	-0.006	3.998	0.047
260.0000	-0.108	-0.006	4.139	0.05
280.0000	-0.113	-0.009	4.171	0.05
300.0000	-0.108	-0.006	4.196	0.053
320.0000	-0.108	-0.006	4.174	0.056
340.0000	-0.103	-0.003	4.228	0.056
360.0000	-0.108	-0.006	4.287	0.053
380.0000	-0.108	-0.006	4.354	0.056
400.0000	-0.098	0	4.391	0.062
420.0000	-0.108	-0.006	4.486	0.059
440.0000	-0.113	-0.009	4.565	0.053
460.0000	-0.113	-0.009	4.599	0.056
480.0000	-0.108	-0.006	4.681	0.059
500.0000	-0.103	-0.006	4.706	0.059
520.0000	-0.103	-0.006	4.716	0.059
540.0000	-0.113	-0.009	4.773	0.053
560.0000	-0.108	-0.006	4.839	0.059
580.0000	-0.108	-0.006	4.795	0.059
600.0000	-0.108	-0.006	4.795	0.056
620.0000	-0.108	-0.006	4.788	0.059
640.0000	-0.108	-0.006	4.757	0.056
660.0000	-0.108	-0.006	4.798	0.059
680.0000	-0.103	-0.003	4.87	0.066
700.0000	-0.108	-0.006	4.949	0.056
720.0000	-0.103	-0.006	4.858	0.062
740.0000	-0.108	-0.006	4.826	0.059
760.0000	-0.108	-0.006	4.839	0.059
780.0000	-0.094	0.003	4.971	0.069
800.0000	-0.089	0.006	5.028	0.075
820.0000	-0.098	0	5.053	0.069
840.0000	-0.098	0	5.053	0.072
860.0000	-0.098	0	5.053	0.072
880.0000	-0.098	0.003	5.135	0.075
900.0000	-0.108	-0.006	5.198	0.059
920.0000	-0.103	-0.003	5.188	0.062
940.0000	-0.103	-0.003	5.283	0.062
960.0000	-0.098	0	5.412	0.069
980.0000	-0.098	0	5.526	0.069
1000.0000	-0.098	0	5.563	0.072
1030.0000	-0.098	-0.003	5.661	0.069
1060.0000	-0.103	-0.003	5.79	0.066
1090.0000	-0.098	0	5.945	0.066
1120.0000	-0.103	-0.003	6.099	0.066
1150.0000	-0.098	0	6.297	0.069
1180.0000	-0.098	0	6.449	0.066
1210.0000	-0.098	0	6.055	0.066
1240.0000	-0.098	0	6.001	0.066
1270.0000	-0.098	0	5.989	0.062

1300.0000	-0.094	0.003	6.137	0.072
1330.0000	-0.094	0.003	6.285	0.072
1360.0000	-0.094	0.003	6.417	0.069
1390.0000	-0.094	0.003	6.543	0.069
1420.0000	-0.094	0.003	6.742	0.072
1450.0000	-0.094	0.003	6.984	0.072
1480.0000	-0.089	0.006	7.057	0.078
1510.0000	-0.084	0.009	7.29	0.075
1540.0000	-0.084	0.009	7.504	0.078
1570.0000	-0.08	0.012	7.457	0.078
1600.0000	-0.084	0.009	7.454	0.075
1630.0000	-0.084	0.009	7.624	0.075
1660.0000	-0.084	0.006	7.684	0.075

END

SE2000
Environmental Logger
5/25/99 11:34

Unit# PENTAWOO Test 3

Setups:	INPUT 1	INPUT 2	INPUT 3
Type	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC
I.D.	MW-05	MW-18	PZ-05
Reference	0	0	0
PSI at Ref.	11.58	10.549	5.555
SG	1	1	1
Linearity	0.11	0.003	0
Scale factor	14.922	9.99	10.009
Offset	-0.05	-0.02	-0.011
Delay mSEC	50	50	50

Step 0 05/21 15:42:37

Elapsed Time	INPUT 1	INPUT 2	INPUT 3
0.0000	0	0	0.003
0.0083	0	0	0.003
0.0166	0	0	0.003
0.0250	0	0	0.003
0.0333	0	0	0.003
0.0416	0	0	0.003
0.0500	0	0	0.003
0.0583	0	0	0.003
0.0666	0	0	0.003
0.0750	0	0	0.003
0.0833	0	0	0.003
0.0916	0	0	0.003
0.1000	0	0	0.003
0.1083	0	0	0.003
0.1166	0	0	0.003
0.1250	0	0	0.003
0.1333	0	0	0.003
0.1416	0	0	0.003
0.1500	0	0	0.003
0.1583	0	0	0.003
0.1666	0	0	0.003
0.1750	0	0	0.003
0.1833	0	0	0.003
0.1916	0	0	0.003
0.2000	0	0	0.003

0.2083	0	0	0.003
0.2166	0	0	0.003
0.2250	0	0	0.003
0.2333	0	0	0.003
0.2416	0	0	0.003
0.2500	0	0	0.003
0.2583	0	0	0.003
0.2666	0	0	0.003
0.2750	0	0	0.003
0.2833	0	0	0.003
0.2916	0	0	0.003
0.3000	0	0	0.003
0.3083	0	0	0.003
0.3166	0	0	0.003
0.3250	0	0	0.003
0.3333	0	0	0.003
0.3500	0	0	0.003
0.3666	0	3.933	0
0.3833	0	0.245	0
0.4000	0	0.865	0
0.4166	0	1.416	0
0.4333	0	1.932	0
0.4500	0	2.375	0
0.4666	0	2.822	0
0.4833	0	3.225	0
0.5000	0	3.622	0
0.5166	0	3.983	0
0.5333	0.004	4.323	0
0.5500	0.004	4.654	0
0.5666	0.004	4.864	0
0.5833	0.004	5.236	0
0.6000	0.009	5.484	0
0.6166	0.009	5.802	0
0.6333	0.009	5.997	0
0.6500	0.014	6.312	0
0.6666	0.014	6.532	0
0.6833	0.014	6.806	0
0.7000	0.019	7.013	0
0.7166	0.019	7.271	0
0.7333	0.019	7.511	0
0.7500	0.023	7.677	0
0.7666	0.028	7.869	0
0.7833	0.028	7.926	0
0.8000	0.028	7.482	0
0.8166	0.033	7.932	0.003
0.8333	0.038	7.86	0.003
0.8500	0.038	7.854	0
0.8666	0.038	7.803	0.003
0.8833	0.042	7.8	0.003
0.9000	0.042	7.668	0.003

0.9166	0.047	7.684	0.003
0.9333	0.047	7.514	0
0.9500	0.052	7.445	0.003
0.9666	0.057	7.312	0.003
0.9833	0.057	7.171	0
1.0000	0.061	7.023	0.003
1.2000	0.076	5.576	0.003
1.4000	0.08	4.314	0.003
1.6000	0.071	3.568	0
1.8000	0.066	2.913	0
2.0000	0.057	2.467	0
2.2000	0.052	2.086	0
2.4000	0.047	1.951	0
2.6000	0.042	2.177	0
2.8000	0.042	2.419	0
3.0000	0.042	2.539	0
3.2000	0.042	2.633	0
3.4000	0.042	2.772	0
3.6000	0.042	2.825	0
3.8000	0.047	2.901	0
4.0000	0.047	2.857	0
4.2000	0.047	2.766	0
4.4000	0.042	2.64	0
4.6000	0.042	2.574	0
4.8000	0.042	2.504	0
5.0000	0.042	2.486	0
5.2000	0.042	2.423	0
5.4000	0.042	2.407	0
5.6000	0.042	2.388	0
5.8000	0.042	2.391	-0.003
6.0000	0.038	2.334	0
6.2000	0.042	2.331	0
6.4000	0.038	2.294	-0.003
6.6000	0.038	2.309	-0.003
6.8000	0.033	2.275	-0.003
7.0000	0.033	2.265	-0.003
7.2000	0.033	2.259	-0.003
7.4000	0.033	2.227	-0.003
7.6000	0.033	2.231	0
7.8000	0.033	2.237	-0.003
8.0000	0.033	2.224	-0.003
8.2000	0.033	2.199	-0.003
8.4000	0.033	2.224	0
8.6000	0.033	2.193	0
8.8000	0.033	2.227	0
9.0000	0.028	2.18	0
9.2000	0.033	2.196	0
9.4000	0.033	2.199	0.003
9.6000	0.033	2.174	0.003
9.8000	0.033	2.171	0.003

10.0000	0.033	2.139	0.003
12.0000	0.033	2.121	0
14.0000	0.028	2.105	0
16.0000	0.028	2.127	-0.003
18.0000	0.028	2.102	-0.003
20.0000	0.028	2.095	-0.003
22.0000	0.033	2.161	-0.003
24.0000	0.028	2.117	-0.003
26.0000	0.028	2.124	-0.003
28.0000	0.033	2.139	-0.003
30.0000	0.033	2.111	-0.006
32.0000	0.028	2.158	-0.006
34.0000	0.033	2.139	-0.006
36.0000	0.028	2.117	-0.006
38.0000	0.028	2.146	-0.006
40.0000	0.028	2.152	-0.006
42.0000	0.028	2.19	-0.006
44.0000	0.028	2.158	-0.006
46.0000	0.028	2.187	-0.006
48.0000	0.028	2.187	-0.006
50.0000	0.028	2.168	-0.006
52.0000	0.033	2.196	-0.006
54.0000	0.033	2.19	-0.006
56.0000	0.028	2.196	-0.009
58.0000	0.028	2.202	-0.006
60.0000	0.028	2.187	-0.012
62.0000	0.033	2.209	-0.012
64.0000	0.033	2.187	-0.012
66.0000	0.028	2.202	-0.012
68.0000	0.033	2.231	-0.009
70.0000	0.033	2.237	-0.006
72.0000	0.033	2.237	-0.009
74.0000	0.028	2.231	-0.012
76.0000	0.033	2.246	-0.012
78.0000	0.033	2.256	-0.012
80.0000	0.033	2.224	-0.012
82.0000	0.033	2.262	-0.012
84.0000	0.033	2.227	-0.012
86.0000	0.033	2.243	-0.015
88.0000	0.033	2.297	-0.012
90.0000	0.033	2.275	-0.015
92.0000	0.028	2.275	-0.015
94.0000	0.028	2.265	-0.015
96.0000	0.033	2.275	-0.015
98.0000	0.033	2.243	-0.015
100.0000	0.028	2.256	-0.015
120.0000	0.028	2.3	-0.015
140.0000	0.033	2.319	-0.022
160.0000	0.028	2.341	-0.022
180.0000	0.033	2.35	-0.025

200.0000	0.033	2.397	-0.025
220.0000	0.038	2.429	-0.028
240.0000	0.033	2.397	-0.034
260.0000	0.033	2.416	-0.04
280.0000	0.028	2.426	-0.044
300.0000	0.028	2.445	-0.044
320.0000	0.028	2.482	-0.047
340.0000	0.033	2.467	-0.05
360.0000	0.033	2.46	-0.059
380.0000	0.033	2.476	-0.063
400.0000	0.033	2.482	-0.066
420.0000	0.028	2.482	-0.072
440.0000	0.033	2.52	-0.075
460.0000	0.033	2.511	-0.081
480.0000	0.033	2.536	-0.088
500.0000	0.033	2.574	-0.088
520.0000	0.028	2.552	-0.091
540.0000	0.033	2.558	-0.094
560.0000	0.023	2.53	-0.094
580.0000	0.023	2.564	-0.091
600.0000	0.028	2.589	-0.094
620.0000	0.028	2.567	-0.094
640.0000	0.023	2.574	-0.094
660.0000	0.028	2.58	-0.097
680.0000	0.028	2.564	-0.1
700.0000	0.028	2.589	-0.1
720.0000	0.028	2.615	-0.056
740.0000	0.028	2.589	-0.056
760.0000	0.023	2.624	-0.056
780.0000	0.028	2.599	-0.056
800.0000	0.023	2.611	-0.053
820.0000	0.023	2.627	-0.053
840.0000	0.023	2.605	-0.053
860.0000	0.023	2.652	-0.056
880.0000	0.023	2.643	-0.053
900.0000	0.028	2.655	-0.056
920.0000	0.028	2.643	-0.056
940.0000	0.028	2.674	-0.056
960.0000	0.028	2.659	-0.056
980.0000	0.038	2.674	-0.056
1000.0000	0.038	2.671	-0.059

END

SE20 0
Environmental Logger
5/25/99 11:45

Unit# PENTAWOO Test 3

Setups:	INPUT 1	INPUT 2	INPUT 3
Type	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC
I.D.	MW-05	MW-18	PZ-05
Reference	0	0	0
PSI at Ref.	11.58	10.549	5.555
SG	1	1	1
Linearity	0.11	0.003	0
Scale factor	14.922	9.99	10.009
Offset	-0.05	-0.02	-0.011
Delay mSEC	50	50	50

Step 1 05/22 08:32:43

Elapsed Time	INPUT 1	INPUT 2	INPUT 3
0.0000	0.042	3.058	-0.059
0.0083	0.042	3.09	-0.059
0.0166	0.042	3.109	-0.059
0.0250	0.042	3.131	-0.059
0.0333	0.042	3.134	-0.059
0.0416	0.042	3.159	-0.059
0.0500	0.042	3.203	-0.059
0.0583	0.047	3.194	-0.059
0.0666	0.047	3.219	-0.059
0.0750	0.042	3.269	-0.059
0.0833	0.042	3.301	-0.059
0.0916	0.042	3.291	-0.059
0.1000	0.047	3.338	-0.059
0.1083	0.047	3.351	-0.059
0.1166	0.047	3.426	-0.059
0.1250	0.047	3.426	-0.059
0.1333	0.047	3.474	-0.059
0.1416	0.047	3.508	-0.059
0.1500	0.047	3.568	-0.059
0.1583	0.047	3.568	-0.059
0.1666	0.047	3.612	-0.059
0.1750	0.047	3.691	-0.059
0.1833	0.047	3.728	-0.059
0.1916	0.047	3.769	-0.059
0.2000	0.047	3.832	-0.059

0.2083	0.047	3.842	-0.059
0.2166	0.047	3.917	-0.059
0.2250	0.047	3.977	-0.059
0.2333	0.047	4.018	-0.059
0.2416	0.047	4.106	-0.059
0.2500	0.047	4.163	-0.059
0.2583	0.047	4.21	-0.059
0.2666	0.047	4.254	-0.059
0.2750	0.047	4.336	-0.059
0.2833	0.047	4.396	-0.059
0.2916	0.052	4.405	-0.059
0.3000	0.047	4.468	-0.059
0.3083	0.047	4.521	-0.059
0.3166	0.047	4.591	-0.059
0.3250	0.052	4.647	-0.059
0.3333	0.052	4.657	-0.059
0.3500	0.047	4.77	-0.059
0.3666	0.052	4.852	-0.059
0.3833	0.052	4.984	-0.056
0.4000	0.052	5.041	-0.059
0.4166	0.052	5.148	-0.056
0.4333	0.052	5.201	-0.056
0.4500	0.052	5.308	-0.059
0.4666	0.052	5.402	-0.059
0.4833	0.052	5.484	-0.056
0.5000	0.057	5.535	-0.056
0.5166	0.057	5.626	-0.056
0.5333	0.057	5.692	-0.056
0.5500	0.057	5.767	-0.056
0.5666	0.057	5.846	-0.056
0.5833	0.057	5.944	-0.056
0.6000	0.061	6.025	-0.056
0.6166	0.061	5.978	-0.056
0.6333	0.061	6.085	-0.056
0.6500	0.061	6.019	-0.056
0.6666	0.061	5.994	-0.056
0.6833	0.061	5.903	-0.056
0.7000	0.061	5.903	-0.056
0.7166	0.066	5.837	-0.056
0.7333	0.066	5.812	-0.056
0.7500	0.066	5.774	-0.056
0.7666	0.066	5.777	-0.056
0.7833	0.066	5.758	-0.056
0.8000	0.066	5.805	-0.056
0.8166	0.066	5.799	-0.056
0.8333	0.066	5.815	-0.056
0.8500	0.066	5.827	-0.056
0.8666	0.066	5.837	-0.056
0.8833	0.066	5.84	-0.056
0.9000	0.071	5.896	-0.056

0.9166	0.071	5.878	-0.056
0.9333	0.071	5.909	-0.056
0.9500	0.071	5.912	-0.056
0.9666	0.071	5.928	-0.056
0.9833	0.071	5.922	-0.056
1.0000	0.071	5.928	-0.056
1.2000	0.076	6.06	-0.056
1.4000	0.08	6.183	-0.056
1.6000	0.08	6.258	-0.056
1.8000	0.08	6.353	-0.056
2.0000	0.085	6.444	-0.056
2.2000	0.085	6.299	-0.056
2.4000	0.085	6.079	-0.056
2.6000	0.085	5.865	-0.056
2.8000	0.085	5.695	-0.059
3.0000	0.085	5.541	-0.059
3.2000	0.085	5.409	-0.059
3.4000	0.085	5.302	-0.059
3.6000	0.08	5.242	-0.059
3.8000	0.08	5.195	-0.059
4.0000	0.08	5.333	-0.059
4.2000	0.08	5.352	-0.059
4.4000	0.08	5.387	-0.059
4.6000	0.08	5.393	-0.059
4.8000	0.08	5.377	-0.059
5.0000	0.08	5.362	-0.059
5.2000	0.08	5.324	-0.059
5.4000	0.08	5.343	-0.059
5.6000	0.08	5.349	-0.059
5.8000	0.076	5.299	-0.059
6.0000	0.076	5.292	-0.059
6.2000	0.076	5.318	-0.059
6.4000	0.076	5.327	-0.059
6.6000	0.076	5.33	-0.059
6.8000	0.076	5.343	-0.059
7.0000	0.076	5.333	-0.059
7.2000	0.076	5.327	-0.059
7.4000	0.076	5.34	-0.059
7.6000	0.076	5.343	-0.059
7.8000	0.076	5.327	-0.059
8.0000	0.076	5.33	-0.059
8.2000	0.076	5.362	-0.059
8.4000	0.076	5.343	-0.059
8.6000	0.076	5.314	-0.059
8.8000	0.076	5.358	-0.059
9.0000	0.076	5.377	-0.059
9.2000	0.076	5.333	-0.059
9.4000	0.08	5.362	-0.059
9.6000	0.08	5.365	-0.059
9.8000	0.076	5.311	-0.059

10.0000	0.076	5.355	-0.059
12.0000	0.076	5.333	-0.059
14.0000	0.076	5.362	-0.059
16.0000	0.076	5.38	-0.059
18.0000	0.076	5.406	-0.059
20.0000	0.076	5.39	-0.059
22.0000	0.076	5.418	-0.059
24.0000	0.08	5.377	-0.059
26.0000	0.08	5.393	-0.059
28.0000	0.08	5.406	-0.059
30.0000	0.08	5.374	-0.059
32.0000	0.08	5.38	-0.059
34.0000	0.08	5.453	-0.063
36.0000	0.08	5.387	-0.063
38.0000	0.08	5.418	-0.063
40.0000	0.08	5.428	-0.063
42.0000	0.08	5.447	-0.063
44.0000	0.08	5.399	-0.063
46.0000	0.08	5.447	-0.063
48.0000	0.08	5.415	-0.063
50.0000	0.08	5.428	-0.063
52.0000	0.08	5.406	-0.063
54.0000	0.08	5.428	-0.063
56.0000	0.076	5.469	-0.063
58.0000	0.076	5.469	-0.063
60.0000	0.08	5.443	-0.063
62.0000	0.08	5.415	-0.059
64.0000	0.076	5.456	-0.059
66.0000	0.08	5.459	-0.063
68.0000	0.08	5.469	-0.063
70.0000	0.076	5.437	-0.059
72.0000	0.076	5.453	-0.059
74.0000	0.076	5.45	-0.059
76.0000	0.076	5.437	-0.059
78.0000	0.076	5.465	-0.059
80.0000	0.08	5.469	-0.059
82.0000	0.08	5.484	-0.056
84.0000	0.076	5.469	-0.056
86.0000	0.076	5.475	-0.056
88.0000	0.08	5.443	-0.056
90.0000	0.08	5.475	-0.056
92.0000	0.076	5.5	-0.056
94.0000	0.08	5.506	-0.056
96.0000	0.076	5.528	-0.056
98.0000	0.08	5.45	-0.056
100.0000	0.076	5.509	-0.056
120.0000	0.076	5.525	-0.05
140.0000	0.071	5.538	-0.047
160.0000	0.085	5.535	-0.044
180.0000	0.08	5.544	-0.047

200.0000	0.076	5.522	-0.044
220.0000	0.071	5.541	-0.044
240.0000	0.071	5.538	-0.04
260.0000	0.076	5.554	-0.031
280.0000	0.076	5.541	-0.028
300.0000	0.071	5.569	-0.025

END

SE2000
Environmental Logger
5/25/99 11:51

Unit# PENTAWOO Test 3

Setups:	INPUT 1	INPUT 2	INPUT 3
Type	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC
I.D.	MW-05	MW-18	PZ-05
Reference	0	0	0
PSI at Ref.	11.58	10.549	5.555
SG	1	1	1
Linearity	0.11	0.003	0
Scale factor	14.922	9.99	10.009
Offset	-0.05	-0.02	-0.011
Delay mSEC	50	50	50

Step 2 05/22 13:44:35

Elapsed Time	INPUT 1	INPUT 2	INPUT 3
0.0000	0.071	5.569	-0.025
0.0083	0.071	5.55	-0.025
0.0166	0.071	5.582	-0.022
0.0250	0.071	5.538	-0.025
0.0333	0.071	5.569	-0.025
0.0416	0.071	5.544	-0.022
0.0500	0.071	5.516	-0.022
0.0583	0.076	5.55	-0.022
0.0666	0.071	5.535	-0.022
0.0750	0.071	5.554	-0.022
0.0833	0.071	5.601	-0.022
0.0916	0.076	5.557	-0.022
0.1000	0.071	5.576	-0.022
0.1083	0.071	5.569	-0.022
0.1166	0.071	5.572	-0.022
0.1250	0.071	5.569	-0.022
0.1333	0.076	5.55	-0.022
0.1416	0.071	5.582	-0.022
0.1500	0.076	5.535	-0.022
0.1583	0.071	5.535	-0.022
0.1666	0.076	5.56	-0.022
0.1750	0.071	5.535	-0.022
0.1833	0.076	5.579	-0.022
0.1916	0.071	5.56	-0.022
0.2000	0.071	5.566	-0.022

0.2083	0.071	5.579	-0.022
0.2166	0.071	5.585	-0.022
0.2250	0.071	5.61	-0.022
0.2333	0.076	5.582	-0.022
0.2416	0.071	5.576	-0.022
0.2500	0.071	5.582	-0.022
0.2583	0.071	5.541	-0.022
0.2666	0.076	5.55	-0.022
0.2750	0.076	5.547	-0.022
0.2833	0.076	5.531	-0.022
0.2916	0.071	5.554	-0.022
0.3000	0.071	5.585	-0.022
0.3083	0.076	5.55	-0.022
0.3166	0.076	5.585	-0.022
0.3250	0.071	5.594	-0.022
0.3333	0.071	5.623	-0.022
0.3500	0.076	5.67	-0.022
0.3666	0.071	5.714	-0.022
0.3833	0.071	5.771	-0.022
0.4000	0.071	5.802	-0.022
0.4166	0.071	5.849	-0.022
0.4333	0.071	5.896	-0.022
0.4500	0.071	5.972	-0.022
0.4666	0.071	6.032	-0.022
0.4833	0.071	6.085	-0.022
0.5000	0.071	6.151	-0.022
0.5166	0.071	6.189	-0.022
0.5333	0.076	6.214	-0.022
0.5500	0.071	6.261	-0.022
0.5666	0.076	6.293	-0.022
0.5833	0.071	6.359	-0.022
0.6000	0.076	6.419	-0.022
0.6166	0.076	6.466	-0.022
0.6333	0.071	6.532	-0.022
0.6500	0.076	6.567	-0.018
0.6666	0.076	6.589	-0.022
0.6833	0.076	6.62	-0.022
0.7000	0.076	6.661	-0.022
0.7166	0.076	6.693	-0.022
0.7333	0.076	6.737	-0.022
0.7500	0.076	6.787	-0.022
0.7666	0.076	6.818	-0.022
0.7833	0.076	6.9	-0.022
0.8000	0.076	6.916	-0.022
0.8166	0.08	6.957	-0.022
0.8333	0.076	6.982	-0.022
0.8500	0.08	7.017	-0.022
0.8666	0.08	7.035	-0.022
0.8833	0.08	7.045	-0.022
0.9000	0.08	7.133	-0.022

0.9166	0.08	7.174	-0.022
0.9333	0.08	7.215	-0.018
0.9500	0.08	7.253	-0.022
0.9666	0.08	7.278	-0.022
0.9833	0.08	7.306	-0.022
1.0000	0.08	7.319	-0.022
1.2000	0.085	7.743	-0.022
1.4000	0.09	8.011	-0.022
1.6000	0.095	8.316	-0.022
1.8000	0.099	8.48	-0.022
2.0000	0.104	8.731	-0.022
2.2000	0.109	8.841	-0.022
2.4000	0.123	8.788	-0.018
2.6000	0.133	8.684	-0.022
2.8000	0.137	8.414	-0.018
3.0000	0.137	8.225	-0.022
3.2000	0.133	8.401	-0.018
3.4000	0.133	8.527	-0.018
3.6000	0.128	8.583	-0.018
3.8000	0.128	8.65	-0.018
4.0000	0.128	8.672	-0.018
4.2000	0.128	8.662	-0.022
4.4000	0.128	8.609	-0.018
4.6000	0.128	8.536	-0.018
4.8000	0.128	8.486	-0.018
5.0000	0.128	8.432	-0.018
5.2000	0.128	8.338	-0.018
5.4000	0.128	8.322	-0.018
5.6000	0.128	8.25	-0.018
5.8000	0.128	8.2	-0.018
6.0000	0.123	8.181	-0.018
6.2000	0.123	8.099	-0.018
6.4000	0.123	8.134	-0.018
6.6000	0.123	8.067	-0.018
6.8000	0.123	8.017	-0.018
7.0000	0.123	8.017	-0.018
7.2000	0.123	7.96	-0.015
7.4000	0.123	7.948	-0.018
7.6000	0.123	7.967	-0.015
7.8000	0.123	7.92	-0.015
8.0000	0.123	7.898	-0.015
8.2000	0.123	7.945	-0.015
8.4000	0.123	7.935	-0.015
8.6000	0.123	7.932	-0.018
8.8000	0.123	7.935	-0.018
9.0000	0.118	7.945	-0.018
9.2000	0.123	7.935	-0.018
9.4000	0.123	7.97	-0.018
9.6000	0.123	7.954	-0.015
9.8000	0.123	7.945	-0.015

10.0000	0.118	7.954	-0.015
12.0000	0.118	7.916	-0.015
14.0000	0.114	7.989	-0.015
16.0000	0.114	8.005	-0.018
18.0000	0.114	8.017	-0.015
20.0000	0.118	8.027	-0.015
22.0000	0.118	8.052	-0.015
24.0000	0.118	8.008	-0.015
26.0000	0.118	8.055	-0.015
28.0000	0.114	8.03	-0.015
30.0000	0.118	7.992	-0.015
32.0000	0.114	7.998	-0.012
34.0000	0.114	8.036	-0.012
36.0000	0.114	8.039	-0.009
38.0000	0.114	8.064	-0.009
40.0000	0.114	8.045	-0.009
42.0000	0.114	8.096	-0.006
44.0000	0.114	8.074	-0.006
46.0000	0.118	8.086	-0.006
48.0000	0.114	8.036	-0.059
50.0000	0.118	8.055	-0.053
52.0000	0.114	8.042	-0.053
54.0000	0.118	8.052	-0.05
56.0000	0.114	8.039	-0.056
58.0000	0.114	8.045	-0.05
60.0000	0.114	8.08	-0.05
62.0000	0.114	8.089	-0.047
64.0000	0.114	8.067	-0.044
66.0000	0.118	8.077	-0.047
68.0000	0.114	8.071	-0.05
70.0000	0.109	8.067	-0.05
72.0000	0.109	8.074	-0.047
74.0000	0.114	8.067	-0.04
76.0000	0.114	8.071	-0.044
78.0000	0.114	8.115	-0.04
80.0000	0.114	8.067	-0.044
82.0000	0.114	8.071	-0.04
84.0000	0.118	8.077	-0.044
86.0000	0.118	8.071	-0.044
88.0000	0.114	8.071	-0.044
90.0000	0.114	8.093	-0.04
92.0000	0.118	8.105	-0.04
94.0000	0.114	8.112	-0.037
96.0000	0.118	8.074	-0.037
98.0000	0.114	8.074	-0.037
100.0000	0.114	8.096	-0.037
120.0000	0.118	8.086	-0.034
140.0000	0.171	10.852	-0.028

END

SE2000
Environmental Logger
5/25/99 11:55

Unit# PENTAWOO Test 3

Setups:	INPUT 1	INPUT 2	INPUT 3
Type	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC
I.D.	MW-05	MW-18	PZ-05
Reference	0	0	0
PSI at Ref.	11.58	10.549	5.555
SG	1	1	1
Linearity	0.11	0.003	0
Scale factor	14.922	9.99	10.009
Offset	-0.05	-0.02	-0.011
Delay mSEC	50	50	50

Step 3 05/22 16:06:04

Elapsed Time	INPUT 1	INPUT 2	INPUT 3
0.0000	0.175	10.833	-0.028
0.0083	0.175	10.83	-0.028
0.0166	0.175	10.82	-0.028
0.0250	0.175	10.814	-0.028
0.0333	0.175	10.805	-0.028
0.0416	0.175	10.827	-0.025
0.0500	0.175	10.811	-0.028
0.0583	0.175	10.801	-0.028
0.0666	0.175	10.801	-0.025
0.0750	0.175	10.827	-0.025
0.0833	0.175	10.811	-0.028
0.0916	0.175	10.82	-0.028
0.1000	0.175	10.833	-0.028
0.1083	0.175	10.842	-0.028
0.1166	0.175	10.842	-0.028
0.1250	0.175	10.836	-0.028
0.1333	0.175	10.858	-0.028
0.1416	0.175	10.864	-0.028
0.1500	0.175	10.855	-0.028
0.1583	0.175	10.833	-0.028
0.1666	0.175	10.855	-0.028
0.1750	0.175	10.83	-0.028
0.1833	0.175	10.817	-0.028
0.1916	0.175	10.811	-0.028
0.2000	0.175	10.83	-0.028

0.2083	0.175	10.827	-0.028
0.2166	0.175	10.798	-0.028
0.2250	0.175	10.814	-0.028
0.2333	0.175	10.817	-0.028
0.2416	0.175	10.817	-0.028
0.2500	0.175	10.808	-0.028
0.2583	0.175	10.817	-0.028
0.2666	0.175	10.824	-0.028
0.2750	0.175	10.83	-0.025
0.2833	0.175	10.83	-0.028
0.2916	0.175	10.839	-0.028
0.3000	0.175	10.868	-0.025
0.3083	0.175	10.839	-0.025
0.3166	0.175	10.83	-0.028
0.3250	0.175	10.852	-0.028
0.3333	0.175	10.858	-0.025
0.3500	0.175	10.824	-0.028
0.3666	0.175	10.839	-0.028
0.3833	0.175	10.805	-0.028
0.4000	0.175	10.82	-0.025
0.4166	0.175	10.792	-0.025
0.4333	0.175	10.824	-0.028
0.4500	0.175	10.817	-0.025
0.4666	0.175	10.846	-0.028
0.4833	0.175	10.836	-0.028
0.5000	0.175	10.849	-0.028
0.5166	0.175	10.83	-0.028
0.5333	0.175	10.811	-0.025
0.5500	0.175	10.824	-0.025
0.5666	0.175	10.811	-0.025
0.5833	0.175	10.792	-0.025
0.6000	0.175	10.827	-0.025
0.6166	0.175	10.836	-0.025
0.6333	0.175	10.842	-0.025
0.6500	0.175	10.855	-0.025
0.6666	0.175	10.83	-0.025
0.6833	0.175	10.817	-0.025
0.7000	0.175	10.805	-0.028
0.7166	0.175	10.83	-0.025
0.7333	0.175	10.792	-0.025
0.7500	0.175	10.839	-0.025
0.7666	0.175	10.833	-0.025
0.7833	0.175	10.861	-0.025
0.8000	0.175	10.849	-0.025
0.8166	0.175	10.868	-0.025
0.8333	0.175	10.833	-0.025
0.8500	0.175	10.817	-0.025
0.8666	0.175	10.814	-0.025
0.8833	0.175	10.805	-0.025
0.9000	0.175	10.817	-0.025

0.9166	0.175	10.842	-0.025
0.9333	0.175	10.842	-0.025
0.9500	0.175	10.852	-0.025
0.9666	0.175	10.858	-0.025
0.9833	0.175	10.858	-0.025
1.0000	0.175	10.849	-0.025
1.2000	0.175	10.811	-0.025
1.4000	0.175	10.827	-0.025
1.6000	0.175	10.855	-0.025
1.8000	0.175	10.833	-0.028
2.0000	0.175	10.827	-0.025
2.2000	0.175	10.833	-0.025
2.4000	0.175	10.836	-0.028
2.6000	0.175	10.849	-0.025
2.8000	0.175	10.836	-0.025
3.0000	0.175	10.827	-0.025
3.2000	0.175	10.855	-0.025
3.4000	0.175	10.83	-0.025
3.6000	0.171	10.808	-0.025
3.8000	0.171	10.849	-0.025
4.0000	0.171	10.846	-0.028
4.2000	0.171	10.805	-0.025
4.4000	0.175	10.811	-0.025
4.6000	0.175	10.827	-0.025
4.8000	0.175	10.839	-0.025
5.0000	0.175	10.842	-0.025
5.2000	0.175	10.811	-0.025
5.4000	0.171	10.798	-0.025
5.6000	0.175	10.789	-0.025
5.8000	0.175	10.805	-0.025
6.0000	0.175	10.82	-0.025
6.2000	0.175	10.839	-0.025
6.4000	0.175	10.808	-0.025
6.6000	0.175	10.798	-0.025
6.8000	0.171	10.786	-0.025
7.0000	0.175	10.798	-0.025
7.2000	0.175	10.817	-0.025
7.4000	0.175	10.83	-0.025
7.6000	0.175	10.83	-0.025
7.8000	0.171	10.805	-0.025
8.0000	0.175	10.789	-0.025
8.2000	0.175	10.795	-0.025
8.4000	0.175	10.792	-0.025
8.6000	0.171	10.83	-0.025
8.8000	0.175	10.792	-0.025
9.0000	0.171	10.801	-0.025
9.2000	0.175	10.773	-0.025
9.4000	0.171	10.808	-0.025
9.6000	0.171	10.817	-0.025
9.8000	0.175	10.808	-0.025

10.0000	0.171	10.801	-0.022
12.0000	0.171	10.801	-0.022
14.0000	0.171	10.798	-0.022
16.0000	0.171	10.814	-0.022
18.0000	0.171	10.82	-0.022
20.0000	0.171	10.783	-0.018
22.0000	0.171	10.616	-0.018
24.0000	0.171	10.578	-0.015
26.0000	0.171	10.572	-0.015
28.0000	0.171	10.556	-0.015
30.0000	0.171	10.6	-0.012
32.0000	0.171	10.578	-0.012
34.0000	0.171	10.584	-0.066
36.0000	0.171	10.588	-0.059
38.0000	0.171	10.603	-0.056
40.0000	0.171	10.632	-0.053
42.0000	0.171	10.603	-0.053
44.0000	0.171	10.613	-0.047
46.0000	0.171	10.603	-0.047
48.0000	0.171	10.603	-0.047
50.0000	0.171	10.641	-0.044
52.0000	0.171	10.644	-0.047
54.0000	0.171	10.628	-0.047
56.0000	0.171	10.632	-0.044
58.0000	0.171	10.657	-0.044
60.0000	0.171	10.619	-0.04
62.0000	0.171	10.654	-0.04
64.0000	0.171	10.641	-0.04
66.0000	0.166	10.625	-0.04
68.0000	0.166	10.616	-0.04
70.0000	0.171	10.644	-0.037
72.0000	0.171	10.654	-0.034
74.0000	0.171	10.632	-0.034
76.0000	0.171	10.663	-0.037
78.0000	0.171	10.622	-0.034
80.0000	0.171	10.647	-0.031
82.0000	0.175	10.644	-0.034
84.0000	0.175	10.672	-0.031
86.0000	0.175	10.682	-0.028
88.0000	0.175	10.657	-0.031
90.0000	0.175	10.65	-0.031
92.0000	0.171	10.657	-0.031
94.0000	0.171	10.644	-0.028
96.0000	0.171	10.666	-0.028
98.0000	0.171	10.691	-0.028
100.0000	0.175	10.691	-0.028
120.0000	0.175	10.72	-0.022
140.0000	0.171	10.654	-0.018
160.0000	0.166	10.72	-0.012
180.0000	0.166	10.72	-0.003

200.0000	0.171	10.761	0
220.0000	0.171	10.704	0.003
240.0000	0.175	10.757	0.003
260.0000	0.18	10.735	0.003
280.0000	0.18	10.767	0
300.0000	0.185	10.773	-0.006
320.0000	0.18	10.808	-0.003
340.0000	0.185	10.824	-0.006
360.0000	0.185	10.852	-0.006
380.0000	0.185	10.927	-0.012
400.0000	0.18	10.971	-0.015
420.0000	0.18	10.956	-0.012
440.0000	0.171	11.006	-0.006
460.0000	0.175	11.063	0
480.0000	0.175	11.003	-0.04
500.0000	0.18	11.044	-0.034
520.0000	0.175	11.025	-0.031
540.0000	0.175	11.022	-0.031
560.0000	0.166	11.059	-0.025
580.0000	0.161	11.034	-0.015
600.0000	0.175	11.094	-0.009
620.0000	0.171	11.053	-0.009
640.0000	0.18	11.047	-0.012
660.0000	0.185	11.056	-0.012
680.0000	0.18	11.085	-0.015
700.0000	0.18	11.078	-0.015
720.0000	0.171	11.066	-0.009
740.0000	0.175	11.104	-0.003
760.0000	0.18	11.1	0
780.0000	0.185	11.119	-0.003
800.0000	0.19	11.126	-0.006
820.0000	0.19	11.126	-0.012
840.0000	0.194	11.097	-0.015
860.0000	0.19	11.166	-0.018
880.0000	0.194	11.138	-0.018
900.0000	0.194	11.138	-0.022

END

6/2/99

LIQUID-PHASE CARBON ADSORPTION MODEL CALCULATIONS

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH
NEW HOPE, MN 55427-2864
PHONE: 612-544-2154
FAX: 612-544-2151

CARBON ADSORBERS:	PC28
NO OF ADSORBERS IN SERIES:	1
TOTAL MASS OF CARBON (LBS):	5000.0
FLOW RATE (GPM):	100.00
HYDRAULIC LOADING (GPM/SQ.FT):	3.5318
EMPTY BED CONTACT TIME (MIN.):	11.995
DESIGN COMPOUND:	PCP
EXPECTED INFLUENT CONCENTRATION (PPB):	14000.
MODEL INFLUENT CONCENTRATION (PPB):	14000.
EFFLUENT CRITERIA (PPB):	1.0000

Note: The model influent concentration results from the impact of the other background compounds, which is determined by using a competitive adsorption model

TIME(DAYS)	VOLUME TREATED(GAL)	EFF. CONC.(PPB)	
10.0	1440000.	0.0000	
20.0	2880000.	0.0000	
30.0	4320000.	0.0000	
40.0	5760000.	0.8733	⇐ breaking through
50.0	7200000.	1.6191	
60.0	8640000.	64.9268	
70.0	10080000.	694.7982	
80.0	11520000.	4022.1321	
90.0	12960000.	6959.5801	
100.0	14400000.	8920.8320	
110.0	15840000.	10307.5314	
120.0	17280000.	11310.5555	
130.0	18720000.	12041.5494	
140.0	20160000.	12574.6760	
150.0	21600000.	12963.1619	
160.0	23040000.	13246.2105	
170.0	24480000.	13452.5501	
180.0	25920000.	13602.8454	
190.0	27360000.	13712.9294	
200.0	28800000.	13792.9219	
210.0	30240000.	13850.2891	
220.0	31680000.	13891.9554	
230.0	33120000.	13921.1759	
240.0	34560000.	13943.4588	
250.0	36000000.	13959.8696	
260.0	37440000.	13970.7528	
270.0	38880000.	13979.1668	
280.0	40320000.	13985.0505	
290.0	41760000.	13989.2560	
300.0	43200000.	13992.2952	

6/2/99

LIQUID-PHASE CARBON ADSORPTION MODEL CALCULATIONS

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH
NEW HOPE, MN 55427-2864
PHONE: 612-544-2154
FAX: 612-544-2151

CARBON ADSORBERS:	PC28
NO OF ADSORBERS IN SERIES:	2
TOTAL MASS OF CARBON (LBS):	10000.
FLOW RATE (GPM):	100.00
HYDRAULIC LOADING (GPM/SQ.FT):	3.5318
EMPTY BED CONTACT TIME (MIN.):	23.989
DESIGN COMPOUND:	PCP
EXPECTED INFLUENT CONCENTRATION (PPB):	14000.
MODEL INFLUENT CONCENTRATION (PPB):	14000.
EFFLUENT CRITERIA (PPB):	1.0000

Note: The model influent concentration results from the impact of the other background compounds, which is determined by using a competitive adsorption model

TIME(DAYS)	VOLUME TREATED(GAL)	EFF. CONC.(PPB)	
10.0	1440000.	0.0000	
20.0	2880000.	0.0000	
30.0	4320000.	0.0000	
40.0	5760000.	0.0000	
50.0	7200000.	0.0000	
60.0	8640000.	0.0000	
70.0	10080000.	0.0000	
80.0	11520000.	0.0000	
90.0	12960000.	0.0000	
100.0	14400000.	0.0000	
110.0	15840000.	0.0000	
120.0	17280000.	0.0000	
130.0	18720000.	0.0000	
140.0	20160000.	0.0000	← breaking through
150.0	21600000.	4.3081	
160.0	23040000.	34.4733	
170.0	24480000.	919.9334	
180.0	25920000.	4302.1314	
190.0	27360000.	7052.0720	
200.0	28800000.	8927.3487	
210.0	30240000.	10274.7042	
220.0	31680000.	11260.3269	
230.0	33120000.	11984.8605	
240.0	34560000.	12518.7350	
250.0	36000000.	12911.9339	
260.0	37440000.	13200.5290	
270.0	38880000.	13412.7073	
280.0	40320000.	13568.7418	
290.0	41760000.	13683.5302	
300.0	43200000.	13767.9460	

6/2/99

LIQUID-PHASE CARBON ADSORPTION MODEL CALCULATIONS

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH
NEW HOPE, MN 55427-2864
PHONE: 612-544-2154
FAX: 612-544-2151

CARBON ADSORBERS:	PC50
NO OF ADSORBERS IN SERIES:	1
TOTAL MASS OF CARBON (LBS):	10000.
FLOW RATE (GPM):	100.00
HYDRAULIC LOADING (GPM/SQ.FT):	2.0030
EMPTY BED CONTACT TIME (MIN.):	23.989
DESIGN COMPOUND:	PCP
EXPECTED INFLUENT CONCENTRATION (PPB):	14000.
MODEL INFLUENT CONCENTRATION (PPB):	14000.
EFFLUENT CRITERIA (PPB):	1.0000

Note: The model influent concentration results from the impact of the other background compounds, which is determined by using a competitive adsorption model

TIME(DAYS)	VOLUME TREATED(GAL)	EFF. CONC.(PPB)	
10.0	1440000.	0.0000	
20.0	2880000.	0.0000	
30.0	4320000.	0.0000	
40.0	5760000.	0.0000	
50.0	7200000.	0.0000	
60.0	8640000.	0.0000	
70.0	10080000.	0.0000	
80.0	11520000.	0.0000	
90.0	12960000.	0.0000	
100.0	14400000.	0.0000	
110.0	15840000.	0.0000	
120.0	17280000.	0.0000	
130.0	18720000.	0.0000	
140.0	20160000.	0.0000	⇐ breaking through
150.0	21600000.	22.3653	
160.0	23040000.	114.7813	
170.0	24480000.	1161.9187	
180.0	25920000.	4328.3223	
190.0	27360000.	7015.3491	
200.0	28800000.	8882.5369	
210.0	30240000.	10229.9470	
220.0	31680000.	11219.3557	
230.0	33120000.	11949.4552	
240.0	34560000.	12488.9708	
250.0	36000000.	12886.5623	
260.0	37440000.	13179.7728	
270.0	38880000.	13396.1073	
280.0	40320000.	13555.7048	
290.0	41760000.	13673.3968	
300.0	43200000.	13760.8652	

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LIQUID-PHASE CARBON ADSORPTION MODEL CALCULATIONS

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH
NEW HOPE, MN 55427-2864
PHONE: 612-544-2154
FAX: 612-544-2151

CARBON ADSORBERS:	PC50
NO OF ADSORBERS IN SERIES:	2
TOTAL MASS OF CARBON (LBS):	20000.
FLOW RATE (GPM):	100.00
HYDRAULIC LOADING (GPM/SQ.FT):	2.0030
EMPTY BED CONTACT TIME (MIN.):	47.979
DESIGN COMPOUND:	PCP
EXPECTED INFLUENT CONCENTRATION (PPB):	14000.
MODEL INFLUENT CONCENTRATION (PPB):	14000.
EFFLUENT CRITERIA (PPB):	1.0000

Note: The model influent concentration results from the impact of the other background compounds, which is determined by using a competitive adsorption model

TIME(DAYS)	VOLUME TREATED(GAL)	EFF. CONC.(PPB)
10.0	1440000.	0.0000
20.0	2880000.	0.0000
30.0	4320000.	0.0000
40.0	5760000.	0.0000
50.0	7200000.	0.0000
60.0	8640000.	0.0000
70.0	10080000.	0.0000
80.0	11520000.	0.0000
90.0	12960000.	0.0000
100.0	14400000.	0.0000
110.0	15840000.	0.0000
120.0	17280000.	0.0000
130.0	18720000.	0.0000
140.0	20160000.	0.0000
150.0	21600000.	0.0000
160.0	23040000.	0.0000
170.0	24480000.	0.0000
180.0	25920000.	0.0000
190.0	27360000.	0.0000
200.0	28800000.	0.0000
210.0	30240000.	0.0000
220.0	31680000.	0.0000
230.0	33120000.	0.0000
240.0	34560000.	0.0000
250.0	36000000.	0.0000
260.0	37440000.	0.0000
270.0	38880000.	0.0000
280.0	40320000.	0.0000
290.0	41760000.	0.0000
300.0	43200000.	0.0000
310.0	44640000.	0.0000
320.0	46080000.	0.0000
330.0	47520000.	0.0000

340.0	48960000.	0.0000 ⇐ breaking through
350.0	50400000.	8.2643
360.0	51840000.	237.8091
370.0	53280000.	1189.2253
380.0	54720000.	4445.3944
390.0	56160000.	7085.7600
400.0	57600000.	8924.2925
410.0	59040000.	10251.5801
420.0	60480000.	11229.1451
430.0	61920000.	11951.4853
440.0	63360000.	12486.1637
450.0	64800000.	12881.2103
460.0	66240000.	13173.0758
470.0	67680000.	13388.7131
480.0	69120000.	13548.1974
490.0	70560000.	13666.2726
500.0	72000000.	13754.0058
510.0	73440000.	13819.3546
520.0	74880000.	13867.2649
530.0	76320000.	13902.1243
540.0	77760000.	13927.9055
550.0	79200000.	13946.3399
560.0	80640000.	13960.4698
570.0	82080000.	13971.3241
580.0	83520000.	13979.1326
590.0	84960000.	13984.5709
600.0	86400000.	13988.8134
610.0	87840000.	13991.8870
620.0	89280000.	13994.0300
630.0	90720000.	13995.6168
640.0	92160000.	13996.7770
650.0	93600000.	13997.6250
660.0	95040000.	13998.3550
670.0	96480000.	13998.9386
680.0	97920000.	13999.3419
690.0	99360000.	13999.6542
700.0	100800000.	14000.0044
710.0	102240000.	14000.2414
720.0	103680000.	14000.2859
730.0	105120000.	14000.4210
740.0	106560000.	14000.4937
750.0	108000000.	14000.4793
760.0	109440000.	14000.4154
770.0	110880000.	14000.3670
780.0	112320000.	14000.3032
790.0	113760000.	14000.2326
800.0	115200000.	14000.1626
810.0	116640000.	14000.1025
820.0	118080000.	14000.0609
830.0	119520000.	14000.0395
840.0	120960000.	14000.0145
850.0	122400000.	14000.0033
860.0	123840000.	14000.0011
870.0	125280000.	14000.0215
880.0	126720000.	14000.0471
890.0	128160000.	14000.0734
900.0	129600000.	14000.0960

U.S.Filter/Westates
2201 Lee Drive
Baytown, TX
281-837-8655 phone
281-837-8054 fax

CUSTOMER: Bill Andrae
CH2MHill
SITE: Philips Components-Mineral Wells
ADDRESS: 411 East Wisconsin Ave, #1600
Milwaukee, WI 53202
VOICE: 414-272-2426
FAX: 414-272-4408

Liquid Isotherm report created on 06/02/99 at 09:19 by Chandra McDaniel.

LIQUID PHASE ISOTHERM DESIGN PARAMETERS

Water Flow Rate 100.00000 gpm

LIQUID PHASE DESIGN

Component Name	*Concentration*	*#GAC/1000 gallons of water*
PHENOL,PENTACHLORO- pH = 3	14.0000 ppmw	0.3399

Total Carbon Usage Estimated at Breakthrough
48.9401 #GAC/day
0.3399 #GAC/1000 gallons of water

The above carbon usage estimates are based on both experimental data as well as predictive models. Actual carbon usage rates observed at various stages of breakthrough depend on many factors, and may therefore differ from the above estimates. Please contact Westates Carbon Products for further assisitance.

U.S.Filter/Westates
2201 Lee Drive
Baytown, TX
281-837-8655 phone
281-837-8054 fax

CUSTOMER: Bill Andrae
CH2MHill
SITE: Philips Components-Mineral Wells
ADDRESS: 411 East Wisconsin Ave, #1600
Milwaukee, WI 53202
VOICE: 414-272-2426
FAX: 414-272-4408

Liquid Isotherm report created on 06/02/99 at 09:20 by Chandra McDaniel.

LIQUID PHASE ISOTHERM DESIGN PARAMETERS

Water Flow Rate 100.00000 gpm

LIQUID PHASE DESIGN

Component Name	*Concentration*	*#GAC/1000 gallons of water*
PHENOL,PENTACHLORO- pH = 9	14.0000 ppmw	0.6923

Total Carbon Usage Estimated at Breakthrough
99.6842 #GAC/day
0.6923 #GAC/1000 gallons of water

The above carbon usage estimetes are based on both experimental data as well as predictive models. Actual carbon usage rates observed at various stages of breakthrough depend on many factors, and may therefore differ from the above estimates. Please contact Westates Carbon Products for further assisilance.

ATTACHMENT 3

M-CACES GOLD COST ESTIMATE

Penta Wood Products
Daniels, WI
Design Criteria Report Cost
Estimate

Designed By: CH2M Hill/Milwaukee
Estimated By: Gina Bayer

Prepared By: Keli Germinaro

Preparation Date: 06/01/99
Effective Date of Pricing: 06/01/99

Sales Tax: 0.00%

M C A C E S G O L D E D I T I O N
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Release 5.30A

Capital Costs		QUANTY	UOM	UNIT COST	TOTAL COST
GW Collection and Treatment					
Capital Costs					
Construction Costs					
Mobilization/Demobilization					
	Mobilization/Demobilization	1.00	LS	15000.00	15,000
	TOTAL Mobilization/Demobilization	1.00	EA	15000.00	15,000
Construct LNAPL/GW Recovery Syst					
	Drilling Extraction Well	980.00	FT	150.00	147,000
	Install Extraction Well Decon	10.00	HR	125.00	1,250
	Recovery Pumps (Electric)	5.00	EA	5000.00	25,000
	Air Piping and Compressor	1.00	LS	4500.00	4,500
	LNAPL Pumps/Controls	1.00	LS	20000.00	20,000
	Pipe Trenching	180.00	CY	2.25	405
	LNAPL Piping	500.00	FT	3.00	1,500
	Groundwater Piping	800.00	FT	3.00	2,400
	Pipe Trench Backfill	180.00	CY	2.25	405
	Controls/Programming	1.00	LS	5000.00	5,000
	LNAPL Storage Tank (15K)	1.00	EA	8500.00	8,500
	Survey Well Locations	2.00	DAY	1000.00	2,000
	Start up	1.00	LS	15000.00	15,000
	TOTAL Construct LNAPL/GW Recovery Syst	1.00	EA	232960.00	232,960
Provide Onsite GW Treatment					
	GW Treatment Building	1.00	LS	100000.00	100,000
	Oil/Water Separator	1.00	LS	10000.00	10,000
	Carbon Filtration	1.00	LS	60000.00	60,000
	System Controls/Instrumentation	1.00	LS	15680.00	15,680
	Pipe Trenching 2'wide x 36"deep	2200.00	CY	2.25	4,950
	Connecting Piping	9500.00	FT	3.00	28,500
	Pipe Trench Backfill	2200.00	CY	2.25	4,950
	TOTAL Provide Onsite GW Treatment	1.00	EA	224080.00	224,080
Abandon Existing Production Well					
	2 @ 170 ft bgs	340.00	FT	35.00	11,900
	TOTAL Abandon Existing Production Well	1.00	EA	11900.00	11,900
Construction Labor					
	Construction Labor	800.00	HR	32.00	25,600

Capital Costs		QUANTY	UOM	UNIT COST	TOTAL COST
	TOTAL Construction Labor	1.00	EA	25600.00	25,600
	TOTAL Construction Costs	1.00	EA	509540.00	509,540
Implementation Costs					
	Permitting	1.00	LS	537.00	537
	Land Use Deed Restriction Docume	1.00	LS	25000.00	25,000
	Services During Construction	1.00	LS	80511.00	80,511
	Health and Safety	1.00	LS	1610.00	1,610
	Report Preparation	1.00	LS	50000.00	50,000
	Engineering Design Costs	1.00	LS	80511.00	80,511
	TOTAL Implementation Costs	1.00	EA	238169.00	238,169
	TOTAL Capital Costs	1.00	EA	747709.00	747,709

Operation and Maintenance Costs		QUANTY	UOM	UNIT COST	TOTAL COST
Operation and Maintenance Costs					
LNAPL/GW Recovery System Operati					
	Annual System Maintenance	1.00	LS	2586.00	2,586
	Electric	1.00	LS	5000.00	5,000
	Load, transport, incinerateLNAPL	750.00	LBS	0.27	203
	Sample treated H2O for reinfilta	12.00	MO	350.00	4,200
	Parttime operator (16 hrs/wk)	832.00	HR	30.00	24,960
	Carbon Exchange Service	1.00	YR	19600.00	19,600
TOTAL	LNAPL/GW Recovery System Operati	1.00	EA	56548.50	56,549
NPV for LNAPL/GW Recovery					
	Additional costs for 10 years	1.00	LS	397922.00	397,922
TOTAL	NPV for LNAPL/GW Recovery				397,922
Environmental Monitoring					
Monitoring Well Sampling					
	Labortory Analytical	21.00	EA	340.00	7,140
	Monitoring Equipment	1.00	LS	500.00	500
	Sampling Equipment	1.00	LS	200.00	200
TOTAL	Monitoring Well Sampling				7,840
Perimeter Well Sampling					
Quarterly events for 5 years					
	Laboratory Analytical	32.00	EA	340.00	10,880
	Sampling Equipment	4.00	LS	200.00	800
TOTAL	Quarterly events for 5 years	1.00	EA	11680.00	11,680
Annually events for 25 years					
	Laboratory Analytical	8.00	EA	340.00	2,720
	Sampling Equipment	1.00	LS	200.00	200
TOTAL	Annually events for 25 years	1.00	EA	2920.00	2,920
TOTAL	Perimeter Well Sampling				14,600
TOTAL	Environmental Monitoring				22,440

Operation and Maintenance Costs		QUANTY	UOM	UNIT COST	TOTAL COST
NPV for Environmental Monitoring					
	NPV for Monitoring Well Sampling	1.00	LS	44087.00	44,087
	NPV for Perimeter Well Sampling	1.00	LS	236316.00	236,316
	TOTAL NPV for Environmental Monitoring				280,403
Inspection,Monitoring,Reporting					
First 5 years - Quarterly Visits					
	2-Person Crew	560.00	HR	140.00	78,400
	Reporting	80.00	EA	3000.00	240,000
	TOTAL First 5 years - Quarterly Visits				318,400
Years 5 through 30					
	2-Person Crew	100.00	HR	140.00	14,000
	Reporting	25.00	EA	3000.00	75,000
	TOTAL Years 5 through 30				89,000
	TOTAL Inspection,Monitoring,Reporting				407,400
NPV for Inspect,Monitor,Report					
	First 5 years -	1.00	LS	1280000	1,280,000
	Years 5 through 30	1.00	LS	110360.00	110,360
	TOTAL NPV for Inspect,Monitor,Report				1,390,360
	TOTAL Operation and Maintenance Costs	1.00	EA	2555074	2,555,074
	TOTAL GW Collection and Treatment	1.00	EA	3302783	3,302,783

Capital Costs		QUANTY	UOM	UNIT COST	TOTAL COST
Bioventing					
Capital Costs					
Construction Costs					
Mobilization/Demobilization					
	Mobilization/Demobilization	1.00	LS	20000.00	20,000
	TOTAL Mobilization/Demobilization	1.00	EA	20000.00	20,000
Building Demolition & Disposal					
	Office Building	1.00	LS	10070.00	10,070
	Garages (2)	1.00	LS	24670.00	24,670
	Treatment Building	1.00	LS	86600.00	86,600
	Storage Shed	1.00	LS	945.00	945
	Oil/Water Separator	1.00	LS	5870.00	5,870
	Shaving Vault Tank	1.00	LS	5945.00	5,945
	Mission Control	1.00	LS	1104.00	1,104
	Peeler Shed	1.00	LS	5580.00	5,580
	Truck Shop	1.00	LS	17115.00	17,115
	Sawmills (5)	1.00	LS	28692.00	28,692
	Slasher Control House	1.00	LS	1290.00	1,290
	Scale House	1.00	LS	315.00	315
	Unnamed Structures (4)	1.00	LS	5646.00	5,646
	TOTAL Building Demolition & Disposal	1.00	EA	193842.00	193,842
Consolidate Soil Contamination					
	Clear, Grub, and Chip Trees	9.00	ACR	3500.00	31,500
	Excavate/Relocate Soil-Dry 1ft	44000	CY	3.50	154,000
	Excavate/Relocate Soil-Wet 2ft	3000.00	CY	8.75	26,250
	Perform Confirmation Sampling	175.00	EA	158.00	27,650
	TOTAL Consolidate Soil Contamination	1.00	EA	239400.00	239,400
Construct Soil Cover					
	Vegetation Layer 6-inches thick	5680.00	CY	12.00	68,160
	Relocate Sand 6"	5680.00	CY	3.50	19,880
	TOTAL Construct Soil Cover	1.00	EA	88040.00	88,040
• Restore Site					
	Regrade using onsite sand	58.00	ACR	750.00	43,500
	Seed	80.00	ACR	1200.00	96,000
	Wetland Restoration	1.00	LS	33000.00	33,000
	Oat Mulch	3267.00	MSF	30.00	98,010
	Erosion Matting	25000	SY	0.70	17,500

Capital Costs		QUANTY	UOM	UNIT COST	TOTAL COST
	Silt Fence	6000.00	FT	1.00	6,000
TOTAL	Restore Site	1.00	EA	294010.00	294,010
Implement Erosion Control Measur					
	Construct Drainage Ditches	1.00	LS	80000.00	80,000
	Install Sediment Basin	3.00	EA	15000.00	45,000
	Filter Fabric	1800.00	SY	2.00	3,600
	Diverison Berms	3600.00	CY	8.00	28,800
	6'x 3'x 3' Gabions	400.00	EA	184.00	73,600
	9'x 5'x 3' Gabions	200.00	EA	143.00	28,600
TOTAL	Implement Erosion Control Measur	1.00	EA	259600.00	259,600
Dismantle Biopad					
	Decon/Breakup Biopad	1.00	LS	80000.00	80,000
	Move concrete to cover area	5585.00	CY	3.50	19,548
TOTAL	Dismantle Biopad	1.00	EA	99547.50	99,548
Excavate Arsenic Contaminated So					
	Excavate soil	6000.00	CY	2.25	13,500
	Solidify onsite	6000.00	CY	24.00	144,000
	Perform Solidification Confirm.	30.00	EA	60.00	1,800
TOTAL	Excavate Arsenic Contaminated So	1.00	EA	159300.00	159,300
Pre-Design Activites					
	Pre-design activites	1.00	LS	125000.00	125,000
TOTAL	Pre-Design Activites	1.00	EA	125000.00	125,000
Construct Bioventing System					
Install Injection Wells					
	Drilling w/ sampling @ residual	1000.00	FT	150.00	150,000
	Decontamination	10.00	HR	125.00	1,250
	PCP, TPH analysis of soils	12.00	EA	250.00	3,000
TOTAL	Install Injection Wells	1.00	EA	154250.00	154,250
Pipe Trenching					
	5ft wide x 3ft deep	2222.00	CY	2.25	5,000

Capital Costs		QUANTY	UOM	UNIT COST	TOTAL COST
	TOTAL Pipe Trenching	1.00	EA	4999.50	5,000
Piping/Pipe Fittings					
	8in polyethlylene	4000.00	FT	6.04	24,160
	TOTAL Piping/Pipe Fittings	1.00	EA	24160.00	24,160
Pipe Trench Backfill					
	5 ft x 36 inches deep	2222.00	CY	2.25	5,000
	TOTAL Pipe Trench Backfill	1.00	EA	4999.50	5,000
Blower					
	5000 cfm	1.00	EA	14500.00	14,500
	TOTAL Blower	1.00	EA	14500.00	14,500
Controls/Programming					
	Controls/Programming	1.00	LS	20000.00	20,000
	TOTAL Controls/Programming	1.00	EA	20000.00	20,000
Electric					
	Electric	1.00	EA	3500.00	3,500
	TOTAL Electric	1.00	EA	3500.00	3,500
Install Piezometers					
	10 nests of 3	1450.00	FT	35.00	50,750
	TOTAL Install Piezometers	1.00	EA	50750.00	50,750
Survey Well/Piezometer Locations					
	Survey well/piezo locations	5.00	DAY	1000.00	5,000
	TOTAL Survey Well/Piezometer Locations	1.00	EA	5000.00	5,000
Start-up					
	Start-up	1.00	LS	5000.00	5,000
	TOTAL Start-up	1.00	EA	5000.00	5,000

Capital Costs		QUANTY	UOM	UNIT COST	TOTAL COST
	TOTAL Construct Bioventing System	1.00	EA	287159.00	287,159
Construction Labor					
	Construction Labor	1870.00	HR	32.00	59,840
	TOTAL Construction Labor	1.00	EA	59840.00	59,840
	TOTAL Construction Costs	1.00	EA	1825739	1,825,739
Implementation Costs					
	Permitting	1.00	LS	2252.00	2,252
	Land Use Dee Restriction & Legal	1.00	LS	25000.00	25,000
	Services During Construction	1.00	LS	337748.00	337,748
	Health and Safety	1.00	LS	6755.00	6,755
	Report Preparation	1.00	LS	50000.00	50,000
	Engineering Design Costs	1.00	LS	337748.00	337,748
	TOTAL Implementation Costs	1.00	EA	759503.00	759,503
	TOTAL Capital Costs	1.00	EA	2585242	2,585,242

Operation and Maintenance Costs		QUANTY	UOM	UNIT COST	TOTAL COST
Operation and Maintenance Costs					
General Maintenance Activities					
Annual Maintenance					
	Annual maintenance	1.00	LS	26712.00	26,712
	TOTAL Annual Maintenance	1.00	EA	26712.00	26,712
Annual Soil Sampling					
	Laboratory analytical	6.00	EA	185.00	1,110
	Sampling Equipment	1.00	LS	200.00	200
	TOTAL Annual Soil Sampling	6.00	EA	218.33	1,310
	TOTAL General Maintenance Activities	1.00	EA	28022.00	28,022
NPV General Maintenance Activity					
	Annual System Maintenance	1.00	LS	49763.40	49,763
	TOTAL NPV General Maintenance Activity	1.00	EA	49763.40	49,763
Bioventing System Operation					
	Annual System Maintenance	1.00	LS	19920.00	19,920
	Electrical	1.00	YR	40000.00	40,000
	Semiannual Soil Gas Analyis	2.00	EA	100.00	200
	TOTAL Bioventing System Operation	1.00	EA	60120.00	60,120
NPV Bioventing System Operation					
	Additional cost for annual	1.00	LS	498547.00	498,547
	TOTAL NPV Bioventing System Operation	1.00	EA	498547.00	498,547
Environmental Monitoring					
Lysimeter Sampling					
	Laboratory Analytical	8.00	EA	200.00	1,600
	Sampling Equipment	1.00	LS	200.00	200
	Monitoring Equipment	2.00	EA	100.00	200
	TOTAL Lysimeter Sampling	1.00	EA	2000.00	2,000

Operation and Maintenance Costs		QUANTY	UOM	UNIT COST	TOTAL COST
Soil Sampling					
	Drilling w/samping	8250.00	FT	15.00	123,750
	Labortory Analytical	220.00	EA	360.00	79,200
	Sampling Equipment	1.00	LS	500.00	500
	TOTAL Soil Sampling	1.00	EA	203450.00	203,450
	TOTAL Environmental Monitoring	1.00	EA	205450.00	205,450
NPV Environmental Monitoring					
	NPV Lysimeter Sampling	1.00	LS	16585.00	16,585
	NPV Soil Sampling	1.00	LS	46222.00	46,222
	TOTAL NPV Environmental Monitoring	1.00	EA	62807.00	62,807
Inspection,Monitoring,Reporting					
First 5 Years					
	2-Person Crew	140.00	HR	140.00	19,600
	Reporting	20.00	EA	3000.00	60,000
	TOTAL First 5 Years	1.00	EA	79600.00	79,600
Years 5 through 30					
	2-Person Crew	100.00	HR	140.00	14,000
	Reporting	25.00	EA	3000.00	75,000
	TOTAL Years 5 through 30	1.00	EA	89000.00	89,000
	TOTAL Inspection,Monitoring,Reporting	1.00	EA	168600.00	168,600
NPV Inspect,Monitor,Report					
	NPV - First 5 Years	1.00	LS	346588.00	346,588
	NPV - Years 5 through 30	1.00	LS	119556.00	119,556
	TOTAL NPV Inspect,Monitor,Report	1.00	EA	466144.00	466,144
	TOTAL Operation and Maintenance Costs	1.00	EA	1539453	1,539,453
	TOTAL Bioventing	1.00	EA	4124695	4,124,695
	TOTAL Penta Wood Products	1.00	EA	7427477	7,427,477

	QUANTITY	UOM	CONTRACT	CONTINGN	PM&ADMIN	TOTAL COST	UNIT COST
G3 GW Collection and Treatment							
G3.01 Capital Costs							
G3.01.01 Construction Costs							
G3.01.01.01 Mobilization/Demobilization	1.00	EA	15,000	3,750	0	18,750	18750.00
G3.01.01.02 Construct LNAPL/GW Recovery Syst	1.00	EA	232,960	58,240	0	291,200	291200.00
G3.01.01.03 Provide Onsite GW Treatment	1.00	EA	224,080	56,020	0	280,100	280100.00
G3.01.01.05 Abandon Existing Production Well	1.00	EA	11,900	2,975	0	14,875	14875.00
G3.01.01.08 Construction Labor	1.00	EA	25,600	6,400	0	32,000	32000.00
TOTAL Construction Costs	1.00	EA	509,540	127,385	0	636,925	636925.00
G3.01.02 Implementation Costs	1.00	EA	238,169	0	0	238,169	238169.00
TOTAL Capital Costs	1.00	EA	747,709	127,385	0	875,094	875094.00
G3.02 Operation and Maintenance Costs							
G3.02.01 LNAPL/GW Recovery System Operati	1.00	EA	56,549	5,655	5,655	67,858	67858.20
G3.02.02 NPV for LNAPL/GW Recovery			397,922	0	0	397,922	
G3.02.03 Environmental Monitoring							
G3.02.03.01 Monitoring Well Sampling			7,840	784	784	9,408	
TOTAL Monitoring Well Sampling			7,840	784	784	9,408	
G3.02.03.02 Perimeter Well Sampling							
G3.02.03.02.01 Quarterly events for 5 years	1.00	EA	11,680	2,336	1,168	15,184	15184.00
G3.02.03.02.02 Annually events for 25 years	1.00	EA	2,920	584	292	3,796	3796.00
TOTAL Perimeter Well Sampling			14,600	2,920	1,460	18,980	
TOTAL Environmental Monitoring			22,440	3,704	2,244	28,388	
G3.02.04 NPV for Environmental Monitoring			280,403	0	0	280,403	
G3.02.05 Inspection,Monitoring,Reporting							
G3.02.05.01 First 5 years - Quarterly Visits			318,400	31,840	31,840	382,080	
G3.02.05.02 Years 5 through 30			89,000	8,900	8,900	106,800	
TOTAL Inspection,Monitoring,Reporting			407,400	40,740	40,740	488,880	

		QUANTITY UOM	CONTRACT	CONTINGN	PM&ADMIN	TOTAL COST	UNIT COST
G3.02.06	NPV for Inspect,Monitor,Report		1,390,360	0	0	1,390,360	
	TOTAL Operation and Maintenance Costs	1.00 EA	2,555,074	50,099	48,639	2,653,811	2653811
	TOTAL GW Collection and Treatment	1.00 EA	3,302,783	177,484	48,639	3,528,905	3528905
S4	Bioventing						
S4.01	Capital Costs						
S4.01.01	Construction Costs						
S4.01.01.01	Mobilization/Demobilization	1.00 EA	20,000	5,000	0	25,000	25000.00
S4.01.01.02	Building Demolition & Disposal	1.00 EA	193,842	48,461	0	242,303	242302.50
S4.01.01.03	Consolidate Soil Contamination	1.00 EA	239,400	59,850	0	299,250	299250.00
S4.01.01.04	Construct Soil Cover	1.00 EA	88,040	22,010	0	110,050	110050.00
S4.01.01.05	Restore Site	1.00 EA	294,010	73,503	0	367,513	367512.50
S4.01.01.06	Implement Erosion Control Measur	1.00 EA	259,600	64,900	0	324,500	324500.00
S4.01.01.08	Dismantle Biopad	1.00 EA	99,548	24,887	0	124,434	124434.38
S4.01.01.09	Excavate Arsenic Contaminated So	1.00 EA	159,300	39,825	0	199,125	199125.00
S4.01.01.10	Pre-Design Activites	1.00 EA	125,000	31,250	0	156,250	156250.00
S4.01.01.11	Construct Bioventing System						
S4.01.01.11.01	Install Injection Wells	1.00 EA	154,250	38,563	0	192,813	192812.50
S4.01.01.11.02	Pipe Trenching	1.00 EA	5,000	1,250	0	6,249	6249.38
S4.01.01.11.03	Piping/Pipe Fittings	1.00 EA	24,160	6,040	0	30,200	30200.00
S4.01.01.11.04	Pipe Trench Backfill	1.00 EA	5,000	1,250	0	6,249	6249.38
S4.01.01.11.05	Blower	1.00 EA	14,500	3,625	0	18,125	18125.00
S4.01.01.11.06	Controls/Programming	1.00 EA	20,000	5,000	0	25,000	25000.00
S4.01.01.11.08	Electric	1.00 EA	3,500	875	0	4,375	4375.00
S4.01.01.11.09	Install Piezometers	1.00 EA	50,750	12,688	0	63,438	63437.50
S4.01.01.11.10	Survey Well/Piezometer Locations	1.00 EA	5,000	1,250	0	6,250	6250.00
S4.01.01.11.11	Start-up	1.00 EA	5,000	1,250	0	6,250	6250.00
	TOTAL Construct Bioventing System	1.00 EA	287,159	71,790	0	358,949	358948.75
S4.01.01.12	Construction Labor	1.00 EA	59,840	14,960	0	74,800	74800.00
	TOTAL Construction Costs	1.00 EA	1,825,739	456,435	0	2,282,173	2282173
S4.01.02	Implementation Costs	1.00 EA	759,503	0	0	759,503	759503.00
	TOTAL Capital Costs	1.00 EA	2,585,242	456,435	0	3,041,676	3041676
S4.02	Operation and Maintenance Costs						
S4.02.01	General Maintenance Activities						

		QUANTITY	UOM	CONTRACT	CONTINGN	PM&ADMIN	TOTAL COST	UNIT COST
S4.02.01.01	Annual Maintenance	1.00	EA	26,712	5,342	2,671	34,726	34725.60
S4.02.01.02	Annual Soil Sampling	6.00	EA	1,310	262	131	1,703	283.83
	TOTAL General Maintenance Activities	1.00	EA	28,022	5,604	2,802	36,429	36428.60
S4.02.02	NPV General Maintenance Activity	1.00	EA	49,763	0	0	49,763	49763.40
S4.02.03	Bioventing System Operation	1.00	EA	60,120	12,024	6,012	78,156	78156.00
S4.02.04	NPV Bioventing System Operation	1.00	EA	498,547	0	0	498,547	498547.00
S4.02.05	Environmental Monitoring							
S4.02.05.01	Lysimeter Sampling	1.00	EA	2,000	400	200	2,600	2600.00
S4.02.05.02	Soil Sampling	1.00	EA	203,450	30,518	20,345	254,313	254312.50
	TOTAL Environmental Monitoring	1.00	EA	205,450	30,918	20,545	256,913	256912.50
S4.02.06	NPV Environmental Monitoring	1.00	EA	62,807	0	0	62,807	62807.00
S4.02.07	Inspection,Monitoring,Reporting							
S4.02.07.01	First 5 Years	1.00	EA	79,600	15,920	7,960	103,480	103480.00
S4.02.07.02	Years 5 through 30	1.00	EA	89,000	17,800	8,900	115,700	115700.00
	TOTAL Inspection,Monitoring,Reporting	1.00	EA	168,600	33,720	16,860	219,180	219180.00
S4.02.08	NPV Inspect,Monitor,Report	1.00	EA	466,144	0	0	466,144	466144.00
	TOTAL Operation and Maintenance Costs	1.00	EA	1,539,453	82,266	46,219	1,667,939	1667939
	TOTAL Bioventing	1.00	EA	4,124,695	538,701	46,219	4,709,615	4709615
	TOTAL Penta Wood Products	1.00	EA	7,427,477	716,184	94,858	8,238,520	8238520

	QUANTITY UOM	DIRECT	BOND	TOTAL COST	UNIT COST
G3 GW Collection and Treatment					
G3.01 Capital Costs					
G3.01.01 Construction Costs					
G3.01.01.01 Mobilization/Demobilization	1.00 EA	15,000	0	15,000	15000.00
G3.01.01.02 Construct LNAPL/GW Recovery Syst	1.00 EA	232,960	0	232,960	232960.00
G3.01.01.03 Provide Onsite GW Treatment	1.00 EA	224,080	0	224,080	224080.00
G3.01.01.05 Abandon Existing Production Well	1.00 EA	11,900	0	11,900	11900.00
G3.01.01.08 Construction Labor	1.00 EA	25,600	0	25,600	25600.00
TOTAL Construction Costs	1.00 EA	509,540	0	509,540	509540.00
G3.01.02 Implementation Costs	1.00 EA	238,169	0	238,169	238169.00
TOTAL Capital Costs	1.00 EA	747,709	0	747,709	747709.00
G3.02 Operation and Maintenance Costs					
G3.02.01 LNAPL/GW Recovery System Operati	1.00 EA	56,549	0	56,549	56548.50
G3.02.02 NPV for LNAPL/GW Recovery		397,922	0	397,922	
G3.02.03 Environmental Monitoring					
G3.02.03.01 Monitoring Well Sampling		7,840	0	7,840	
TOTAL Monitoring Well Sampling		7,840	0	7,840	
G3.02.03.02 Perimeter Well Sampling					
G3.02.03.02.01 Quarterly events for 5 years	1.00 EA	11,680	0	11,680	11680.00
G3.02.03.02.02 Annually events for 25 years	1.00 EA	2,920	0	2,920	2920.00
TOTAL Perimeter Well Sampling		14,600	0	14,600	
TOTAL Environmental Monitoring		22,440	0	22,440	
G3.02.04 NPV for Environmental Monitoring		280,403	0	280,403	
G3.02.05 Inspection,Monitoring,Reporting					
G3.02.05.01 First 5 years - Quarterly Visits		318,400	0	318,400	
G3.02.05.02 Years 5 through 30		89,000	0	89,000	
TOTAL Inspection,Monitoring,Reporting		407,400	0	407,400	

	QUANTITY	UOM	DIRECT	BOND	TOTAL COST	UNIT COST
G3.02.06 NPV for Inspect,Monitor,Report			1,390,360	0	1,390,360	
TOTAL Operation and Maintenance Costs	1.00	EA	2,555,074	0	2,555,074	2555074
TOTAL GW Collection and Treatment	1.00	EA	3,302,783	0	3,302,783	3302783
S4 Bioventing						
S4.01 Capital Costs						
S4.01.01 Construction Costs						
S4.01.01.01 Mobilization/Demobilization	1.00	EA	20,000	0	20,000	20000.00
S4.01.01.02 Building Demolition & Disposal	1.00	EA	193,842	0	193,842	193842.00
S4.01.01.03 Consolidate Soil Contamination	1.00	EA	239,400	0	239,400	239400.00
S4.01.01.04 Construct Soil Cover	1.00	EA	88,040	0	88,040	88040.00
S4.01.01.05 Restore Site	1.00	EA	294,010	0	294,010	294010.00
S4.01.01.06 Implement Erosion Control Measur	1.00	EA	259,600	0	259,600	259600.00
S4.01.01.08 Dismantle Biopad	1.00	EA	99,548	0	99,548	99547.50
S4.01.01.09 Excavate Arsenic Contaminated So	1.00	EA	159,300	0	159,300	159300.00
S4.01.01.10 Pre-Design Activites	1.00	EA	125,000	0	125,000	125000.00
S4.01.01.11 Construct Bioventing System						
S4.01.01.11.01 Install Injection Wells	1.00	EA	154,250	0	154,250	154250.00
S4.01.01.11.02 Pipe Trenching	1.00	EA	5,000	0	5,000	4999.50
S4.01.01.11.03 Piping/Pipe Fittings	1.00	EA	24,160	0	24,160	24160.00
S4.01.01.11.04 Pipe Trench Backfill	1.00	EA	5,000	0	5,000	4999.50
S4.01.01.11.05 Blower	1.00	EA	14,500	0	14,500	14500.00
S4.01.01.11.06 Controls/Programming	1.00	EA	20,000	0	20,000	20000.00
S4.01.01.11.08 Electric	1.00	EA	3,500	0	3,500	3500.00
S4.01.01.11.09 Install Piezometers	1.00	EA	50,750	0	50,750	50750.00
S4.01.01.11.10 Survey Well/Piezometer Locations	1.00	EA	5,000	0	5,000	5000.00
S4.01.01.11.11 Start-up	1.00	EA	5,000	0	5,000	5000.00
TOTAL Construct Bioventing System	1.00	EA	287,159	0	287,159	287159.00
S4.01.01.12 Construction Labor	1.00	EA	59,840	0	59,840	59840.00
TOTAL Construction Costs	1.00	EA	1,825,739	0	1,825,739	1825739
S4.01.02 Implementation Costs	1.00	EA	759,503	0	759,503	759503.00
TOTAL Capital Costs	1.00	EA	2,585,242	0	2,585,242	2585242
S4.02 Operation and Maintenance Costs						
S4.02.01 General Maintenance Activities						

		QUANTITY	UOM	DIRECT	BOND	TOTAL COST	UNIT COST
S4.02.01.01	Annual Maintenance	1.00	EA	26,712	0	26,712	26712.00
S4.02.01.02	Annual Soil Sampling	6.00	EA	1,310	0	1,310	218.33
	TOTAL General Maintenance Activities	1.00	EA	28,022	0	28,022	28022.00
S4.02.02	NPV General Maintenance Activity	1.00	EA	49,763	0	49,763	49763.40
S4.02.03	Bioventing System Operation	1.00	EA	60,120	0	60,120	60120.00
S4.02.04	NPV Bioventing System Operation	1.00	EA	498,547	0	498,547	498547.00
S4.02.05	Environmental Monitoring						
S4.02.05.01	Lysimeter Sampling	1.00	EA	2,000	0	2,000	2000.00
S4.02.05.02	Soil Sampling	1.00	EA	203,450	0	203,450	203450.00
	TOTAL Environmental Monitoring	1.00	EA	205,450	0	205,450	205450.00
S4.02.06	NPV Environmental Monitoring	1.00	EA	62,807	0	62,807	62807.00
S4.02.07	Inspection,Monitoring,Reporting						
S4.02.07.01	First 5 Years	1.00	EA	79,600	0	79,600	79600.00
S4.02.07.02	Years 5 through 30	1.00	EA	89,000	0	89,000	89000.00
	TOTAL Inspection,Monitoring,Reporting	1.00	EA	168,600	0	168,600	168600.00
S4.02.08	NPV Inspect,Monitor,Report	1.00	EA	466,144	0	466,144	466144.00
	TOTAL Operation and Maintenance Costs	1.00	EA	1,539,453	0	1,539,453	1539453
	TOTAL Bioventing	1.00	EA	4,124,695	0	4,124,695	4124695
	TOTAL Penta Wood Products	1.00	EA	7,427,477	0	7,427,477	7427477
	Scope and Bid Contingency					716,184	
	SUBTOTAL					8,143,662	
	PM & Administrative					94,858	
	TOTAL INCL OWNER COSTS					8,238,520	

	QUANTITY	UOM	UNIT COST	TOTAL COST
G3 GW Collection and Treatment				
G3.01 Capital Costs				
G3.01.01 Construction Costs				
G3.01.01.01 Mobilization/Demobilization	1.00	EA	15000.00	15,000
G3.01.01.02 Construct LNAPL/GW Recovery Syst	1.00	EA	232960.00	232,960
G3.01.01.03 Provide Onsite GW Treatment	1.00	EA	224080.00	224,080
G3.01.01.05 Abandon Existing Production Well	1.00	EA	11900.00	11,900
G3.01.01.08 Construction Labor	1.00	EA	25600.00	25,600
TOTAL Construction Costs	1.00	EA	509540.00	509,540
G3.01.02 Implementation Costs	1.00	EA	238169.00	238,169
TOTAL Capital Costs	1.00	EA	747709.00	747,709
G3.02 Operation and Maintenance Costs				
G3.02.01 LNAPL/GW Recovery System Operati	1.00	EA	56548.50	56,549
G3.02.02 NPV for LNAPL/GW Recovery				397,922
G3.02.03 Environmental Monitoring				
G3.02.03.01 Monitoring Well Sampling				7,840
TOTAL Monitoring Well Sampling				7,840
G3.02.03.02 Perimeter Well Sampling				
G3.02.03.02.01 Quarterly events for 5 years	1.00	EA	11680.00	11,680
G3.02.03.02.02 Annually events for 25 years	1.00	EA	2920.00	2,920
TOTAL Perimeter Well Sampling				14,600
TOTAL Environmental Monitoring				22,440
G3.02.04 NPV for Environmental Monitoring				280,403
G3.02.05 Inspection,Monitoring,Reporting				
G3.02.05.01 First 5 years - Quarterly Visits				318,400
G3.02.05.02 Years 5 through 30				89,000
TOTAL Inspection,Monitoring,Reporting				407,400

		QUANTITY	UOM	UNIT COST	TOTAL COST
G3.02.06	NPV for Inspect,Monitor,Report				1,390,360
	TOTAL Operation and Maintenance Costs	1.00	EA	2555074	2,555,074
	TOTAL GW Collection and Treatment	1.00	EA	3302783	3,302,783
S4	Bioventing				
S4.01	Capital Costs				
S4.01.01	Construction Costs				
S4.01.01.01	Mobilization/Demobilization	1.00	EA	20000.00	20,000
S4.01.01.02	Building Demolition & Disposal	1.00	EA	193842.00	193,842
S4.01.01.03	Consolidate Soil Contamination	1.00	EA	239400.00	239,400
S4.01.01.04	Construct Soil Cover	1.00	EA	88040.00	88,040
S4.01.01.05	Restore Site	1.00	EA	294010.00	294,010
S4.01.01.06	Implement Erosion Control Measur	1.00	EA	259600.00	259,600
S4.01.01.08	Dismantle Biopad	1.00	EA	99547.50	99,548
S4.01.01.09	Excavate Arsenic Contaminated So	1.00	EA	159300.00	159,300
S4.01.01.10	Pre-Design Activites	1.00	EA	125000.00	125,000
S4.01.01.11	Construct Bioventing System				
S4.01.01.11.01	Install Injection Wells	1.00	EA	154250.00	154,250
S4.01.01.11.02	Pipe Trenching	1.00	EA	4999.50	5,000
S4.01.01.11.03	Piping/Pipe Fittings	1.00	EA	24160.00	24,160
S4.01.01.11.04	Pipe Trench Backfill	1.00	EA	4999.50	5,000
S4.01.01.11.05	Blower	1.00	EA	14500.00	14,500
S4.01.01.11.06	Controls/Programming	1.00	EA	20000.00	20,000
S4.01.01.11.08	Electric	1.00	EA	3500.00	3,500
S4.01.01.11.09	Install Piezometers	1.00	EA	50750.00	50,750
S4.01.01.11.10	Survey Well/Piezometer Locations	1.00	EA	5000.00	5,000
S4.01.01.11.11	Start-up	1.00	EA	5000.00	5,000
	TOTAL Construct Bioventing System	1.00	EA	287159.00	287,159
S4.01.01.12	Construction Labor	1.00	EA	59840.00	59,840
	TOTAL Construction Costs	1.00	EA	1825739	1,825,739
S4.01.02	Implementation Costs	1.00	EA	759503.00	759,503
	TOTAL Capital Costs	1.00	EA	2585242	2,585,242
S4.02	Operation and Maintenance Costs				
S4.02.01	General Maintenance Activities				

		QUANTITY	UOM	UNIT COST	TOTAL COST
S4.02.01.01	Annual Maintenance	1.00	EA	26712.00	26,712
S4.02.01.02	Annual Soil Sampling	6.00	EA	218.33	1,310
	TOTAL General Maintenance Activities	1.00	EA	28022.00	28,022
S4.02.02	NPV General Maintenance Activity	1.00	EA	49763.40	49,763
S4.02.03	Bioventing System Operation	1.00	EA	60120.00	60,120
S4.02.04	NPV Bioventing System Operation	1.00	EA	498547.00	498,547
S4.02.05	Environmental Monitoring				
S4.02.05.01	Lysimeter Sampling	1.00	EA	2000.00	2,000
S4.02.05.02	Soil Sampling	1.00	EA	203450.00	203,450
	TOTAL Environmental Monitoring	1.00	EA	205450.00	205,450
S4.02.06	NPV Environmental Monitoring	1.00	EA	62807.00	62,807
S4.02.07	Inspection,Monitoring,Reporting				
S4.02.07.01	First 5 Years	1.00	EA	79600.00	79,600
S4.02.07.02	Years 5 through 30	1.00	EA	89000.00	89,000
	TOTAL Inspection,Monitoring,Reporting	1.00	EA	168600.00	168,600
S4.02.08	NPV Inspect,Monitor,Report	1.00	EA	466144.00	466,144
	TOTAL Operation and Maintenance Costs	1.00	EA	1539453	1,539,453
	TOTAL Bioventing	1.00	EA	4124695	4,124,695
	TOTAL Penta Wood Products	1.00	EA	7427477	7,427,477
	Scope and Bid Contingency				716,184
	SUBTOTAL				8,143,662
	PM & Administrative				94,858
	TOTAL INCL OWNER COSTS				8,238,520

	TOTAL COST
<<< No Division ID >>>	7,407,477
01 General Requirements	20,000
	7,427,477

	DIRECT	BOND	TOTAL COST
<<< No Division ID >>>	7,407,477		7,407,477
01 General Requirements	20,000		20,000
	7,427,477	0	7,427,477

	CONTRACT	CONTINGN	PM&ADMIN	TOTAL COST
<<< No Division ID >>>	7,407,477	711,184	94,858	8,213,520
01 General Requirements	20,000	5,000		25,000
	7,427,477	716,184	94,858	8,238,520

No errors detected...

* * * END OF ERROR REPORT * * *

No Backup Reports...

* * * END TABLE OF CONTENTS * * *