FINAL ISTT DESIGN

IN-SITU THERMAL TREATMENT
FRONTIER FERTILIZER NPL SITE
Davis, CA

Final RAMP
Specification 01400, Paragraph 1.5

CONTRACT NO: EP-S9-08-04
Task Order 002
CH2M Hill Project 384210.FD.01
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September 29, 2009

Subcontractor's Approval Stamp
Project Name: *ISTT Frontier Fertilizer, Davis, CA*
Submittal No: *0006* ***Specification No:*** *01400* ***Paragraph****: 1.5*
This submittal has been reviewed, checked and approved for compliance with Contract Documents.
Reviewer(s): *James J. Malot P.E.(PE#CA59088)*
Approval Date: *09/29/2009*

FINAL DESIGN REPORT
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FRONTIER FERTILIZER NPL SITE
Davis, CA

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CES Project 78-0033 CH2M HILL Project 384210.FD.01
CH2M Hill Contract No. EP-S9-08-04, Task Order: 0002

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ABBREVIATIONS AND ACRONYMS

APCD	Air Pollution Control District
BGS (or bgs)	Below Ground Surface
BMP	Best Management Practice
BTU/HR	British Thermal Units/Hour
BTV	Base Treatment Volume
C	Degrees Centigrade
Cal/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CEM	Continuous Emissions Monitor
CES	Current Environmental Solutions, LLC
CIH	Certified Industrial Hygienist
CFR	Code of Federal Regulations
CLIN	Contract Line Item Number
CMP	Contingency Management Plan
COC	Compound of Concern
CTO	Contract Task Order
CY	Cubic Yards
DBCP	Dibromochloropropane
DCDQCR	Daily Chemical Data Quality Control Report
DCP	Dichloropropane
DOT	Department of Transportation
DNAPL	Dense Non-Aqueous Phase Liquid
DQO	Data Quality Objectives
DTSC	Department of Toxic Substances Control
DTV	Final Designated Treatment Volume
DVE	Dual (Phase) Vacuum Extraction
EDB	Ethylene Dibromide
EPA	(United States) Environmental Protection Agency
EPP	Environmental Protection Plan
ERH	Electric Resistance Heating
ESQ	Environmental, Safety, and Quality
EW	Groundwater Extraction Well

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FRP	Fiberglass Reinforced Plastic
FS	Feasibility Study
FSP	Field Sampling Plan
FSS	Field Services Supervisor
FT	Feet/foot
GAC	Granular Activated Carbon
GAL	Gallons
GPW	Groundwater Pumping Wells
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HG	Mercury
HSVE	Horizontal Soil Vacuum Extraction
ID	Inside Diameter
IN	Inch
KJ/MOL	Kilo-joules/mole
KVA	Kilo-Volt-Amp
KW	Kilowatt
KW-HRS	Kilowatt-hours
ISTT	In-Situ Thermal Treatment
LDR	Land Disposal Restriction
LPGAC	Liquid Phase Granular Activated Carbon
MW	Monitoring Well
MPE	Multi-Phase Extraction (same as DVE)
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OD	Outside Diameter
OMP	Operation and Maintenance Plan
P	Page
PC	Performance Criteria
PG&E	Pacific Gas & Electric Company
PHA	Process Hazard Analysis
PLC	Programmable Logic Controller
PM	Project Manager
PMP	Process Monitoring Plan
PO	Purchase Order

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PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
PSU	Power Supply Unit
PWD	Public Works Department
QAPP	Quality Assurance Project Plan
RAMP	Remedial Action Management Plan
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RDA	Remote Data Acquisition
RFP	Request For Proposal
RT (or FT)	Remediation Technician/Field Technician
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SCR	Silica Control Rectifier
SCADA	System Control and Data Acquisition
SPEC	Specification
SPH	Six-Phase Heating
SSHO	Site Health and Safety Officer
STLC	Soluble Threshold Limit Concentration
SOP	Standard Operating Procedure
SMP	Site Management Plan
SQCC	Subcontractor Quality Control Plan
SQFT	Square Feet
SQRT	Square Root
SVE	Soil Vacuum Extraction
SVOC	Semivolatile Organic Compound
TC	Thermocouple
TCLP	Toxicity Characteristic Leaching Procedure
TCP	Trichloropropane
TD	Total Depth
TMW	Temperature Monitoring Well
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
TSDF	Treatment, Storage, and Disposal Facility
TTLC	Total Threshold Limit Concentration

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USDA	U.S. Department of Agriculture
VEU	Vacuum Extraction Unit
VOC	Volatile Organic Compound
VMP	Vapor Monitoring Piezometer
VPGAC	Vapor Phase Granular Activated Carbon
WMP	Waste Management Plan

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FINAL DESIGN
IN-SITU THERMAL TREATMENT
FRONTIER FERTILIZER NPL SITE
DAVIS, CA

1.0 INTRODUCTION

This document represents the Final Design component of the Remedial Action Management Plan for the In-Situ Thermal Treatment (ISTT) remedy using Electric Resistive Heating (ERH) at the Frontier Fertilizer National Priorities List (NPL) site (the "Site") in Davis, California. This portion of the Remedial Action Management Plan is submitted by Current Environmental Solutions, LLC (CES). The Final Design is developed to treat the pesticide source zone media which contains the majority of pesticide chemicals of concern (COCs). The boundary for the volume to be treated was modified by CH2M HILL and EPA from the Base Treatment Volume included in Specification 2182 to the Designated Treatment Volume (DTV) shown in Figure 1; the basis for treatment volume modification is predicated on the results of the Preliminary Monitoring Point installation (CLIN 3 work) conducted in the fall of 2008.

This document is composed of four primary sections as described in the following text. **Section 2** of this plan describes the Basis of Design, including assumptions, calculations, mass and energy balances, and drawings. It also provides manufacturer and/or construction details for key ISTT components, including but not limited to, performance monitoring components, heating electrodes, power supply, gas and groundwater control components, and planned installation locations (re: Specification 01400.1.3.2). **Section 3** outlines some specific design functions. **Section 4** describes the ISTT equipment and process specifications.

The Remedial Action Management Plan (RAMP) is an integral set of documents that are used to coordinate and guide implementation of the ISTT. The RAMP is the compilation of plans, specifications, and drawings necessary to safely and efficiently implement ISTT. Below is a synopsis of the plans that are to be included in the overall RAMP document.

- Design Specifications, Drawings & Figures (this document)
- Site Management Plan (SMP)
- Health and Safety Plan (HASP
- Environmental Protection Plan (EPP)
- Sampling and Analysis Plan (SAP)
- Subcontractor Quality Control Plan (SQCP)
- Waste management Plan (WMP)
- Process Monitoring Plan (PMP)
- Operation and Maintenance Plan (O&M Plan)

Reference to one or more of these plans occurs throughout this design document.

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1.1 Available Power Discussion

Pacific Gas & Electric (PG&E) is the utility that owns the electrical distribution lines adjacent to the Site. Since the Pre-Final design was developed, PG&E has identified that they can deliver 1 MW continuously and can deliver up to 5 MW from September 1 thru May 1. For effective implementation of ISTT, a year-round constant power is important. Therefore, up to three of the campaigns planned to occur sequentially with 1 MW of power, could be heated simultaneously using 3 MW of power. Heating with 3 MW of power would reduce the treatment duration from about 3 years to about 1 year, if 3 MW is delivered continuously. To supplement electrical power service delivered by PG&E during peak power demand period, which is May 2 through August 31, EPA is investigating alternative sources of power to supplement the 1 MW available during the peak season including: on-site solar electric power generation and storage, partnerships with nearby power users to reduce demand on the grid and make available more power during the peak season, and natural gas powered generators.

Solar electric power generation and agreements with nearby users to access available power demand are the preferred source of energy. Installation of solar electric generation on the Site (about seven acres), using solar photovoltaic panels, could generate about 1 MW of power. To supplement on-site solar electric generation, EPA plans to coordinate adding solar generation capacity at other power users (public or private) facilities and establishing agreements with other users to access unused electrical power demand. If the additional 2 MW of continuous power from both solar electric power and circuit load reduction cannot be secured, two 1.25 MW natural gas generators would be required.

The design, presented in following sections, is based on continuous 1 MW of available power which requires 6 treatment campaigns, each estimated to last about a half-year. It seems likely, but not guaranteed, that the EPA will be successful in acquiring an additional 2 MW of electricity from May 1 through September 1 to facilitate continuous 3 MW service to the Site. If that is the case, multiple campaigns can be operated concurrently and the duration of treatment will be reduced. The subsurface ISTT system component design will remain unchanged regardless of available power, but the aboveground treatment system components will be scaled-up to facilitate application of additional available power. To utilize 3 MW of continuous power, additional ISTT system components, such as three step-down transformers and power supply units, would be necessary along with process equipment to manage increased flow rates of soil gas and ground water. It is anticipated that this design report will be amended to facilitate operation with 3 MW of electrical service, once that additional service is secured.

In addition, shallow soils are typically not actively heated by ERH as a ground current safety measure. Due to concerns about duration of treatment, EPA identified the need to actively heat shallow soil, therefore shallow cap electrodes and ancillary equipment are planned. In areas where shallow soil contamination has been detected, cap electrodes may be placed to selectively heat this volume on an as needed basis. Details of shallow soil heating will be included in the design as an amendment.

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2.0 DESIGN BASIS AND COMPONENTS OF ISTT

[Spec. 01400-1.3.8 and -1.5.1]

The overall project objective is to safely remove contaminants of concern (COC) from the designated soil volumes, using ISTT according to the applicable performance standards, while controlling all emissions to prevent any unacceptable risk to human health or the environment. The soil volume to be treated has been defined by CH2M HILL and EPA as seven different zones based on preliminary monitoring point results, as well as historical data. Criteria for the selection were outlined in CH2M HILL Technical Memorandum: "Preliminary In-Situ Thermal Treatment Volume", dated February 19, 2009. The target soil treatment volume is depicted in Figure 1. This Tech Memo states: "The ISTT treatment volume was selected to encompass the highest concentrations of contaminants in soil, while lower concentrations will continue to be treated via the pump-and-treat system. To focus the ISTT on the site media that will result in the greatest recovery of contaminants and thus the sharpest decline of groundwater COC levels, site media at 10 times the Remedial Action Objectives (RAOs) (as defined in the Record of Decision [ROD]) was selected for treatment."

CES uses a proprietary numerical model to develop ERH design requirements based on available site information, direction provided with the bid solicitation documents and from additional discussions with EPA and CH2M HILL. As a result of additional information obtained from the CLIN 3 work some input parameters have been changed from numerical models submitted with the 10% or 30% RAMP (as described in the following Sections). Inputs to the numerical model summary are divided into three categories, which can generally be described as follows:

1) **General Site Information**: First, user inputs include the general site conditions that describe the treatment area, volume, and depth. These parameters were initially defined by bid specifications but have now been modified based on additional investigation and data analysis by CH2M HILL. These inputs also include: groundwater levels, assumed or given groundwater velocity, local ambient temperatures and rainfall, and other site specific parameters.

2) **Geophysical and Hydrogeological:** Next, more detailed geophysical and hydrogeological parameters are input. These include: site hydrogeology utilizing any site specific data that has been provided, and these are segmented by heated zone layers and heat loss layers for the model. Typical parameters (conductivity, resistivity, permeability, porosity, sorption coefficients) for the given soil and/or groundwater are then utilized in the numerical calculations. In cases where site specific data is not provided or otherwise unavailable, the numerical model contains a database of "typical" soil properties that were derived from several sources, with the most common one being information available from the U.S. Department of Agriculture (USDA) "Rosetta" web site which can be accessed at:

   http://www.ars.usda.gov/Services/docs.htm?docid=8953

3) **Contaminant Properties:** The next inputs are contaminant properties and their distribution. This portion of the model shows some pertinent characteristics of the site contaminants, such as molecular weight, boiling point, and vapor pressure. Total contaminant mass is derived

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from the average soil contaminant concentrations throughout the treatment volume. This data is compared to the mass estimates based on CH2M HILL's model efforts. Weighted average parameters at ambient and elevated temperatures are derived using known Henry's constants and vapor pressures to account for the entire treated depth.

The following RAMP Sections provide additional details and highlight several key assumptions and parameters. The associated specifications are cross-referenced for each subject or item addressed.

2.1 Design Calculations and Assumptions [Spec. 01400-1.5.1.B.1]

As described above, CES uses a proprietary ERH numerical model, which has proven accurate when compared to actual field results. CES's numerical models routinely have predicted the site-wide temperatures and system performance within a few days. For example, the numerical model analyses both historical and real time field data to evaluate and/or predict:

Site Geology and Hydrogeology
Contaminant Distribution
Electrode Design and Specifications
Extraction System Design and Specifications
Groundwater Extraction and Hydraulic Control of Aquifer
Electrolyte Use and Overall Water Balance
Estimated Treatment Times and Energy Requirements
Power Supply Specifications and Electrical Requirements
Subsurface Treatment Temperatures and Pressures
Subsurface Energy Distribution and Thermodynamic Heat Loss
Vapor Extraction Cooling in Upper, Lower, and Lateral Heat Loss Zones
Projected Treatment Performance and Removal Rates
Contaminant Fate and Thermal Degradation
Predicted Soil and Groundwater Concentrations

The model has been well validated by comparing modeling results against actual site results on several sites. The model was used at the request of the US EPA during the Silresim Superfund Project in Lowell, MA, a site containing PCE in glacial till, and CES's model accurately predicted the results to within 15%. The model was also used for the Camelot Cleaners Superfund Site in Fargo, North Dakota, (perchloroethylene in silty clay) and there the model predicted subsurface temperature trends within a few days.

As inputs to the model, CH2M HILL performed detailed data reduction and statistical evaluations of the geophysical soil properties, hydrogeological data, and information regarding contaminant extent and magnitude from the supplemental site assessment work completed under CLIN 3 of the CES contract. Based on the results of this evaluation, the DTV was segregated into nine distinct layers for numerical model analysis including two upper heat loss layers, five heated layers, and two lower heat loss layers. The model contains all data inputs and calculations for site geology and hydrogeology, contaminant properties, electrical and extraction design specifications, power requirements, predicted subsurface temperatures, thermodynamic calculations for energy distribution in the subsurface, treatment performance and removal rates for soil and groundwater, contaminant fate projections, and

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water balance calculations. The design calculations are based on a proprietary ERH Model that CES has developed and validated to support system design and sizing. Additional process and design calculations are summarized in Sections 2.2 and 2.3.

2.1.1 Source Zone Electrode Spacing Sensitivity Analysis

After the 10% RAMP was submitted in April 2008, CES and CH2M HILL had several conference calls to review the preliminary 10% RAMP ERH numerical model. Together, personnel from both companies (the "review team") evaluated the information provided with the Request for Proposal (RFP) and any additional information, including site experience that was beneficial in developing a revised model.

For the 30% design, CH2M HILL divided the source zone into four sections and labeled them from south to north as Zones A, B, C, and D, respectively. The dimensions of each zone along with its presumed treatment depth provided a reasonable representation of the conditions within the BTV as well as a potential deeper treatment interval from 0 to 90 ft below ground surface (bgs), so the review team decided that the electrode spacing sensitivity analyses should focus on Zone B, the deepest treatment volume. Moreover, it was presumed reasonable that both water-bearing zones, S-1 and S-2, (see Frontier Fertilizer ROD for more information on hydrogeologic setting) would be encountered by any well that penetrated to 90 ft bgs in Zone B. One objective of this study was to establish an electrode spacing so that the borings drilled during the installation of preliminary monitoring points would roughly be located in the center of an ERH electrode triangle. Numerous discussions were held between CES and CH2M HILL regarding a variety of electrode spacing versus heat-up times and energy consumption, assuming that the S-1 zone extended from 40 to 45 ft bgs and the S-2 from 72 to 80 ft. bgs.

Another objective of the sensitivity analysis regarded boundary conditions between any two zones, as well as the perimeter of the BTV and source zones. For example, CES suggested, and CH2M HILL agreed, that the boundary between Zones A and B would be treated as Zone B, meaning that the northernmost row of electrodes in Zone A, which has a treatment depth of 0 to 40 ft bgs, would actually be installed to 90 ft bgs, the treatment depth defined for Zone B. This was to ensure that the imaginary plane between Zones A and B would actually be heated to 90 ft bgs, as opposed to only 40 ft bgs.

After several iterations, the review team ultimately recommended an electrode spacing of about 16 ft. in the 30% Preliminary RAMP design as a "placeholder" pending additional information that became available during the CLIN3 work. These data have been evaluated to revise the electrode placement and design for this document.

2.1.2 Deviations from the 10% RAMP Design Criteria Report ERH Numerical Model

The parameters used during the modeling efforts performed for the electrode spacing sensitivity analysis were then applied only to the BTV for the 30% Preliminary RAMP design. Again, the review team selected the changed parameters and results. Major changes are briefly described below:

- **Groundwater Flow Velocity:** Based on observed low recharge rates during well development activities of the CLIN 3 work, groundwater flow velocity was decreased back to 0.01 ft/day. Increased groundwater flow velocity results in more energy consumption due to

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the cooling effects of the water. The review team recommended this change after studying the stratigraphy in borings SB-1, SB-2, SB-3 and SB-4 along with the previous site experience of CH2M HILL. For the 30% design effort, the higher permeable layer was assumed to begin immediately below the BTV. Once the preliminary monitoring points were installed, more data over a greater area became available below 40 ft bgs, and any changes to the stratigraphy are addressed in this design.

- **Upper Layer 1 (0 to 3 ft bgs):** Changed from "Clay" to "Sandy Clay Loam" due to the higher sand content observed near the surface, which results in an order of magnitude increase in permeability for the layer (e.g. increased from 10^{-5} to 10^{-4} cm/sec). Since this layer is in the vadose zone, the increased permeability facilitates steam and vapor recovery in the layer.

- **Lower Layer 1 (42 to 47 ft bgs):** The lower heat loss layer directly below the BTV treatment interval of 0 – 40 ft bgs was changed from "Clay" to "Sandy Clay" to account for the higher sand content in this shallow water bearing aquifer.

- **Groundwater Conductivity:** Was raised from 1,500 uS in 30% design to 2,500 uS, based on field measurements during preliminary monitoring point sampling event. It does not change the subsurface design, and only impacts the output transformer tap settings during operations. As the subsurface heats-up, it tends to become more conductive, and this means that constant power can be maintained at a lower output voltage. The numerical model was programmed to compute this change over time.

- **Total Organic Carbon (TOC)**: Lowered from 0.5% to 0.09%. Heating humic material may form ketones, namely acetone, but typically only at parts per billion (ppb) levels. Generally this becomes more prevalent when TOC levels exceed about 2%, so TOC is not considered a significant parameter at this Site. Table 01115-1 of the specifications reported an average of 0.88% and 0.09% for the vadose zone (identified as 10-30 ft bgs during dry periods or during agricultural irrigation), and S-1 zone (also 10 to 30 ft bgs, but during wet periods or non-agricultural pumping), respectively. These two averages were derived from essentially the same stratigraphic zone, so originally CES used the "average" of these averages, or 0.5% as the basis for the 10% Design Criteria Report model. After speaking with CH2M HILL, the review team agreed that the lower number more accurately reflected the organic carbon content of the overall soils in the BTV. Again, TOC is not considered to be a significant factor for the Site.

- **Electrode Spacing:** Reduced from 17.5 ft to 16 ft. The number of electrodes for the treatment volume increased from 84 in the 10% RAMP to 117 in the 30% RAMP on account of the closer spacing and the perimeter electrodes at the BTV boundaries. The preliminary monitoring points include groundwater monitoring and sampling points, and vacuum piezometers.

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2.1.3 Deviations from the 30% RAMP Design ERH Numerical Model

Based on the data obtained during the preliminary monitoring point installation and supplemental site assessment work (CLIN 3 work), several parameters changed. Again, the review team selected the changed parameters and results, and they are included in the model summaries contained in Appendix A. This appendix contains representative model input/output data that have been generated for the upper (i.e., Zone 1) and lower (i.e. Zone7) target treatment zones. These zones represent the two extremes of shallow and deep treatment campaigns. Major changes are briefly described below:

- **Treatment Volume:** The treatment volume grew in size and complexity. Instead of the rectangular BTV of 34,767 cubic yards (CY) with 3 boundary conditions, the final designated treatment volume (DTV) increased to 7 distinct treatment areas of differing treatment depths resulting in 39 different boundary conditions. The DTV volume was increased to 52,478 CY. Each treatment area is designated as a Treatment Zone as follows:

Table 1 – Treatment Zones

Zone	Targeted Depths	Area (sq.ft.)	Volume (CY)
1	0-40 ft.	5,273	7,812
2	0-80 ft.	7,881	23,353
3	15-80 ft.	4,991	12,015
4	15-60 ft.	1,140	1,900
5	25-60 ft.	1,106	1,433
6	25-80 ft.	1,676	3,413
7	40-80 ft.	1,722	2,552
TOTAL		**23,789**	**52,478**

- **Perimeter Fill:** The electrode layout was designed to heat the DTV to about 11 ft beyond the outer electrode, with boiling anticipated within the DTV to within about 8 feet of the outer electrodes.

- **Soil Layers:** Based on CH2M HILL's analysis of the soil types encountered at the site, a representative soil profile was developed that indicated relative percent clay, silt and sand for each depth interval. These data were then summarized into specific USDA soil classifications (see Figure 2) that CES's ERH numerical model can use to characterize various soil parameters based on the USDA Rosetta model. For example, the soil porosity and permeability of the soil layers are extracted from the USDA Rosetta model and then used as input data for the ERH model, which is presented in Appendix A for treatment Zones 1 and 7.

- **Upper Heated Layer:** Due to the low concentrations of COCs in the upper 10 feet of most of the DTV and the energy limitations of heating the upper few feet of soil, the first heated layer of the soil starts at 6 feet, which would allow temperatures to be expected to reach boiling below 10 ft. and not necessarily above that depth.

- **Lower Heated Layer:** Heat loss layers in the BTV were considered below 40ft. In the DTV, there are a variety of different depths to which heating is required. To assure

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heating at the lower depth, electrodes will be installed 4 feet below the targeted treatment depth for each zone.

- **Average Soil Concentrations:** Characterization results derived from the Preliminary Monitoring Point installation event were combined with previous characterization results refine source zone information. The combined characterization results were loaded into a model to revise the earlier mass estimate. The revised mass estimate indicates about 35 kilograms of COCs are present, with dichloropropane (DCP) making up about 25Kg of the total COC mass.

- **In-situ Degradation:** The model uses published literature values for hydrolysis degradation rates as referenced in the site documents. Two sets of models were run for each treatment volume (upper and lower depth intervals) that represent the expected degradation rates for EDB and DBCP. These compounds represent the "book-ends" of the treatment processes expected for the site contaminants and conditions. For example, EDB is expected to degrade rapidly at elevated temperatures based on published literature data (i.e., half-life of 8.8 hours for EDB at 100C [ref: White Paper: Compilation of Physical and Chemical Data on Ethylene Dibromide, 1,2-Dichloropropane, 1,2,3-Trichloropropane, and 1,2-Dibromo-3-chloropropane, E. Davis, EPA, November 12, 2007]). At these degradation rates, EDB concentrations in groundwater are expected to reduce 100-fold in a few days, therefore, EDB below the water table degrades before it can be steam stripped. Any vinyl bromide generated from EDB hydrolysis can be expected to be stripped from the aqueous phase and adsorbed to the vapor phase carbon at about 1% capacity, or 20 pounds on 2000 pounds of granular activated carbon. At the other end of the spectrum DBCP is expected to hydrolyze at a much slower rate and steam strip at a much lower rate as compared to the other COCs at the site. Accordingly, the ERH models in Appendix A for DBCP illustrate the slower end of the spectrum for treatment processes that are expected based on the input parameters for the site. Overall, a mixture of the two models are expected that will manifest in different treatment times depending upon location specific initial concentrations of initial COCs. The contaminant destruction process is stimulated by electric resistive heating, and destruction processes, such as temperature-driven hydrolysis and documented higher microbial degradation rates, continue after the power source is removed and the matrix slowly cools.

- **Power:** The power required for the 30% design of the BTV was 2,500KW and 2900 amps. With the larger volume and complex boundary conditions power requirements would increase to about 6,000 amps. The current design assumes the immediately available power at the site is 1,000KVA, which provides 1,200 amps at 480 volts and 3-phase power. This power constraint significantly changes the design and operations as the volume that can be treated at any one time and the rate of cleanup are strongly correlated to the energy input into the subsurface. As a result, the cleanup will proceed in up to six campaigns that treat the DTV in sequence.

- **Cleanup approach:** The 30% design was based on cleanup of the BTV with adequate power (i.e., 6MW or more) delivered to the site. The model predicted the performance objectives would be met within 250 days of operations. However, due to the increased volume and complexity of the DTV, and the limited power available to the Site, the DTV

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will be heated in stages or campaigns. There were many approaches evaluated to determine which approach would be most effective to achieve cleanup objectives.

The approach developed using 1 MW of continuously available power includes six sequential treatment campaigns of roughly 9,000 CY each. This approach allows for an adequate energy density, which results in a more controlled treatment process and less heat losses. The strategy allows parts of the site to clean up faster. The six campaign approach results in a more efficient operation since there is one operation that can be essentially repeated six times on the site; what is learned during the first campaign (i.e., in-situ heating rates) can be applied to the next campaign. Monitoring of groundwater and vapor concentrations over time are less time consuming per event, so there are less power shut downs to perform this intrusive work in the active treatment area. There is also a cost savings with less infrastructure costs in being able to move transformers, electrical cables and piping from one treatment area to another. This plan increases reuse and recycling of critical field components and materials.

Electrical power supply to the site is limited and the ability and timeframe in which the local utility can increase power capacity is unknown. The site therefore the entire DTV cannot be heated at once since there is less power being applied to the ground. As a result, the treatment time for the entire target treatment volume will take longer than originally proposed by EPA. The BTV was expected to take less than a year given adequate power supply. Full treatment of the larger and more complex DTV considered in the Pre-Final Ramp, coupled with power limitations, could take as long as three years. The ERH operating time may shorten significantly if hydrolysis plays a major role in reducing COC concentrations to cleanup objectives at elevated temperatures. Much of the existing laboratory data appears to support hydrolysis for the dominant mass of COCs in the source area (88% of the contaminant mass is represented by DCP and EDB, which are most amenable to removal by hydrolysis).

2.2 Energy and Mass Balances [Spec. 01400.1.5.1.A.5]

Energy balances are calculated by the model using a sophisticated iterative technique that considers heat inputs and outputs due to mass transfer out of the treatment area (vertically and laterally), sensible and latent heats related to groundwater extraction, drip injection, convection, and advection. The results are summarized in the output of the models presented in Appendix A. The first two models represent the shallow (0-40 ft.) treatment volume for EDB and DBCP and the second two models represent the deeper (40-80 ft.) volumes for EDB and DBCP. All of the seven treatment Zones and six treatment Campaigns are subsets or combinations of these two depth models and are expected to be bounded by the processes represented by EDB and DBCP.

The model results predict the temperature in each heated zone and upper and lower buffer layers of soil. Specifically, the energy required for the ISTT for the full DTV is about 12,500,000 kW-hr. This has changed from that presented in the 30% RAMP due to two factors: 1) the volume of the DTV is about 50% more than the BTV, and 2) energy losses due to all the boundary conditions account for a 10% increase in energy on a volumetric basis. The majority of the energy required at the beginning of

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the process goes to sensible heating of subsurface water and later about 65% of the energy goes into steam production as the treatment progresses. Subsurface energy density (i.e., energy per unit volume required to treat the site to the desired performance objectives) is anticipated to be about 227 to 250kw-hrs/CY with a power density of about 45 watts/CY.

Mass balances are focused on groundwater mass removal and inputs (i.e. drip system) and contaminant mass removal. Groundwater extraction rates are based on two primary processes: 1) DVE extraction and 2) steam generation, extraction and condensation. The DVE extraction rates are based on soil characteristics summarized in Figure 2 and typical Theis type pumping curves as shown in the output of the model (see p. 6 of each model in Appendix A). The soil profiles in the models are the result of numerous discussions between CES and CH2M HILL after the 30% Design report was submitted. Also shown in the model (Appendix A, p.6 of each model) is a graphical representation of the overall water balance. At this final design level, the groundwater extraction rates only represent those being calculated by the model to maintain hydraulic control of the groundwater during operations of the ERH ISTT within the DTV of the deeper treatment depths of about 40-80 ft bgs, which is entirely below the water table and will have the highest expected groundwater extraction rates.

To maintain hydraulic control of the groundwater within the DTV during each treatment campaign, groundwater will be extracted from perimeter primary electrodes. Campaign 2 was used to represent the most groundwater extracted in any of the treatment campaigns and it generates about 1.4 gpm. This averages out to about 0.2 gpm from each of the DVE well electrodes in the area. Steam production rates are based on energy balances once the system is up to boiling temperatures. The maximum rate of steam production is expected to be about 370 scfm. Condensate from steam production will produce about 3.7 gpm, and electrode wetting amounts to about 0.09 gpm.

An estimated subsurface energy distribution is provided in p. 7 of the model output (Appendix A). This portion of the numerical model analyzes the thermodynamics that will occur in the subsurface during ISTT treatment. As one might expect, a much higher percentage of energy is required during the first 75 – 90 days of the treatment to bring the formation up to boiling temperatures. Once that occurs, additional power input goes into steam production. Also depicted are the percentages of power that are expected for losses due to groundwater flow, groundwater extraction, radial heat, and electrode wetting as well as upper and lower layer heat losses.

Contaminants are removed primarily by four mechanisms: 1) volatilization with vapor extraction, 2) steam stripping 3) in-situ degradation and 4) groundwater extraction. Contaminant mass balance is calculated based on initial average concentrations in each soil layer and removed based on temperature dependent Henry's law partitioning and vapor extraction rates. Since the timeframe for treatment is generally driven by the relative concentrations of the compound with the highest boiling point and how much lower the cleanup objectives are for a COC. For example, 1,2-dibromo-3-dichloropropane (DBCP) has the highest boiling point of the COCs; however, there are many more places in the DTV where the concentration of EDB was more than 10,000 times higher than the treatment objectives as compared to DBCP. On the other hand, DCP has the highest estimated COC mass on the site, representing about 70% of the total COC mass. Since DCP has the lowest boiling point and highest air/water partition coefficient (Henry's constant), it is expected to be removed at the fastest rate. EDB was selected as the COC for which contaminant properties, such as boiling point, molecular weight, activation energy and vapor pressure are modeled because it dominates the contaminant mass in the source area of the Site and has slower removal kinetics than DCP.

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Although in-situ degradation rates at elevated temperatures are an inexact science at best, CES's numerical model simulates in-situ degradation both biologically (aerobic and anaerobic) and through hydrolysis (Arrhenius functions). CES used an activation energy of 103 kilo-joules per mole (kJ/mol) for EDB to establish a preliminary baseline degradation rate in the model. This activation energy is consistent with those mentioned in site documents (e.g., references from the White Paper, Compilation of Physical and Chemical Data on Ethylene Dibromide, 1,2-Dichloropropane, 1,2,3-Trichloropropane, and 1,2-Dibromo-3-chloropropane, E. Davis, EPA, November 12, 2007). The impact of hydrolysis on the projected contaminant fate is shown on page 9 of model output (see Appendix A). Under this scenario, the model predicts that approximately 95% of the EDB mass will degrade in place during ERH treatment. On the other end of the treatment spectrum, only about 16% of DBCP is expected to degrade in the upper treatment volume with the majority (84%) being removed by vaporization/steam stripping.

A mass balance of the COCs removed during the ISTT process is shown on p. 9 of the model output (see Appendix A). The mass of EDB remaining in the soil is projected to decrease rapidly just before the pore water begins to boil and soil temperatures exceed about 60C after about 40 days of heating. DBCP concentrations decline rapidly after about 70 to 100 days of heating. The model output shows that after 100 to 130 days about 99% of the contaminant mass is removed. After this point diminishing returns are reached but it may take another 80 days of steaming throughout the treatment volume to reach cleanup objectives for groundwater.

Energy can be delivered to various electrodes in response to temperature observations and results of vapor and groundwater sampling. Due to the extreme heterogeneities in COC distribution within the DTV some areas will clean up faster than others. As this occurs, energy will be directed to those areas needed additional cleanup and other campaign volumes as the ISTT process continues. For example, when Campaign 1 is in cool-down mode and power is being delivered to Campaign 2, follow-up sampling of Campaign 1 can be used to gauge how much more contaminant destruction occurs after the electrodes are turned off (i.e., increased levels of biodegradation has been observed for several months after heating has stopped and is expected here as well). This data can be used to fine tune the electrode energy distribution in subsequent campaigns.

2.3 Process Flow
[Spec. 01400-1.5.1.A.2]

The ISTT process as applied by CES basically superimposes the process of Dual Vacuum Extraction (DVE) with Electric Resistive Heating (ERH). The components of these processes include the following process equipment:

1. Electrodes/DVE wells (111). While all wells will have DVE capability only the primary electrodes will be operated as such. The remaining secondary electrodes will collect vapors and steam as an SVE well. There are 31 DVE wells/primary electrodes and 80 SVE wells/secondary electrodes. Figures 3A to D, and Figures 4A to C show the design of the typical electrode construction for Zones 1 through 4 and Zones 5 through 7, respectively. Figure 5 shows the layout of these wells and electrodes and the seven treatment zones.

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2. Temperature Monitoring Well (TMW) (19). Nineteen TMWs will be installed within the DTV. Figures 6 and 7 shows the details of the TMWs for Zones 1 through 4 and Zones 5 through 7, respectively. In addition, 6 monitoring wells just outside of the DTV will have thermocouples installed in them to aid in verifying that hydraulic control is being maintained.

3. Groundwater monitoring wells (28). These wells were installed as preliminary monitoring points during the CLIN 3 work in 2008 and typically monitor either the S-1 or S-2 hydrogeologic zone. Appendix B contains details on these wells, including boring logs, well construction details. Since many of these wells were drilled to help define the fringe of the soil contamination and thus delineate the DTV, only 15 groundwater monitor wells are within the DTV. The locations of these wells are shown in Figure 5.

4. Hopper Tank: 500 gallon steel tank, primarily for sediment removal, with impingement plate and level controls, high level shutdown switches and transfer pump.

5. Air-Water Separator: 150-gallon unit for additional water removal with demister pad. Unit is made of steel, has tangential entry, impingement plate and level controls, high level shutdown switches and transfer pump (on pump skid).

6. Settling Tank: 1000 gallon steel tank to provide settling of solids removed from the holding tank. Solids are removed for disposal in compliance with the CERCLA Offsite Rule.

7. Coalescer: 150-gallon unit for additional water removal with demister pad. Unit is made of steel, has tangential entry, impingement plate and level controls, high level shutdown switches and transfer pump.

8. Vacuum Extraction Unit (VEU): One 40-horsepower, Duroflow Model 4512, positive displacement blower, or equivalent. This unit has the capacity of about 500scfm and 12 in. Hg. It also comes with silencers and a sound reducing enclosure.

9. Power Supply Units (PSU): One 750 kW PSU custom made by CES. This PSU controls the output power to one 750 KVA or three 250 KVA output transformers and set of electrodes. The power supply consists of three independent 3-phase silicon controlled rectifiers rated at 350 amps at 480 VAC. The power controller permits three zone operation with each zone operated at constant voltage, constant power and constant current or constant subsurface temperature. The output of each rectifier is connected to a field located 3-phase isolation transformer.

10. System Control and Data Acquisition (SCADA) unit: One custom build unit made by CES. This collects subsurface and operating data, feeds it into a control logic program, which then modulates the operations to meet the operating conditions set by CES. The SCADA is remotely accessible via internet connection. A pager modem is typically included to alert project staff of a system fault or warning.

11. Transformers: One 750 KVA or three 250 KVA output transformers for distribution of power phases to electrodes. These will be placed in the field and moved for each campaign to minimize line losses as they distribute power to lower voltages and higher amperage that goes to the individual electrodes.

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12. Condenser/Cooling Tower Skid: Skid mounted with plate heat exchanger, 100-ton capacity cooling tower, condensate separators and transfer pumps. This size of condenser is matched with the 750KW PSU with some additional capacity. The model indicates power loading to the field of 410KW to 520KW, of which about 65% is used to generate steam later on in the process. This translates to a condenser sizing of 61 tons of cooling (410kw x 65% x 3414 BTU/hr x ton/15000BTU/hr = 61 tons of cooling). Therefore, the unit has about one-third excess capacity to deal with spikes in steam production that may occur in localized areas.

13. Brine and drip skids: Skid mounted units, custom made by CES, for controlled supply of electrolyte solution to electrode to maintain conductivity. The projected average flow of wetting solution to the electrodes is about 0.09 gpm total or about 0.2 gal/hr per electrode.

14. Vapor Phase Granular Activated Carbon (VPGAC): Three VPGAC Units in series. Each VPGAC Unit consists of two 1000-pound vessels in parallel, which is equivalent to one 2000-pound VPGAC Unit; therefore, a total 6000 pounds of VPGAC provides carbon treatment for recovered soil vapor. The discharge from primary unit is processed through a secondary unit and then a tertiary unit to provide two levels of backup treatment. Each Unit has more than adequate adsorptive capacity for each campaign since there is expected to be a total of 35kg of COCs to be removed from the entire DTV. However, CES is tripling that amount for additional assurance of treatment capacity, which will provide 200% backup in line so that if breakthrough does occur in the first set of carbon vessels, it will be captured on the second or third set of carbon Units. This provides a high degree of assurance that potential emissions are minimized.

15. Liquid Phase Granular Activated Carbon (LPGAC): Two 1000-pound units to treat a projected maximum water flow of 5.1 gpm (1.4 gpm groundwater from DVE and 3.7 gpm condensate) in the event the existing groundwater treatment system goes down. One unit will be primary and the other secondary, in series.

16. Poly Holding Tank: 7,500 gallon polyethylene tank with high-high level shut down controls and pump controllers to reuse treated water throughout the system via the SCADA.

17. Site Cap Vent. The target treatment depths are 0-40ft. and 0-80ft. for Zones 1 and 2, respectively. In order to treat these zones a cap, consisting of a gravel layer overlain with a plastic liner, will be installed to capture contaminants driven upward by heat and steam. In treatment zones that start at 15 ft. bgs (Zones 3 and 4) a cap will also be provided due to the relatively shallow heating in these zones. In other treatment zones, (Zones 5, 6 and 7) the contamination is deeper and target treatment volumes don't begin until 25 or 40ft bgs and are contained under an earth cap of 25 ft. or more. Lateral vapor migration to electrodes is typically much shorter and presents the path of least resistance for the volatilized contaminants, so a cap is not deemed necessary in Zones 5, 6 and 7. Approximately 5,000 sq.ft. of Zones 1 and 2 indicate shallow (<10ft) soil contamination that will need to remain adequately heated to carry contaminants into the cap for capture. This area will be insulated above the gravel and plastic liner and covered with another liner to reduce heat losses in this area. Figure 8A shows the layout of the cap, including the areas that are insulated and Figure 8B shows the construction details of the cap.

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These components collectively comprise the ISTT system and are shown on a process flow diagram (PFD) in Figure 9.

2.3.1 Process Flow Analysis

In general, the ISTT process uses electrical power delivered subsurface via electrodes to drive COCs from soil and groundwater and transfers them in water, vapor or steam flows that are separated, condensed and captured on activated carbon. The captured COCs are ultimately destroyed when the activated carbon is regenerated off site.

The characteristics of various process streams shown on the PFD are summarized in Table 2. This tracks the maximum flows (water, vapor, steam), pressures, temperatures and COC concentrations that are expected throughout the process. The maximums are shown since the process is highly variable and the process equipment must be designed to handle the maximums as well as expected turndown ratios for each process stream. Most of these data are taken from the model output (Appendix A).

2.3.2 Piping Plan

There are two distinct vapor/steam capture mechanisms employed at this site. The primary vapor/steam capture system is the SVE and DVE wells at each electrode. The secondary system is the site cap. Since each well is planned for vapor and steam extraction under vacuum, the wells are connected to the central VEU via manifolds at each electrode wellhead. Each wellhead includes an SVE or DVE well, shallow vent pipe and electrodes with wetting tubes. Figure 10 shows the construction details of the SVE and DVE wellheads. The DVE wellheads are designed to extract water and vapor (including steam) from the well, while the SVE wells just handle vapor and steam. The shallow cap (see well construction details, Fig 3A-3D, and 8B) wells are designed to allow fresh air to enter at the wellhead, or through air inlet vents, and sweep through the gravel layer, pick up COC vapors and steam (if present), and be collected at the adjacent electrode where another vacuum manifold is connected to the shallow well.

The manifolds are sized to handle the maximum expected flow per well, with about 50% additional capacity built into the piping system. Figure 11 shows the layout of the piping manifold from each electrode, which goes to the VEU. As more electrode wells are connected to the manifold, the size of the manifold increases to handle the additional flow. The manifold is designed to handle flow of vapors, water and steam simultaneously. Fluids and materials collected by the SVE/DVE manifold includes a combination of water, vapor, air, sediment and steam and must pass through two vapor/liquid/solids separators and a condenser prior to treatment by activated carbon. The cap vent system using the shallow wells is usually relatively dry and cool since ambient air is allowed to enter to sweep out the vapors present and is carried directly to the carbon units for treatment. The relatively cool and dry cap vent manifold system is combined with the humid condensed vapor stream to provide a less humid vapor stream to the carbon so that COC removal efficiencies are higher. The two systems are manually balanced during the process as the dynamics of vapor and steam flow change over the 30-day period that characterizes the transition from soil temperatures near 80C to boiling.

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TABLE 2
PROCESS STREAM ANALYSIS

CAMPAIGN 2: 36-84 FT bgs

			Design Flows - Maximum									
Process Stream ID	Description	Pipe (type, size, rating)	Air Flow (scfm)	Water Flow (gpm)	Steam Flow (scfm)	COC Concentration (mg/l)	Temperature (oC)	Pressure (psia)	Other	Other units	Maximum Turndown (%)	Comments
A	Power to Electrodes	4/0 insulated copper cable							112	Volts	100%	
									53	Amps		
B	DVE extraction Well	2" FRP, 250F	19	0.2	13	0.07	<110	11.8	11	wells	100%	6"Hg vacuum
C	SVE Extraction Well	2" FRP, 250F	5	0	13	0.12	<110	11.8	20	wells	100%	6"Hg vacuum
D	Vapor/Water Separator--Vapor Out	6" CPVC, Sch.80	309	0	363	0.12	100	11.3			100%	7"Hg vac.
E	Condenser Vapor Out	6" CPVC, Sch.80	345	0	0	0.12	35	10.8	100	%Relative Humidity	100%	8"Hg vac.
F	Cap Vent Out	6" CPVC, Sch.80	150	0	0	n/a	100	10.8	30	%Relative Humidity	100%	8"Hg vac.
G	VGAC In Primary	6" CPVC, Sch.80	495	0	0	0.12	35	10.8	100	%Relative Humidity	100%	8"Hg vac.
H	VGAC Out Primary	6" CPVC, Sch.80	495	0	0	0.005	35	10.3	100	%Relative Humidity	100%	9"Hg vac.
I	VGAC Out Secondary	6" CPVC, Sch.80	495	0	0	0	35	9.8	100	%Relative Humidity	100%	10"Hg vac.
J	Stack --VEU Out	6" Steel, Sch.40	495	0	0	0	118	14.9			60%	
K	Vapor/Water Separator--Water Out	2" CPVC, Sch.80	0	5.72	0	0.64	100	11.2			100%	Batch basis
L	Condenser Water Out	1" CPVC Sch.80	0	3.66	0	1.9	35	11.2			100%	
M	Settling Tank Out	2" CPVC, Sch.80	0	10	0	1.1	35	29.7			100%	Batch basis
N	LGAC In Primary	2" CPVC, Sch.80	0	10	0	1.1	35	24.7			100%	Batch basis
O	LGAC Out Primary	2" PVC, Sch.40	0	10	0	0	35	19.7			100%	Batch basis
P	LGAC Out Secondary	2" PVC, Sch.40	0	10	0	0	35	14.8			100%	Batch basis
Q	Discharge to City Sewer	2" PVC, Sch.40	0	10	0	0	35	16.7			100%	Batch basis
R	Make-up Water to Condenser	1" CVC, Sch.40	0	10			35	24.7			100%	Batch basis
S	Drip skid out	1/4" PE tubing	0	0.25	0	0	35	24.7			100%	Batch basis
T	Solids from filter	Solids to DOT drum	0	0	0	0	35	14.7	40	% Solids	100%	Batch basis

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Initially, the wells are connected to the manifold and operated in the DVE and SVE mode to maintain subsurface vacuum and hydraulic control. The initial flows are typically vapor and water only and tend to be very small relative to the steam flows that are generated later in the ISTT process. The vacuum is maintained at the wellhead at sufficient vacuum to collect vapors and water. As steam begins to be produced from a SVE well, the vacuum extracts the steam at a higher volumetric flow rate and the valve at the wellhead is adjusted accordingly. At the DVE well, steam is produced and it replaces the flow of water in the extraction tube and water continues to be extracted from the well in the form of steam. As more energy is supplied to the electrode, more steam is produced such that the main vacuum valve at the wellhead is opened to continue steam extraction under vacuum.

2.4 Performance Monitoring Components [Spec. 01400.1.3.2]

Several components of the ISTT system are designed for monitoring of its performance, including monitor wells, temperature probes, vacuum monitor points, and devices to measure flow of water and vapors throughout the system. Each major component is discussed below.

2.4.1 Monitor Wells to Track Groundwater Control

2.4.1.1 Electrode DVE Wells.

Figures 3 and 4 shows construction details of the electrode and vent system. Each Electrode Well is capable of simultaneously heating and extracting vapors and steam via SVE in the vadose zone and DVE below the static water table. Dual Vapor Extraction (DVE) utilizes an entrainment tube from the vacuum extraction system that is advanced to the water level to remove water and lower the water table. DVE will be conducted in the primary electrodes at the perimeter of the area treated in each Campaign to maintain hydraulic control. There will be 7 to 11 DVE wells operating in each of the six Campaigns, depending upon the location of primary electrodes within the treatment area for a particular Campaign. The remainder will be SVE wells collocated with the secondary electrodes.

Each electrode/SVE/DVE well will be constructed with temperature resistant materials and will be installed as a single well in the same borehole as the electrode. Near the surface, the well will be sealed with grout. In addition, there will be a surface vent in the upper three feet that will collect steam that may be present at shallow depths or beneath the surface cap. Each electrode vent will be equipped with a control valve, and a pressure and sample monitoring port. The vacuum level applied to any specific well will vary based on actual pressure generated during heating. The model indicates an electrode/DVE well spacing of 16 ft. will be sufficient to supply electricity to the soils and allow capture of the steam that is generated in the ISTT process from the low permeability clays present at the site. A 12-inch OD hole will be drilled to four feet below the target treatment depth, which varies in each zone from 40 to 80 ft, and a full-depth DVE well screened at least entire treatment depth, and multi-level electrodes installed as shown in Figures 3 and 4.

CES will use DVE to maintain hydraulic control of the S-1 and S-2 water bearing zones. Although the buoyancy effects of hot vapors and steam would generally cause them to rise vertically to the

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vadose zone where they can be captured by the DVE/SVE system, complex lithologies can trap this steam and vapors beneath lower permeable lenses causing them to migrate laterally as opposed to vertically. Field experience at several sites has proven that even a nominal amount of groundwater extraction by DVE can effectively control the soil pore pressure to prevent steam escaping at the surface. However, there are many soil perforations that have been previously installed by others over the last 20 years at the site, which are not completely known, and could cause steam to vent before it can be collected. In addition, soil heterogeneities, such as old stream channels, may cause lateral migration of vapors that should be captured. To mitigate these potential steam release conditions, a cap is proposed for the portions of the treatment area where treatment begins at shallow depths (i.e., less than 25 ft bgs). Vapors will be captured by the vacuum system due to the negative pressure maintained in a gravel layer beneath a synthetic liner (see Figure 8B) that is connected to the vacuum system.

SVE and DVE wells are fully screened to the bottom of the well to facilitate groundwater extraction, if necessary, well development, and steam extraction from all depths. Typically, the steam will enter the borehole wall as it migrates from the relatively high pressure in the formation where it is generated to the porous backfill . The least path of resistance for the steam is to travel laterally inward a few inches, driven by a negative pressure gradient towards the well screen, and enter the DVE/SVE well through its screen. The vacuum and flows are set more to provide a pressure relief point in the formation rather than a typical vacuum extraction process where more vacuum produces more flow and faster remediation. In ERH, if the vacuum is set too high, the DVE/SVE well draws in cold fresh air from the surface around the well and competes with the heating process and slows down the remediation. Therefore, there isn't any significant "competition" between upper and lower zones in a typical fully screened well that is being treated throughout its length.

2.4.1.2 Temperature Monitoring Wells (TMW)

Figures 6 and 7 show construction details of the Temperature Monitoring Wells (TMW). Fiberglass reinforced plastic (FRP) pipe is used for the TMW risers (solid pipe) due to its being both non-conductive and heat resistant. Temperature probes are installed within the pipe to monitor the soil temperature at 5 foot intervals starting at 5 feet bgs or 10 feet above the top of the target treatment depth, whichever is deeper, down to a depth of 5 feet below the bottom of the target treatment depth. For example, Zone 5 has a target treatment depth from 25 to 60 ft. bgs; therefore, temperature probes will be installed at 5-foot intervals from 15 to 65 ft. bgs. These temperature probes provide real time data that is fed into the SCADA system, which controls the PSU and subsurface energy delivery.

2.4.1.3 Monitoring Wells (MWs)

The boring logs in Appendix B show construction details of the groundwater monitoring wells (MWs) installed as preliminary monitoring points in 2008. One inch diameter FRP pipe, two-inch CPVC, and four-inch CPVC were used for the MW risers due to its being both non-conductive and heat resistant. Stainless steel (SS-304) was used for the MW screen. Since many of these wells were drilled to help define the fringe of the soil contamination and thus delineate the DTV, 15 groundwater monitor wells are within the DTV and may be used to monitor groundwater concentrations during the ISTT process. In addition, these wells will be connected to the SVE manifold so that any pore pressure can be relieved during operations and prior to sampling. Three of the monitor wells (EE-1, GG-2, GG-3) will be abandoned due to close proximity to electrodes.

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2.4.1.4 Monitoring Groundwater Containment

The DVE process, spacing of wells and the inherent nature of the ISTT process itself should provide adequate hydraulic containment. First, the ISTT process is a net water removal process, so there is an overall inward hydraulic gradient, even though there can be local pressure buildup as steam is initially generated. The model indicates that at least one foot of drawdown will be present between wells with the extraction pipe within each DVE well set about 5 feet below the static water table; therefore, an inward gradient can be expected throughout the ISTT process.

Hydraulic control will be monitored by monitoring the temperature of groundwater near but outside the treatment volume. If warmer water is not moving out from the treatment volume, then groundwater temperature will not rapidly increase outside of the treatment volume, but may show a very slow, steady increase due to heat conduction. Thermocouples will be installed in the screened, water bearing zone at wells such as AA-1, CC-1, CC6, DD1, EE5, GG-1, to monitor groundwater temperature, which will indicate whether containment is being achieved. Other TMWs in treatment zones which are outside of a particular heating campaign can also be used for monitoring hydraulic containment.

2.4.2 Temperature Monitoring

Heat management is an ongoing optimization process and shall be managed by CES's PSU operating software that will interact with the TMWs. Power can be directed to cool spots, decreased in hot spots, and controlled elsewhere, as necessary. The ISTT treatment needs to only vaporize about 35-50% of the pore water to achieve most clean-up objectives. Soil shrinkage or subsidence through ISTT is generally <1%. CES has experience managing these phenomena in shallow heating regimes and in very low permeable formations. Rather than completely desiccating the soil during ISTT operation, CES intends to preferentially heat these critical areas only until the target temperature and diminishing returns are achieved. This will allow the ERH process to focus energy input in other areas that may be more difficult to heat, thereby conserving energy. Based on the evaluation of subsurface temperatures, extraction data, and other operating data, CES will be able to predict and automatically regulate subsurface temperatures. This valuable operating capability adds a level of safety and affords time for the CES team, CH2M HILL and EPA to discuss the advantages and disadvantages of lowering, raising, or maintaining temperatures in any given area as the treatment progresses in each Campaign.

The TMWs will be custom made by CES, and they will be placed inside FRP casings installed at the boring locations. The TMWs will be connected to field voltage isolation boxes and then transferred to the site computer for real-time data logging. TMW temperatures are typically recorded twice daily for the first two weeks then three times per week thereafter by the PLC control system and the information is maintained in the on-site computer as well as remote back-up databases maintained at CES offices.

2.4.3 Vacuum

Subsurface vacuum is critical to monitoring performance of the ISTT system, managing fugitive emissions, and protection of human health and the environment. No additional SVE wells will be

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installed since vapors are collected from electrode wells and shallow vents. The SVE and DVE wells will be connected to separate manifolds and to the influent of the holding tank and air water separator. In Zones 1, 2, 3 and 4, the shallow vents, which are pneumatically connected to the surface cap (via the contiguous gravel surrounding the vents and the surface gravel beneath the plastic liner, where present) will be connected to a different manifold since the flow dynamics of the shallow vent system are very different from the steam vents. It is more effective to manage these vapor streams in separate manifold systems. Each vacuum manifold will be monitored continuously for vacuum. Each vent will be equipped with vacuum gauges to verify negative pressure at the wells. Gauges will have a range of 0 to -30 inches Hg and a resolution of 1 inch Hg.

In addition, vacuum monitoring points (VMPs) installed during the CLIN 3 work can be used for vacuum monitoring. VMPs within 20 ft. of an operating campaign will be monitored for subsurface vacuum/pressure with a manometer.

2.4.4 Control of VOC Emissions

There are three systems designed to capture potential fugitive VOC emissions: DVE wells, SVE wells and surface vents. All extracted vapor will be treated by granular activated carbon with 200% backup system on line continuously (in series) as well. To assist with compliance with typical air permit conditions, and protection of the health of workers and neighbors, an additional carbon unit (tertiary treatment unit consisting of two 1000-pound carbon vessels) will be installed and weekly vapor sampling between the second and last carbon unit will be conducted. Samples will also be collected and analyzed at an outside laboratory or on-site laboratory during operations, in addition to routine monitoring with a photoionization detector as part of the operations and monitoring activities.

Shallow vents at the electrodes as shown in Figures 3, 4 and 8B will capture the steam and vapor that migrates to the surface cap through the gravel layer beneath the plastic cover of the surface cap. The gravel of the cap is contiguous with the gravel surround the shallow vents, which are connected to surface cap vacuum manifold. Therefore, in areas where steam and vapors are produced at shallow depths, vapors are controlled by lateral migration to the shallow vents via the surface gravel. Air inlets can be opened to atmosphere sweep fresh air through the surface gravel layer to the adjacent shallow vent under vacuum.

2.4.5 Flow Rates

Flow rates of water and vapors (soil gas) will be monitored throughout the operations period of the ISTT system.

2.4.5.1 Water

Process water comes from three sources: 1) groundwater extraction from DVE wells, and 2) condensate from extracted heated vapors and 3) steam condensate. Groundwater extraction rates for Campaign 2, which is expected to have the greatest production of water, are projected at 1.4 gpm with an additional condensate flow of about 3.7 gpm.

Flow rates of condensate and DVE extracted water will be measured using flow meters such as Seametrics model EX-81, which will display flow rates and total flow through the ERH operating

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software. The frequency of measurements can be programmed in the software at any interval, though generally these are set to record once per hour. The locations of process monitoring of water flows are shown in Figure 9.

Discharge of extracted groundwater, following temperature adjustment and particulate material removal, will be directed to the EPA-operated existing groundwater treatment system, which discharges to the City of Davis sanitary sewer under a permit. Based on the process flow analysis (Table 2), it is anticipated that the existing groundwater treatment system will continue to meet all permit conditions.

2.4.5.2 Soil Gas

Soil gas flow rates are typically determined by measuring differential pressure, using a self-averaging pitot tube for a specific pipe size, the signal from which is then transmitted to the site computer and displayed using system software. Specifications call for gauges with direct readings to measure the system influent and total process influent and effluent. CES generally uses Dwyer differential pressure meters (Annubars) sized appropriately for the inside pipe diameter, and the flow data is transmitted to the onsite computer data logging system. The Annubars are calibrated using normal water manometers. The frequency of measurements can be programmed in the software at any interval, though generally these are set to record once per hour.

2.4.5.3 Air Emissions

All process stream vapors will be treated for COCs using the GAC vessels and discharged out the stack of the VEU. CES, CH2M HILL and EPA will coordinate with the local Air Quality Management District to comply with applicable requirements. Discharge will be through a 6" stack at a height of 10 feet. It is anticipated that stack emissions will be non-detect for COCs and the routine monitoring will verify that the treatment process is effective.

2.5 Heating Electrodes [Spec. 01400-1.3.2]

The ERH design for the DTV will use 111 electrodes, divided into four groups of 27 to 36 electrodes that will be used to treat six different soil volumes in sequential treatment Campaigns. The ERH numerical model derives the number of electrodes based on an optimum spacing for power density for the treatment volume, size of electrodes, soil conductivity and phasing of power. Figure 12 shows the electrode layout and the combinations of electrodes that represent each treatment campaign. The treatment campaigns are summarized below:

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Table 3 –Treatment Campaigns

Treatment Campaign	Zones Heated	Depths Heated	DVE Electrode/ Wells	SVE Electrode/ Wells
1	Zone 1 + few electrodes/wells in Zone 2 for phase balancing and hydraulic control	0 to 40 ft.	7-11	20
2	Most of deep portion of Zone 2	44 to80 ft.	9-10	17
3	Most of shallow portion of Zone 2	0 to 44 ft.	9-10	17
4	Most of deep portion of Zone 3, southern portion of Zone 7 and remainder of Zone 2	44 to80 ft.	7-8	27
5	Most of shallow portion of Zone 3, and remainder of Zone 2	15 to 44 ft. 0 to 44 ft.	7-8	27
6	Remainder of Zone 7 Zone 6 Zone 5 Zone 4	44 to80 ft 25 to 80 ft. 25 to 60 ft. 15 to 60 ft.	7-9	17

Each electrode will have three to five conductive intervals separated by 5-foot gravel isolation packs as depicted in Figures 3 and 4. Electrode length determines power density, so the middle zone will receive a higher power density based on preliminary numerical modeling. As mentioned above, the numerical model (Appendix A) predicts that the total power input for Campaign 2 will be about 2,600,000 kw-hrs at a power density of about 230 kw-hrs/cy.

2.6 Power Supply Unit (PSU) [Spec. 01400-1.3.2]

The PSUs are equipped with a completely remote addressable control system. Though CH2M HILL and EPA will be provided access to the data screens, only qualified CES personnel will be permitted to alter operational configurations. The power supply will be used to deliver an average of 410 to 510 kW to the subsurface treatment volume. The PSUs can deliver three (3) to six (6) separate electrical phases to the electrodes. The PSUs require 1,200 amps of 480 V, 3-phase power to service the DTV. The DTV is divided into six treatment volumes, which will be treated sequentially in six Campaigns with 1 MW electrical power service.

Each treatment campaign will be powered by a single 750 KW PSU, custom made for CES. One 750 KW PSU has either one 750 KW or three separate 250 KW transformers. The transformer(s) will be connected to the electrodes in such a way as to balance the power delivery within each treatment volume. The subsurface energy can be directed to the subsurface based on constant power or constant temperature, using the numerous thermocouple signals as feedback.

The PSU contains instrumentation that enables fully manual on-site control as well as control through a computer-based process logic control (PLC) and data acquisition system with fully remote addressing. CES staff will monitor both on site and remotely all field data, including subsurface temperatures, pressures, blower, condenser, system interlock status, electrode currents and voltages, and all input power load and energy parameters via broadband data line communications. All major

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power and extraction system parameters can be controlled locally by the on-site staff or remotely by authorized CES staff.

2.7 Soil Gas and Groundwater Components [Spec. 01400-1.3.2]

Figures 3 and 4 also show the vent/DVE wells that shall be co-located with the electrodes. These DVE vents will consist of temperature resistant, fiberglass (FRP) pipe, as well as the shallow vents for capture of rising steam and vapors. Finally, in portions of the site where the treatment volume is targeted from depths less than 25 feet (e.g., Zones 1, 2, 3 and 4) a surface cap constructed of gravel and a site cap consisting of high-density polyethylene (HDPE) provides the final surface collection point for steam and vapors. Soil vapor will be treated with granular activated carbon. In these zones, the active treatment area will be covered with a cap of gravel covered by a synthetic liner that is maintained under negative pressure.

CES will use DVE to maintain hydraulic control in the DTV. Cross-linked polyethylene tubing will be extended to and below the water table down each of the fiberglass vent line of the electrodes. The vacuum system can then be utilized to entrain and remove water at each DVE electrode. CES shall construct the ISTT system to permit DVE from the primary electrodes and SVE from the other secondary electrodes. Although each electrode shall have the subsurface capability of DVE, the surface connections will be different (see Figure 10). It is expected that the existing wells downgradient of the DTV currently being pumped and treated by CH2M HILL will continue to be operated throughout the ISTT process; this will provide the ultimate hydraulic control for the DTV. CES and CH2M HILL will closely coordinate groundwater extraction rates to ensure that hydraulic control for the DTV will be maintained throughout heating process.

2.8 Planned Installation Locations [Spec. 01400-1.3.2]

Figure 13 shows the site layout, including well locations for the DTV and the approximate locations of the main process equipment components listed in Section 2.3 above. Included in this drawing are two 40-foot steel containers for tools, spare parts and equipment, and an office trailer for the site. The power drop will come from the south via poles that will have transformers on site (see Figure 14). Distribution of electrical power is shown in the one-line drawing in Figure 15. A security fence will surround the active treatment area. For construction details of the fence, see Figure 16.

Prior to installation of the electrodes, existing structures that may interfere with the ISTT process will be removed. These structures include subsurface conduits for prior extraction and injection operations that were discontinued years ago. Details of this activity are presented in the Site Management Plan.

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2.9 Temperature Performance Criteria [Spec. 2182-2.2.4]

The specified temperature performance criteria is to reach 95C ± 5C in the vadose zone (currently expected above 26 ft. bgs) and boiling temperatures (at least 100C) below the water table. Several considerations regarding temperature profiles in the heated zones must be considered:

1) EPA has designated the treatment volume (the DTV), which is the target heated volume, as 52,478 cubic yards, comprised of seven distinct Zones and outlined in the CH2M HILL February 19, 2009 Technical Memorandum. The exact volume heated is determined by the layout of the electrodes that overlay the target heated volume, which is shown in Figure 12. The objective CES was given was to match the overlay, as best as possible, the area of the DTV with the area covered by the electrodes at the required spacing. Within this heated volume from the electrode overlay to the target heated volume there are small areas in which heating will occur outside the DTV and small areas at the edge of the DTV, where heating may not occur to a significant degree. These areas are further described below.

   As a result of the overlay of the electrodes to the DTV, two volumes are created: first, the total heated volume, and second, the volume brought to and held at boiling in a reasonable timeframe, consistent with the temperature performance objectives. On Figure 12, the first area is delineated along the outside perimeter of the electrodes and shown as a scalloped outer edge in blue. The second area is shown with pink angular lines about half way in from the outer electrodes to the next interior electrode.

   CH2M HILL and CES have agreed (re: email 3/27/09 from R. Dahl of CES to P. Seday of CH2M HILL) to the treatment area that will be brought to boiling as being defined as an area that is inset a distance of inset equal to 0.866 * electrode spacing (S) or (cosine 30 deg * S) from the perimeter electrodes. This places performance TMWs no closer than this distance from the perimeter. TMW locations are shown in Figure 12. CES believes these locations will enable temperature control and meet monitoring needs.

   The larger heating zone, beyond the outer electrodes, is defined as the area extending to a radial offset distance is equal to S/sqrt(2), which is about 11 ft. The offset corresponds to the line-to-neutral physical spacing. The space between the outer treatment zone and the perimeter electrode row is the perimeter wall. It is recognized by all parties that the temperature performance criteria cannot be met within the perimeter wall region although significant heating of this area may occur.

   A perimeter wall of electrodes is often installed and operated outside the treatment zone in order to better treat the perimeter of the treatment zone. EPA identified that the DTV is the total heated volume. Accordingly, the electrodes will be inset from the indicated treatment boundaries by an average distance of about 11 ft., which results in a reduction in the overall perimeter fill, as mentioned above.

2) Perimeter boundaries of the heated zones will not be required to reach boiling point temperatures. Temperature monitoring will be conducted within the electrode array, inset from boundaries. The performance TMWs will be inset further away from all edges and

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there may be a few electrodes that change depth designation. This phenomenon is further complicated by the limitation of power. Since with 1200 amps of power, it will take six Campaigns to treat the DTV, each Campaign will have its own perimeter heating zone. In order to reach target temperatures in these zones between campaigns, a 'rolling campaign' will be used. This will entail energizing the closest row of electrodes of the next campaign before turning off the boundary electrodes of the previous campaign so that target temperatures are achieved at all interior locations (8 ft within the boundary electrodes of the DTV). Again, the interior heating zone that can be expected to reach boiling temperatures is inset about half an electrode spacing.

The above discussion focused on the areal dimension in plan view. The vertical dimension also has an inset on each end (top and bottom) equivalent to vertical inset equal to S/4 (= 4ft.) off the bottom and from the top of the terminal graphite columns in each borehole. These dimensions vary for each treatment zone based on the depths of desired treatment. Therefore, electrodes at 16 ft spacing, with graphite from for instance 6 to 80 ft bgs, would be expected to heat to boiling the region from 10 ft bgs to 76 ft bgs. The shallowest performance thermocouple (TC) in that case would be at 10 ft bgs and the deepest at 75 ft bgs, since TCs are on a 5 ft. vertical spacing. Shallower and deeper TCs would not be tied to performance; however, they would be monitored to assess the degree of treatment that may be expected.

As a result of these conditions, the temperature performance objectives are expected to be met in the interior portions (as defined above) of each treatment volume for each Campaign. Since the vast majority of the contaminant mass is removed at the initiation of boiling (see Appendix A, p. 9, Projected Treatment Performance and p. 8, Estimated Subsurface Energy Distribution for each model), it is expected that the primary objective of removing COC mass from the soils in a cost effective manner will be met and that each Zone will be heated until diminishing returns are observed. Modeling indicates that diminishing returns may be met once steam generation peaks at about 100 days when about 95% of the COC mass has been removed. The team will use a weight-of evidence approach, using available monitoring data collected during each campaign, to determine when the point of diminishing returns has been met and adequate treatment has been achieved.

With the limited power available and with the overall objective of removing the greatest mass of COCs from the source area in a reasonable time and within budget, this ISTT design is expected to meet the temperature performance objectives in areas defined above and to move to the next treatment campaign once diminishing returns have been met.

"Target temperatures" are considered as a combination of temperature history and energy input for any portion of the treatment volume.

2.10 Concentration Performance Criteria [Spec. 2182-2.2.6]

In reaching the concentration performance criteria there are two seemingly independent criteria: one for soil and the other for groundwater. These criteria are theoretically correlated, however, DBCP has the highest detected soil concentration (1,000,000 ug/kg in CPT-11 at about 25ft. deep) and the lowest maximum concentration in groundwater of the four COCs (800 ug/l). This difference cannot

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be explained by fate and transport mechanisms alone. In addressing various cost-effective treatment strategies, one must look at the maximum observed concentrations relative to performance criteria to determine the most cost effective approach and timeframe to achieve cleanup. Contaminant mass removal and costs are driven by the maximum concentrations observed at the site for each COC. These relative effects are summarized below:

Table 4: Concentration Criteria and Clean-up Criteria

COC	Max. Soil Concentration (ug/kg) [1]	Soil Cleanup Criteria (ug/kg) [1]	Treatment Efficiency Required	Max. Groundwater Concentration (ug/l) [2]	Groundwater Cleanup Criteria (ug/l) [1]	GW Treatment Efficiency Required
EDB	50,000	2.5	98.995%	50,000	0.05	99.9999%
DCP	90,000	20	99.978%	68,000	5	99.99%
TCP	10,000	2.5	99.975%	1,100	0.5	99.95%
DBCP	1,000,000	10	99.999%	800	0.2	99.98%

Notes: [1] RFP documents; maximum soil concentrations all came from one sample: CPT-11 at 25ft.
[2] Preliminary In-Situ Thermal Treatment Volume, Frontier Fertilizer Site, CH2M HILL Technical Memorandum, February 19, 2009, Figure 9.

A soil cleanup criterion pertains to the vadose zone to 10 feet bgs (ref. Record of Decision, Table 17, Remedial Action Objectives). Required treatment efficiencies and partition coefficients (Henry's constant)) predominately determine the rate limiting factors in meeting soil performance criteria at this site. Degradation rates (hydrolysis) may also play a roll. The most difficult criteria are those for DBCP, which has the lowest partition coefficient and least likely to hydrolyze. Therefore, based on these data, DBCP will be rate limiting with respect to soil cleanup objectives.

In groundwater, a similar effect is expected. While EDB requires the highest level of treatment (99.9999%) in groundwater, it has a partition coefficient that is 5 times higher and a much higher rate of hydrolysis than DBCP; therefore, EDB is expected to clean up faster than DBCP in groundwater. However, EDB has 200 times farther to go to reach cleanup objectives for groundwater ([1-99.98%] / [1-99.9999%] = 200). At the very low clean-up concentrations for EDB, it is difficult to assess the linearity of partition coefficients, soil particle diffusion, etc. Based on these data, the clean-up rate for DBCP or EDB may be controlling in reaching groundwater cleanup standards. Accordingly, modeling of the ISTT process was conducted on these two COCs (Appendix A).

One might assume that treatment to concentration based criteria will be met by simply continuing ERH longer as COC mass is removed at slower and slower rates. However, this assumption is not true for several reasons:

a. It is not cost effective since it requires the maximum amount of energy to be expended in recovering a much smaller amount of mass since contaminants may be slowly desorbed from soil particles, maintaining the groundwater concentrations above cleanup criteria for extended time periods;

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b. The negative groundwater and vapor gradients towards the source area (as required by the RFP) will cause additional contaminants to enter the treatment zone, especially from the highly contaminated area just downgradient of the source area; and

c. Contaminants, in groundwater downgradient of the treatment area and above the cleanup objectives, could potentially migrate back into treatment area.

Because of these factors, it is not cost effective to continue heating until very low cleanup criteria are met, as it requires the maximum amount of energy to be expended to recover a small amount of mass. This approach would be especially unwise at a site where the amount of energy available is limited, such as this site. Thus, the energy to the subsurface will be terminated when diminishing returns are reached, and the existing groundwater capture and treatment system (along with other attenuation process that will be occurring while the subsurface remains at elevated temperatures) is expected to address this remaining contamination.

Accordingly, a flexible operating program seems appropriate to attempt to reach the concentration based cleanup criteria.

2.11 Operational Strategy

Based on the above described limitations of temperature or concentration performance criteria, a combined operational strategy will be used. The approach CES proposes to meet the source area treatment objectives at the Frontier Fertilizer NPL Site is:

1. Install every electrode with SVE/DVE capability.

2. Heat the DTV in six Campaigns with 1 MW service as outlined in Section 2.5 until diminishing returns are observed, which will be further evaluated by the project team through vapor, temperature and groundwater monitoring. This minimizes energy input and maximizes COC extraction/in-situ destruction rate. Based on the high volatility of the COCs, it is expected that about 90% of the COC mass in the vadose zone will be extracted or degraded in about 50 to 110 days (see Appendix A, p. 9 of each model). Also, the upward mobility and recovery of steam and vapors generated in the ERH process are increased as the vadose zone becomes desiccated, so rising steam will help to treat the near surface soils (e.g. 0-4 ft bgs). Note the incremental "lag time" for the shallow soils at 1.5 and 4.5 ft bgs on the graph titled Predicted Subsurface Temperature Trends (Appendix A, p. 8 of each model).

3. As target temperatures (i.e., the boiling point of water or more than 100C)) and energy input are evaluated, these data will be used to optimize power distribution and treatment. Decisions to terminate heating and/or direct heating to the more problematic zones (i.e., areas indicating lower temperatures) will be made by the operations team based on all the available data. This facilitates energy conservation as well as the opportunity for sampling groundwater.

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4. Run the ERH at energy input rates required to maximize mass removal by using multi-level electrodes that can be focused on cold spots and highly contaminated zones.

5. Induce further energy input with the intent of producing more steam in areas of highest concentrations of COCs.

6. Monitor COC extraction rates in vapors to determine when diminishing returns are observed, as determined by the project team. The project team will utilize a "lines of evidence" to determine diminishing returns that will take into account temperatures achieved, initial concentrations of soil, groundwater and vapor and final vapor and groundwater concentrations, mass removed, operating time and other parameters that are deemed appropriate.

7. Utilize “rolling campaign” concept to transition power from clean areas of one treatment zone to begin applying power at adjacent electrode row of next zone or increase power where temperatures are low. For example, when Campaign 1 has reached diminishing returns, transfer power to the closest row of electrodes in Campaign 3, so that the entire zone betweens Campaigns 1 and 3 are heated towards target temperatures to provide treatment to diminishing returns for the entire DTV.

8. Adjust DVE to maintain hydraulic control by monitoring the perimeter monitoring points. After heating stops and extraction rates drop off, focus more aggressive DVE in areas where vapor or groundwater concentrations are high relative to other areas. With the high vapor partition coefficients of the COCs at elevated temperatures, continued reduction in soil and groundwater concentrations is expected and may continue to be cost effective for some time.

3.0 PROTECTION OF HUMAN HEALTH AND ENVIRONMENT

Safety and protection of human health and the environment are critical to CES and the design of ISTT process. CES has developed several plans and specifications that promote safe operations and mitigate risks. These include a Site Heath and Safety Plan, Process Hazard Analysis and Methods to minimize impact to the public and environment.

3.1 Site Heath and Safety Plan *(HASP)*

All CES and CES's subcontractor personnel shall be trained according to OSHA 1910.120 as the requirements relate to the work. All personnel also participate in a medical monitoring program and respirator fit testing program that exceeds the OSHA requirements. A detailed site specific HASP will be prepared for this work as part of the RAMP. Since ISTT is somewhat unique to the remediation industry, CES has developed enhanced HASP procedures specifically regarding electrical safety and for working in hot environments (e.g. steam), and these shall be addressed in detail in the HASP. CES has retained an independent CIH and SSHO from CAPE, Inc. (from offices in Los

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Angeles, San Antonio, Denver, Atlanta, or others) for this project. CES developed an addendum to the existing CH2M HILL Health and Safety Plan that is specifically adapted for ISTT.

3.2 Process Hazard Analysis

As part of the final design CES and CH2M HILL conducted a detailed review of all the process components and the overall ISTT process in a Process Hazard Analysis (PHA). The purpose of the PHA is to identify and evaluate potential causes and consequences of potential failures in the ISTT process system which may result in the accidental release of toxic substances regulated under the Code of Federal Regulations and to identify the safeguards, resources and recommended risk reduction measures. An interdisciplinary team from CES and CH2M HILL performed the ISTT PHA with expertise in electrical, engineering, process and remediation operations. The results of the PHA have been incorporated into this final design.

3.3 Methods to Minimize Impact to Public and Environment [Spec. 01400-1.5.1.A.4]

Control of COCs in the air and groundwater are the primary focus of mitigating risk of exposure to people and the environment. These efforts include control of potential emissions with a robust vacuum extraction system, including backup systems in the event of a power outage. In addition, control of groundwater by maintaining hydraulic gradients around the treatment area will assist in minimizing impact to the public and environment. Furthermore, specification and control of the exclusion zone is critical to minimizing impact to the public. There will be five levels of protection for excluding the public: 1) the perimeter fence around the site, 2) a perimeter fence around the DTV, 3) a motion sensor to detect movement inside the DTV fence, and 4) gate latch that is interlocked to shut down the ISTT if the gate is opened, and 5) cap over most of the ISTT area.

3.3.1 Management of Fugitive Emissions

CES expects no fugitive emissions. The final design includes four methods for vapor and steam capture. They are: 1) primary electrode DVE vents, 2) secondary electrode SVE vents, 3) shallow vents collecting vapors beneath the capped areas, and 4) maintaining vacuum on all process lines through capture on VPGAC. In addition, the steam and vapor treatment process design minimized the potential of fugitive emission by the following methods:

- Heavy duty synthetic cap sealed over the areas where COC have been detected near the surface to contain any vapors rising up to the surface as a result of the ISTT process.
- VPGAC adsorption on the inlet of the VEU, thereby maintaining all contaminants under vacuum, and preventing any pressurized contaminants. If any leaks occur in the process piping, only fresh air can enter the process, and nothing escapes.
- Continuous vacuum measurements of vacuum in vapor manifolds at the skid.
- Routine and customary background air quality checks with hand held photoionization detector (PID) (see CH2MHILL Air Monitoring Plan for details of validation air sampling).
- Back-up generator, which automatically switches on to operate the spare VEU if site power is lost.

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- 200% redundancy on all carbon adsorption systems to provide complete backup on line at all times in the event of a breakthrough in the primary carbon system.

3.3.2 Monitoring Offsite Migration

The objective of CES's unique design and operating protocols is to mitigate any migration of contaminants outside the treatment area. A thorough monitoring program shall confirm this and indicate any potential problem areas that might require operational adjustments. The monitoring program includes:

a) Temperature Monitoring Wells (TMWs) within the treatment area (automatic to PLC),
b) TMWs at the perimeter of the treatment area (automatic to PLC), and
c) Subsurface pressure monitoring at the VMPs (manual).

An important element of CES's ERH system to help mitigate off-site migration is the flexibility to control groundwater and steam migration through DVE. Since CES's electrodes double as DVE wells, the electrodes will be screened and used to intercept and capture steam and contaminant vapors generated by heating. Screening the entire electrode interval will take advantage of the secondary porosity layers throughout the treatment volume to capture rising steam.

3.3.3 Waste Minimization

To further minimize the impact of operations on the environment CES has adopted several activities into its design and operations:

1) Water reuse: sprinkler irrigation for dust control/evaporation.
2) Water reuse: Recycle as source water for cooling tower/drip skids.
3) Decontamination water and development water will be placed in a poly tank to be treated through the water treatment system at a later date, to minimize offsite transport and disposal.
4) Carbon: reactivate (offsite at a licensed resource Recovery facility- e.g. Siemens) and reuse, if necessary, on site.
5) Soil cuttings will be placed in bins, sampled and disposal decision will be made in coordination with EPA and DTSC. One option could be onsite spreading in an area of known surface contamination that will be covered with a heavy duty synthetic liner and treated as part of the ISTT process.

3.4 Design Safety

Several safety features are designed into the ISTT system by CES and are summarized below.

3.4.1 Interlocks

Numerous and redundant safety interlocks consisting of both physical and software programmable logic controllers shall provide safety and security for protection of human health and the environment. There are seven redundant safety measures in CES's ERH systems:

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1) 1200 Ampere Breaker - Physical disconnect located on main feed of each output transformer, a physical breaker would trip if current exceeds this value.

2) 1200 Ampere Fused Disconnect - Physical fuses in each disconnect circuit that would blow if output power exceeds 1200 Amperes on any given leg of the 3-phase power.

3) 1000 Ampere over current limit: Set at 83% of the breaker limits above, this software will trip the output Silica Control Relays (SCRs) that send power to the electrode field.

4) Tap-Specific Current Limit on Transformer Secondary: The main transformers that send power to the electrodes have several physical "taps" for voltage range controls. Each of these taps has their own safety overloads on the secondary windings.

5) Power Range Adjustable SCRs: The SCRs themselves have adjustable power ranges that are set well below the 1000 ampere current limit mentioned in #3 above.

6) Average Current Adjustable Limits on Silica Control Rectifiers (SCRs): The SCRs are programmed to shut down power to the electrodes if the "average" current varies excessively.

7) Individual Cable Current Limits: CES' software has the capability to monitor the current through every electrode cable by using a set of current transducers (CTs). Programmed to National Electrode Codes (NEC), this software will shut-down the PSU if any individual electric cable exceeds the maximum amperage specified by the NEC for any given cable size.

In addition to the ERH system shutdowns, several other process and safety interlock circuits and instrumentation will be provided to remove electrode power in the event of:

- The exclusion area access gate being opened.
- Motion sensors inside the DTV fence are tripped.
- High temperature or over amperage of the SVE blower.
- Failure of the condensate collection system (because of a full condensate collection tank or failure of the condensate transfer pump).
- Over-pressure condition in primary SVE manifold, indicating a loss of vacuum.
- Hi-Hi Level in air/water separator tank, holding tank and settling tank.
- One-push Emergency stop safety-switch at entrance to treatment area.
- Backup generator, automatically actuated, controls a separate SVE blower in event of power outage.

Combined, these safety features make CES's ERH system extremely safe and reliable. If the system shuts down for any reason, there is an auto-dial feature that will call whoever is on call at the time and the system can be trouble shot remotely. If not responded to quickly, it will continue to call others on the call list. Three CES personnel are available within one hour of the site to respond to shut-down situations that require an on-site adjustment or repair prior to restart.

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3.4.2 Hydraulic Control

CES will primarily use DVE on the perimeter electrodes of the volume being treated in a given treatment campaign to maintain hydraulic control groundwater in the DTV. Although the buoyancy effects of hot vapors and steam would generally cause them to rise vertically where they can be captured by the vapor capture systems, complex lithologies can trap this steam and vapors beneath lower permeable lenses causing them to migrate laterally as opposed to vertically. Field experience at several sites has proven that even a nominal amount of groundwater extraction by DVE can effectively control the soil pore pressure.

In addition, there are several groundwater pumping wells just downgradient of the DTV that will continue to pump groundwater and control migration of COCs from the DTV. Based on data from the site characterization work in late 2008, the wells influence the entire DTV area in the lower water-bearing zone (S-2 wells) since the water table in the S-2 wells were substantially lower than the S-1 wells and responded to extraction wells being turned off and on again. Therefore, a significant degree of hydraulic control will be achieved by continuing pumping of these existing wells during the ISTT process.

3.4.3 Condensate Control

Extracted steam and vapor will be processed through two vapor/liquid/solid separators and then pass through the condensing unit. From there, the condensate is pumped to a holding tank pending treatment through Liquid Phase Granular Activated Carbon (LPGAC) followed by analytical sampling (for discharge compliance by applicable permit conditions), and then shall be pumped to the sanitary sewer or reused in the process.

3.4.4 Air Pollution Control

Once through the condenser skid, the contaminant-laden vapors will be treated with vapor phase granular activated carbon (VPGAC). CES's design shall place the VPGAC on the *inlet* side of the vacuum blower. This configuration has been used successfully at more than 2,000 SVE sites worldwide, and carbon adsorption efficiencies under this configuration have been shown to be at least as good, if not greater, than designs that place the carbon on the outlet of the SVE unit (e.g. 10% – 20%). There is an important safety advantage with this design. If there are any leaks that develop in the SVE manifold(s), the entire system is under vacuum, so only fresh air can enter the system while no discharge of contaminated vapors is possible. VPGAC treatment after the VEU is done under pressure, and hence, there is always the risk that a failed fitting, valve or other pressure failure in the manifold will result in contaminated vapors escaping to the atmosphere. Also, the heat generated as vapors pass through the blower raises the temperature of the vapor, which reduces carbon efficiencies.

The VPGAC treatment system will consist of primary, secondary and tertiary treatment units with a vapor monitoring port between the units. The primary carbon vessels are sized sufficiently to remove 100% of the expected mass of COCs generated within a treatment campaign. There is also a 100% backup system on line during the treatment process to capture any vapors that might break through the primary carbon due to some upset condition or saturation is reached earlier than expected. In addition, another 100% backup is provided in line with the tertiary carbon unit. This will provide

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effective monitoring and response in the event extracted mass of COCs is much greater than anticipated, while providing 200% backup for capture of COCs. When, and if, the primary vessel(s) are spent, the secondary vessel(s) shall be moved to the primary position and fresh VPGAC will be placed in the secondary position. Sufficient spare carbon vessels shall be maintained on site for rapid changes. This configuration is designed so that no contaminant-laden vapors reach the VEU. Spent carbon shall be sent for reactivation or disposal at a site in compliance with the CERCLA Offsite Rule. Certificates of destruction will be obtained to verify destruction of COCs and reuse of carbon at this site. Breakthrough for the primary VPGAC vessels will be determined by on-site vapor sampling between the primary and secondary vessels. The SVE and DVE wells and cap vent system along with the GAC vapor phase treatment system, provide an effective vapor control system.

3.4.5 SVE Backup System

An additional safety factor, common only to CES's operations, is the back-up SVE system. A diesel generator (25KW) will power the emergency backup SVE system. An interlock in the power control system will automatically start the generator and back-up SVE system if site power is lost or the primary SVE unit shuts down for any reason. Hence, there should be no loss in SVE operations for any reason throughout the project.

The safety back-up SVE system will be a 10 horsepower rotary-lobe vacuum blower capable of 200 CFM at 15 in Hg and will be placed in noise attenuating cabinet. This safety SVE blower will automatically start on generator power should site power be lost or if the primary blower shuts down.

4.0 ISTT DESIGN SPECIFICATIONS

[Spec. 01400-1.5.1C and D]

This design document addresses two stages of design: Intermediate (60%) design and Final (90%) design. Details applicable to each are described in the next two sections.

4.1 Intermediate Design Specifications

Intermediate design specifications, which are incorporated into this final design, include ISTT system specifications and drawings and identification of long lead-time equipment. This section addresses these items.

4.1.1 ISTT System Specifications

ISTT system specifications include construction, installation, site preparation and field work standards and equipment startup and operator training plans. These specifications are incorporated in this Final Design Plan, Site Management Plan, Waste Management Plan, Environmental Protection Plan and the Operations and Maintenance Plan.

4.1.2 ISTT System Drawings

The ISTT System Drawings are part of this Final Design Document and includes:

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Figure 1: Designated Treatment Volume (DTV)
Figures 3A to 3D: Electrode Detail: Zones 1 through 4
Figures 4A to 4C: Electrode Detail: Zones 5 through 7
Figure 5: Electrode Layout
Figure 6: Thermowell Detail: Zones 1 through 4
Figure 7: Thermowell Detail: Zones 5 through 7
Figure 8A: Cap Layout
Figure 8B: Cap and Air Inlet Detail
Figure 9: Process and Instrumentation Diagram
Figure 10: Wellhead Detail
Figure 11: Piping Layout -- Zone 1
Figure 12: Treatment Campaigns
Figure 13: Equipment Layout
Figure 14: Utility Location Plan
Figure 15: Electrical One-Line
Figure 16: Fence Construction Details

4.1.3 Long Lead-time Items for Scheduling

Long lead-time items include those that are either not in CES stock, readily available from vendors or equipment or materials that would take more than three months to have operable on site after notice to proceed for the installation and startup phase of the remediation. Long lead-time items include:

- Power Drop to site by local utility (estimated 6 months from application and submittal of drawings, which is already in process).
- Power Supply (16 weeks) if not available in CES stock (currently there is a 750KW Power Supply Unit available in CES stock); however, delays in this project and acceleration of others, may change that condition, depending upon timing of approval of installation and startup phases of the work.
- Output transformer(s) (14 weeks), if not available in stock.

4.2 Final Design Specifications

This Final Design incorporates the standards requested in Section 1400-1.5.1 Design Content, including:

- Nature and type of ISTT to be implemented (see Section 2),
- Size, capacity and layout of the surface and subsurface ISTT system components (see Section 2 and Appendix A),
- Energy sources and supply systems (see Sections 2.13, 2.2, 2.5, 2.6, 2.8),
- Energy conservation features (see Sections 2.13, 2.5, 2.11).
- Strategies and technologies used to optimize treatment efficiency (see Section 2.11),
- Temperature monitoring point completion details (see Figures 6 and 7),
- Well completion details (see Figures 3, 4, 6, 7, 10 and Appendix B),
- Equipment specifications (see Operations and Maintenance Plan),
- Waste material storage specifications (see Waste Management Plan),

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- Excavation, grading and boring specifications (there is no grading proposed, excavation is described in the Site Management Plan, and boring specifications are shown Figures 3, 4, 6, 7),
- Type and quantity of equipment to be used (see Section 2.3), and
- Utility connection (see Figure 14).

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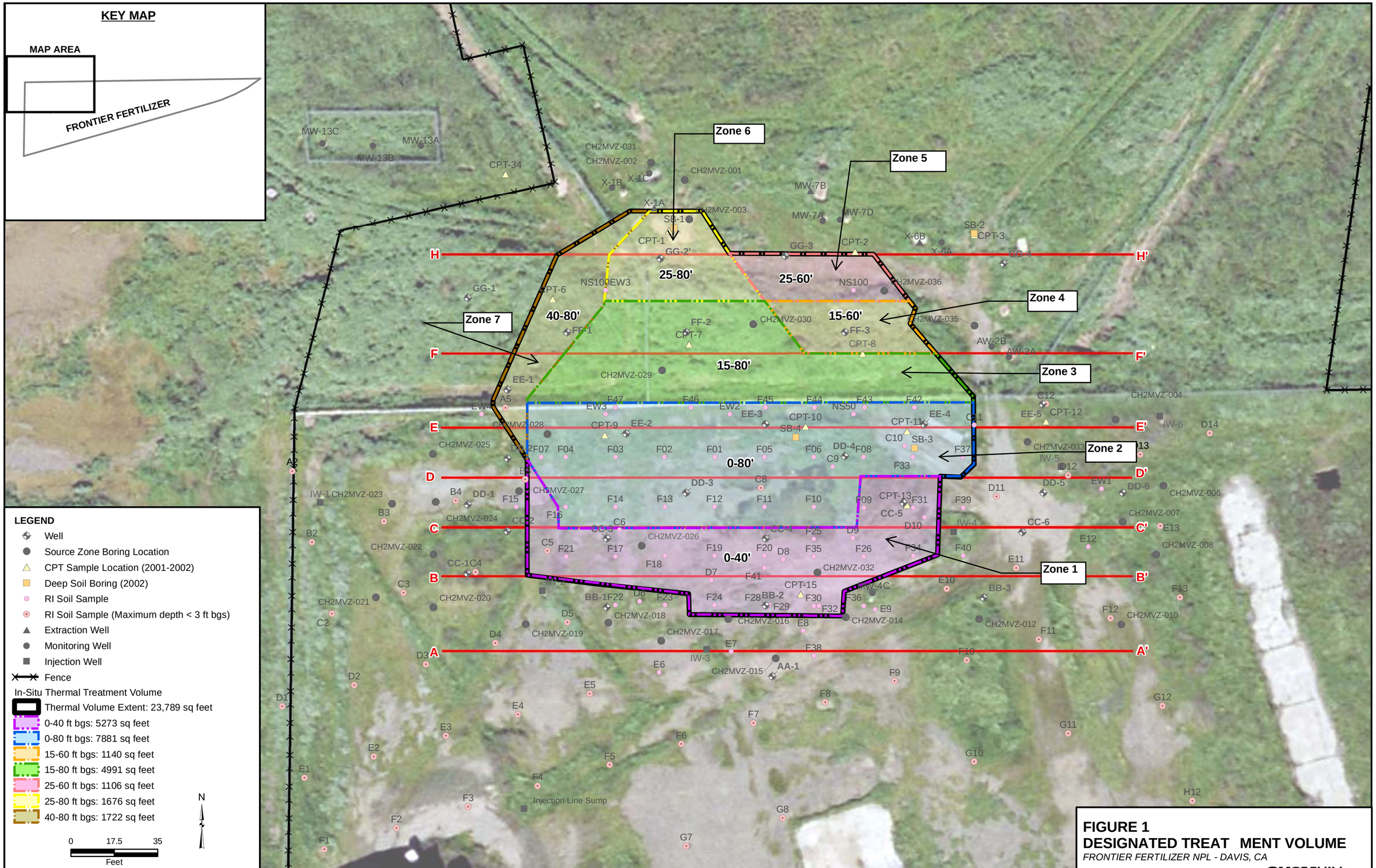


FIGURE 1
DESIGNATED TREAT MENT VOLUME
FRONTIER FERTILIZER NPL - DAVIS, CA

CH2MHILL

\\ZION\SACGIS\SACGIS\FRONTIER\MXD\TECH_MEMO_FIGURES\FIG10_IN-SITU_THERMALTREATMENTVOLUME.MXD SSCOPES 2/13/2009 15:55:38

Figure 2 Soil Profile and USDA Classification

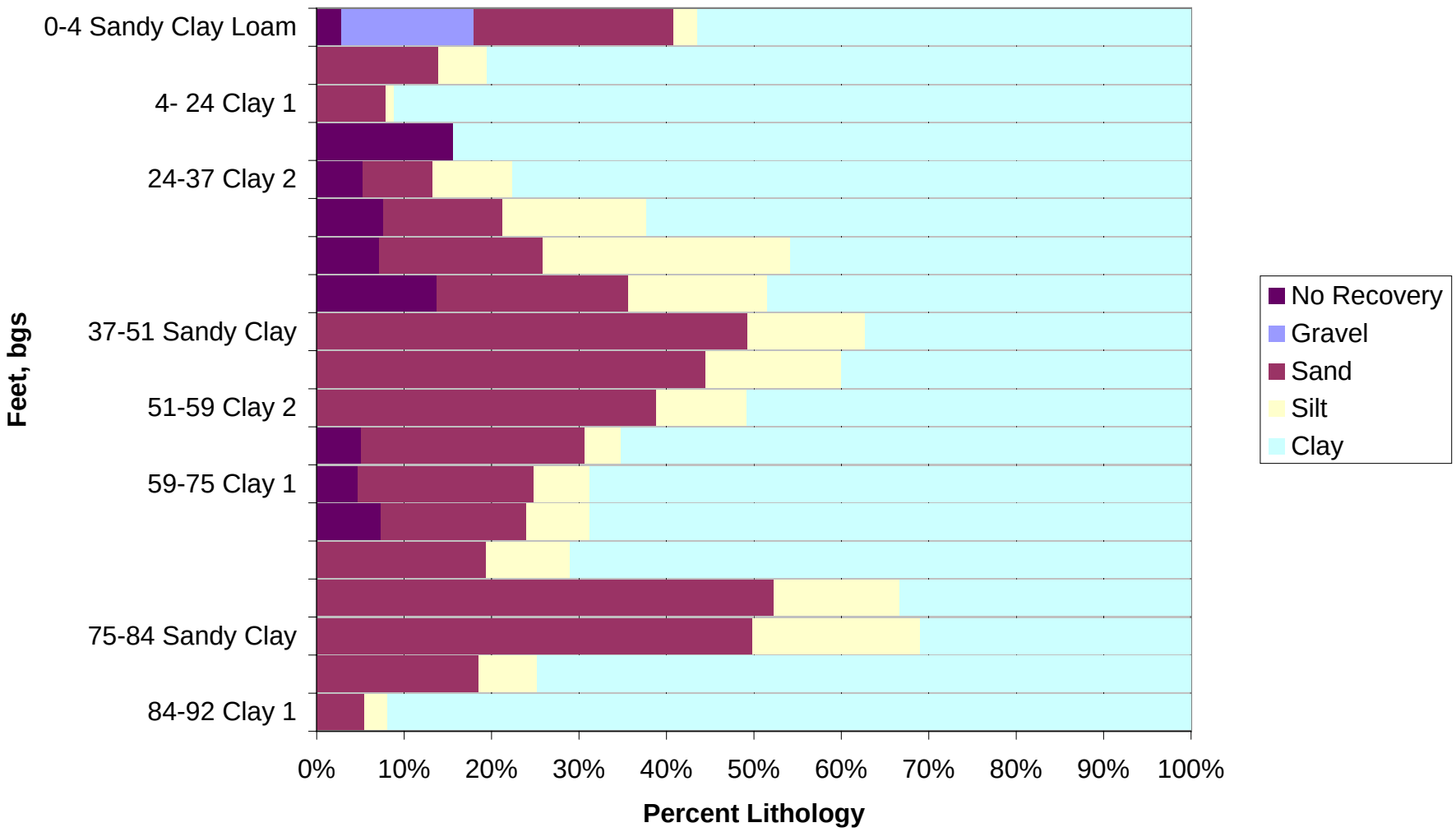


Figure 2- Data References

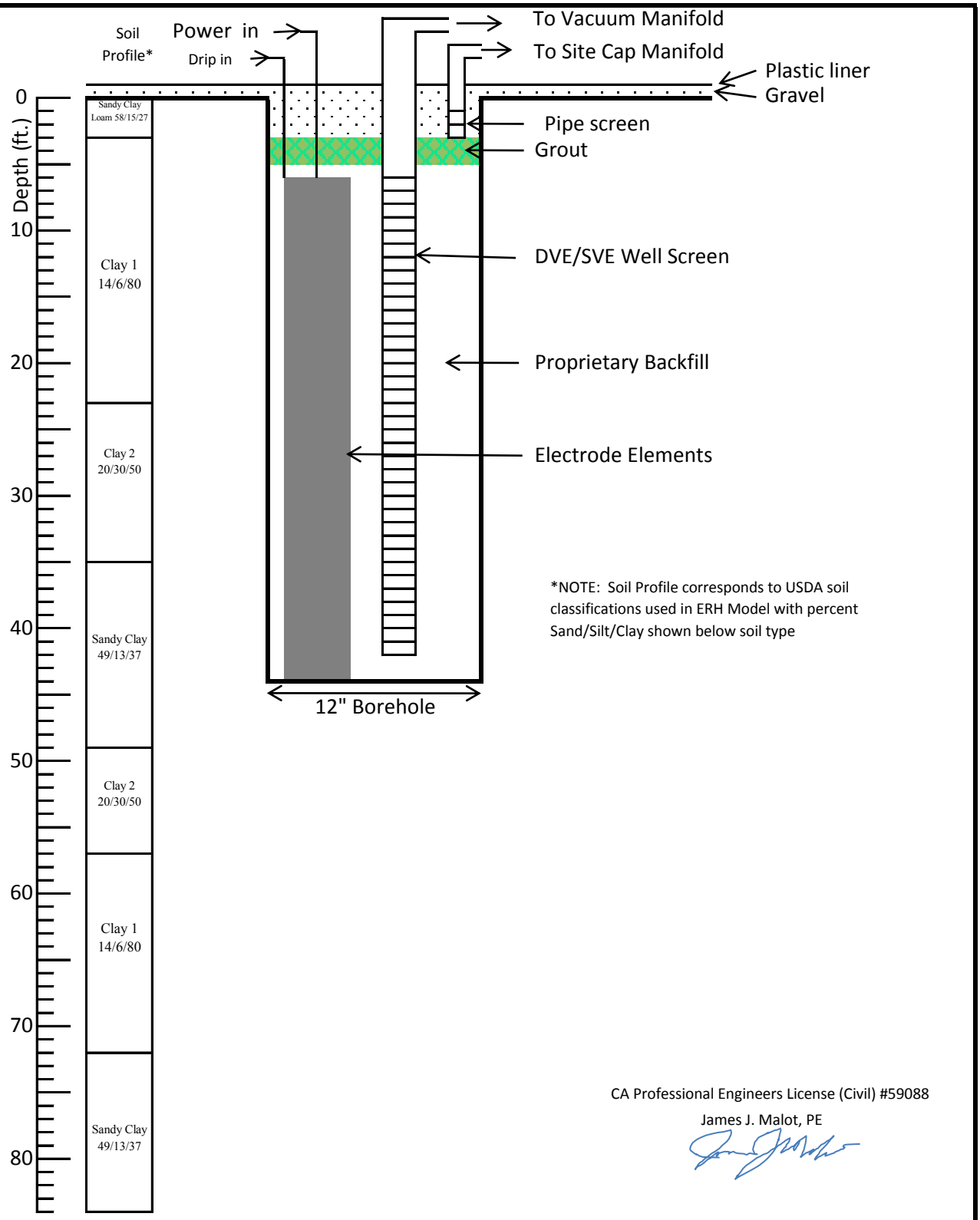
Percent Lith by Elevation

Elevation, msl	Feet, bgs	Gravel	Sand	Silt	Clay	No Recovery
30	**0**	15.2%	22.9%	2.7%	56.5%	2.8%
25	**-5**	0.0%	13.9%	5.6%	80.6%	0.0%
20	**-10**	0.0%	7.9%	0.9%	91.2%	0.0%
15	**-15**	0.0%	0.0%	0.0%	84.4%	15.7%
10	**-20**	0.0%	8.0%	9.1%	77.6%	5.3%
5	**-25**	0.0%	13.6%	16.5%	62.3%	7.6%
0	**-30**	0.0%	18.7%	28.2%	45.9%	7.2%
-5	**-35**	0.0%	21.9%	15.9%	48.5%	13.8%
-10	**-40**	0.0%	49.3%	13.4%	37.3%	0.0%
-15	**-45**	0.0%	44.5%	15.5%	40.1%	0.0%
-20	**-50**	0.0%	38.8%	10.4%	50.8%	0.0%
-25	**-55**	0.0%	25.5%	4.2%	65.2%	5.2%
-30	**-60**	0.0%	20.2%	6.3%	68.8%	4.7%
-35	**-65**	0.0%	16.6%	7.2%	68.8%	7.4%
-40	**-70**	0.0%	19.4%	9.6%	71.0%	0.0%
-45	**-75**	0.0%	52.3%	14.3%	33.4%	0.0%
-50	**-80**	0.0%	49.9%	19.1%	31.0%	0.0%
-55	**-85**	0.0%	18.5%	6.7%	74.8%	0.0%
-60	**-90**	0.0%	5.5%	2.6%	92.0%	0.0%

Source document: K Estimate Results, CH2MHILL, email from P. Seday, March 2, 2009

USDA Soil Textural Classifications used for CES modelling

Soil Type	%	%	%
Gravel	**100**	**0**	**0**
Sand	**92**	**5**	**3**
Loamy Sand	**82**	**12**	**6**
Sandy Loam	**58**	**32**	**10**
Silty Loam	**17**	**70**	**13**
Silt	**10**	**85**	**5**
Loam	**43**	**39**	**18**
Sandy Clay Loam	**58**	**15**	**27**
Silty Clay Loam	**10**	**56**	**34**
Clay Loam	**32**	**34**	**34**
Sandy Clay	**49.3**	**13.4**	**37.3**
Silty Clay	**6**	**47**	**47**
Clay	**13.9**	**5.6**	**80.6**
Dense Clay	**0**	**0**	**100**
Bedrock	**10**	**80**	**10**
Clay2	**20**	**30**	**50**



*NOTE: Soil Profile corresponds to USDA soil classifications used in ERH Model with percent Sand/Silt/Clay shown below soil type

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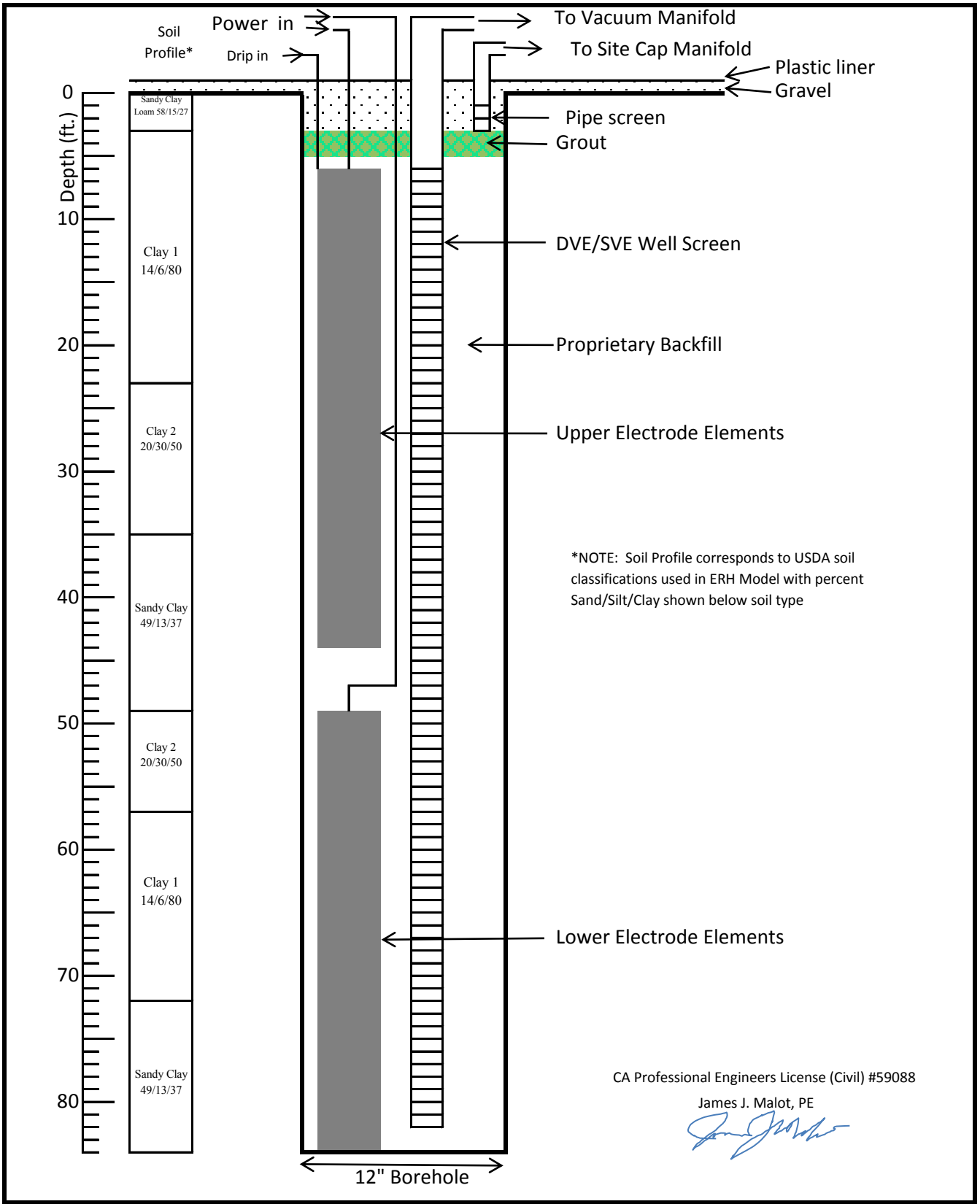
CURRENT ENVIRONMENTAL SOLUTIONS	CH2M HILL Contract: EP-S9-08-04 Task Order 0002 CH2M HILL Project: 384211.FD.01	Scale: NTS Date: 6/25/09 Drawn by: JM Checked by: TD	ELECTRODE -- ZONE 1 ISTT, FRONTIER FERTILIZER NPL	Project 78-0033 **Figure 3A**



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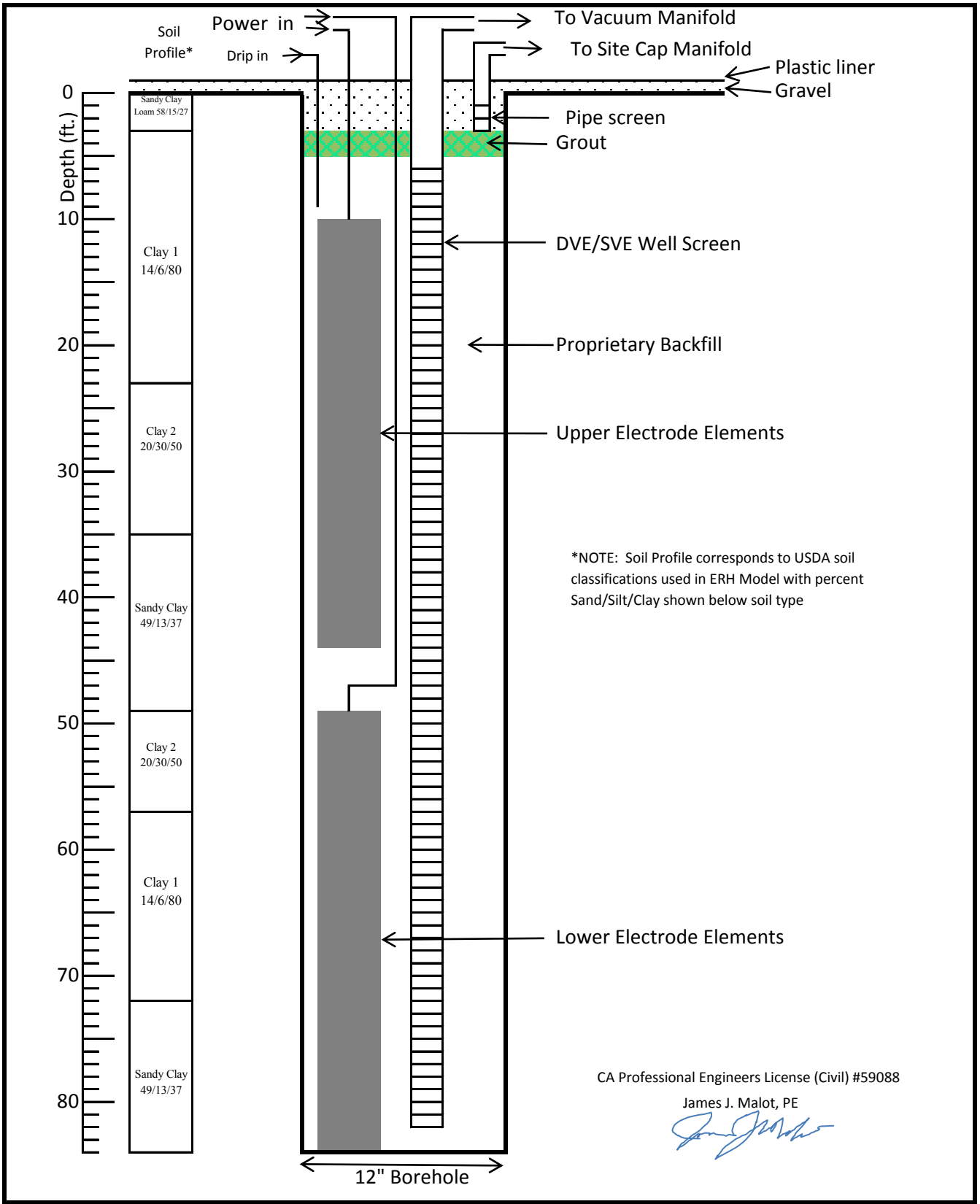

*NOTE: Soil Profile corresponds to USDA soil classifications used in ERH Model with percent Sand/Silt/Clay shown below soil type

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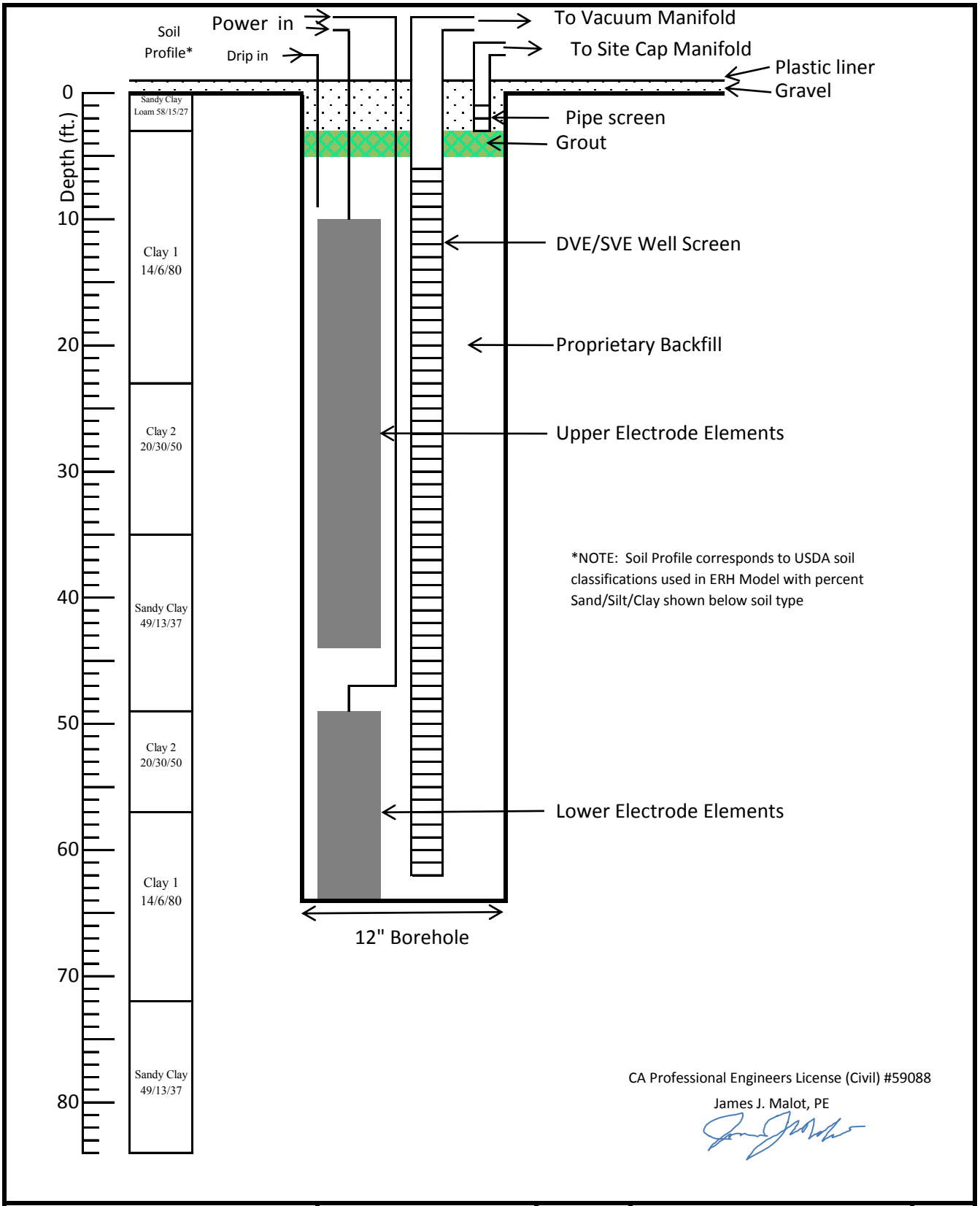

*NOTE: Soil Profile corresponds to USDA soil classifications used in ERH Model with percent Sand/Silt/Clay shown below soil type

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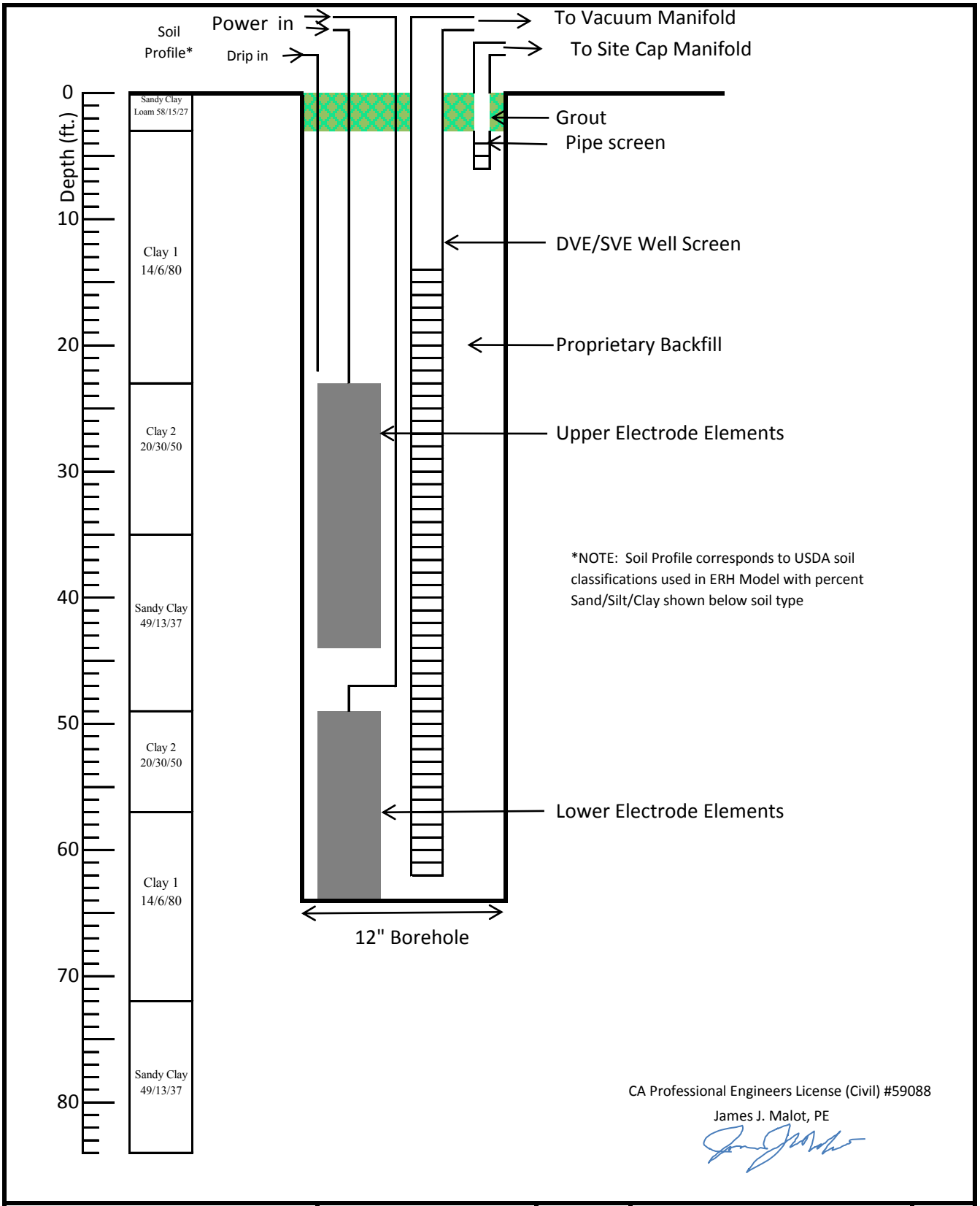

*NOTE: Soil Profile corresponds to USDA soil classifications used in ERH Model with percent Sand/Silt/Clay shown below soil type

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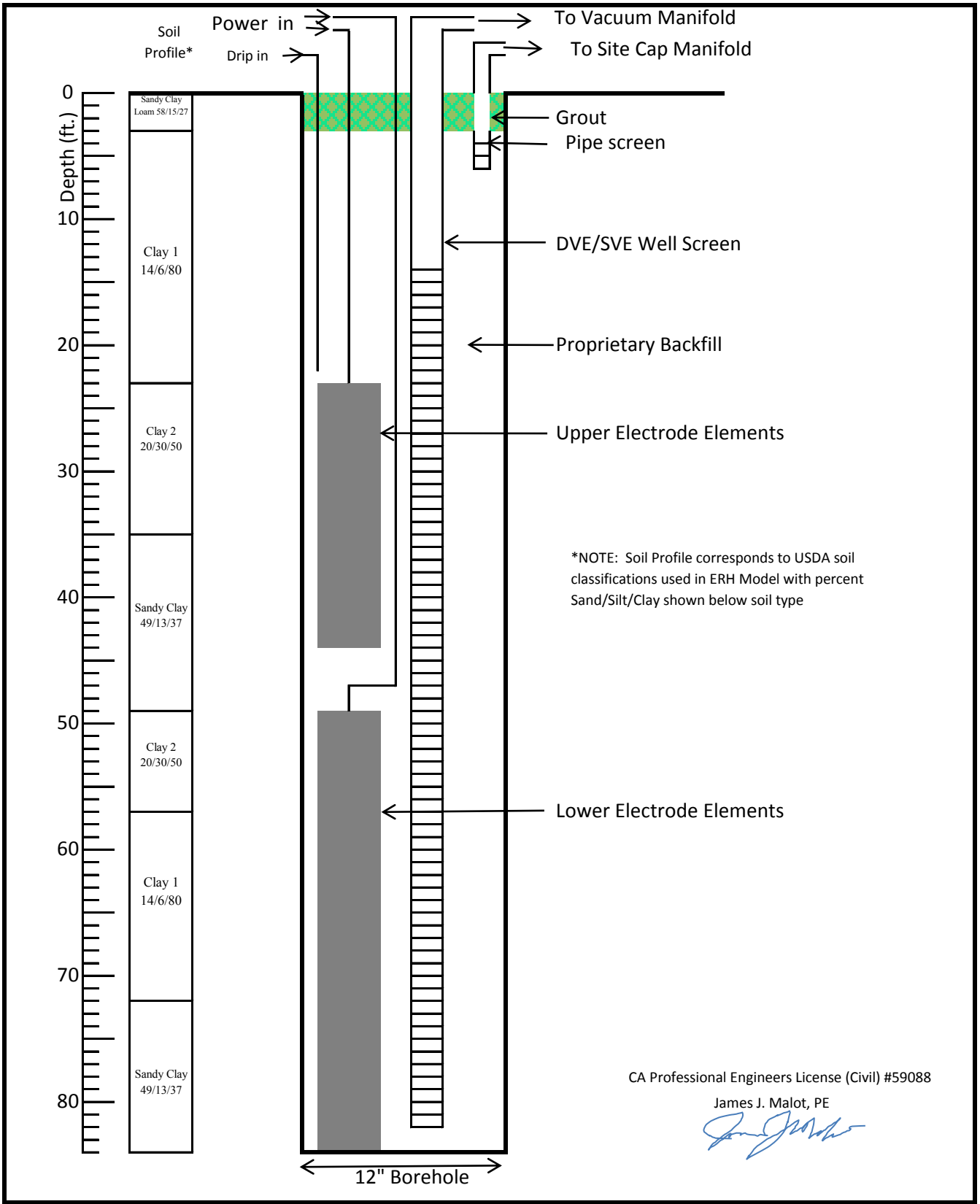

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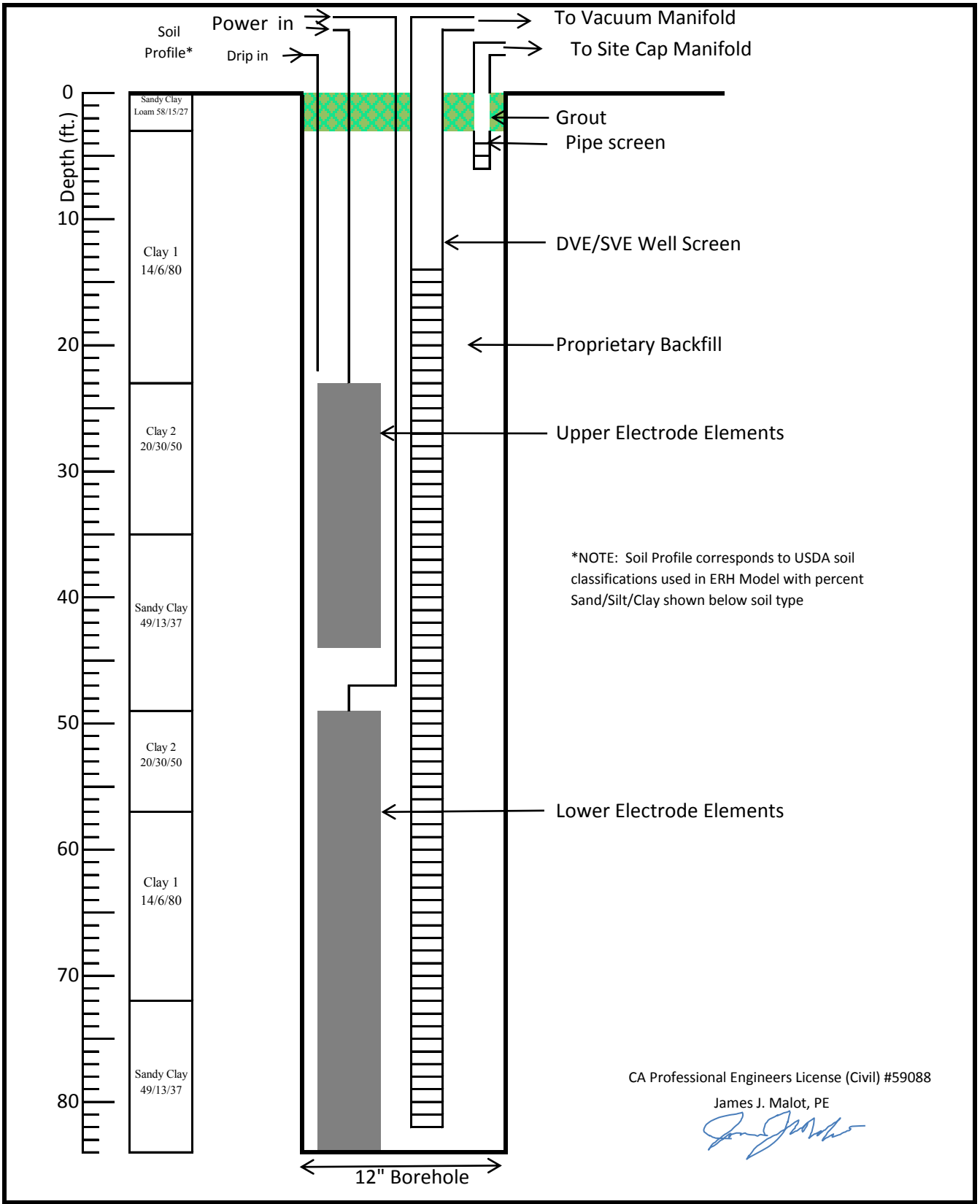

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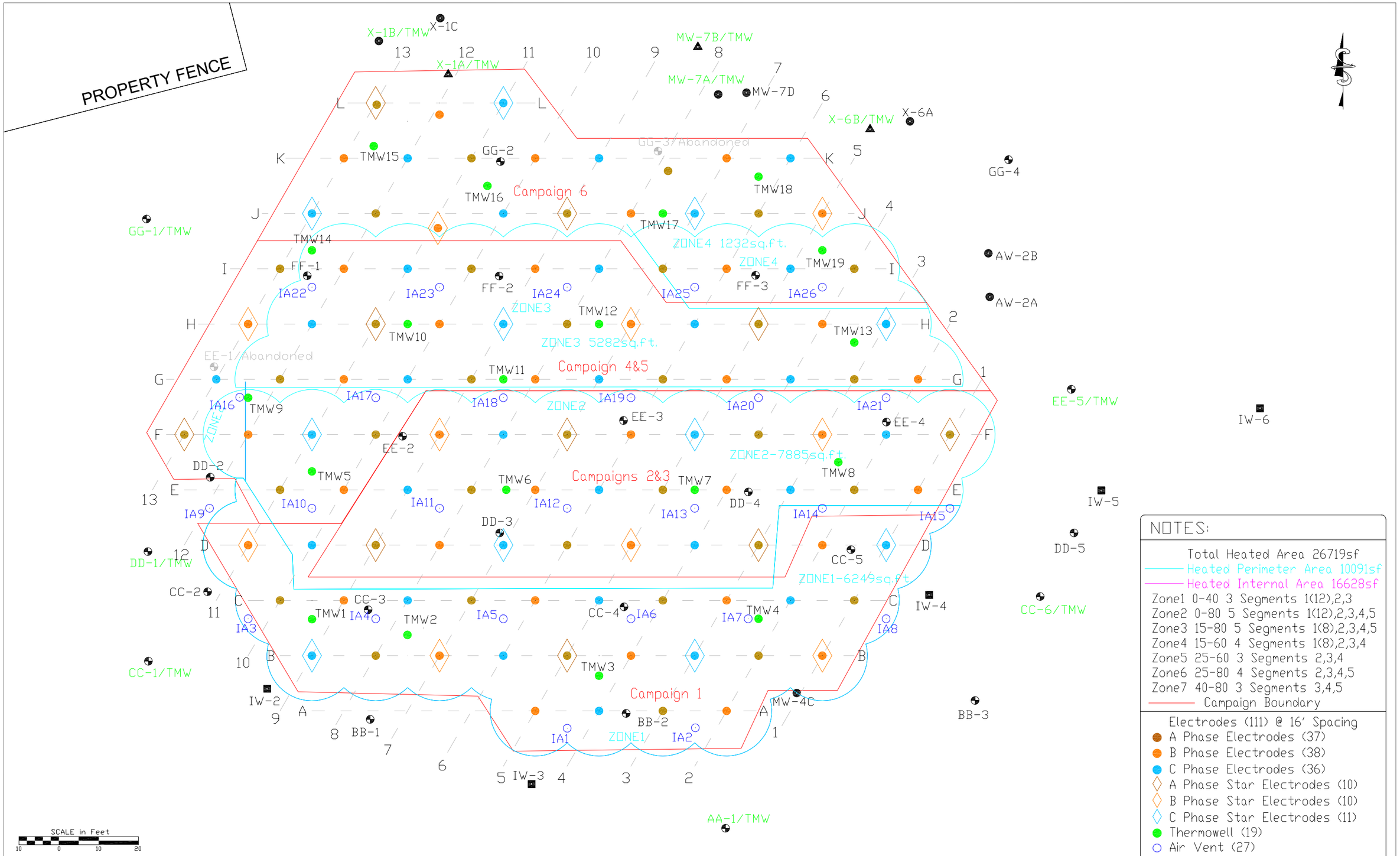

NOTES:

Total Heated Area 26719sf
Heated Perimeter Area 10091sf
Heated Internal Area 16628sf
Zone1 0-40 3 Segments 1(12),2,3
Zone2 0-80 5 Segments 1(12),2,3,4,5
Zone3 15-80 5 Segments 1(8),2,3,4,5
Zone4 15-60 4 Segments 1(8),2,3,4
Zone5 25-60 3 Segments 2,3,4
Zone6 25-80 4 Segments 2,3,4,5
Zone7 40-80 3 Segments 3,4,5
Campaign Boundary

Electrodes (111) @ 16' Spacing
A Phase Electrodes (37)
B Phase Electrodes (38)
C Phase Electrodes (36)
A Phase Star Electrodes (10)
B Phase Star Electrodes (10)
C Phase Star Electrodes (11)
Thermowell (19)
Air Vent (27)

CURRENT ENVIRONMENTAL SOLUTIONS

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Designed By: William Heath
Approved By: Jim Wood PE
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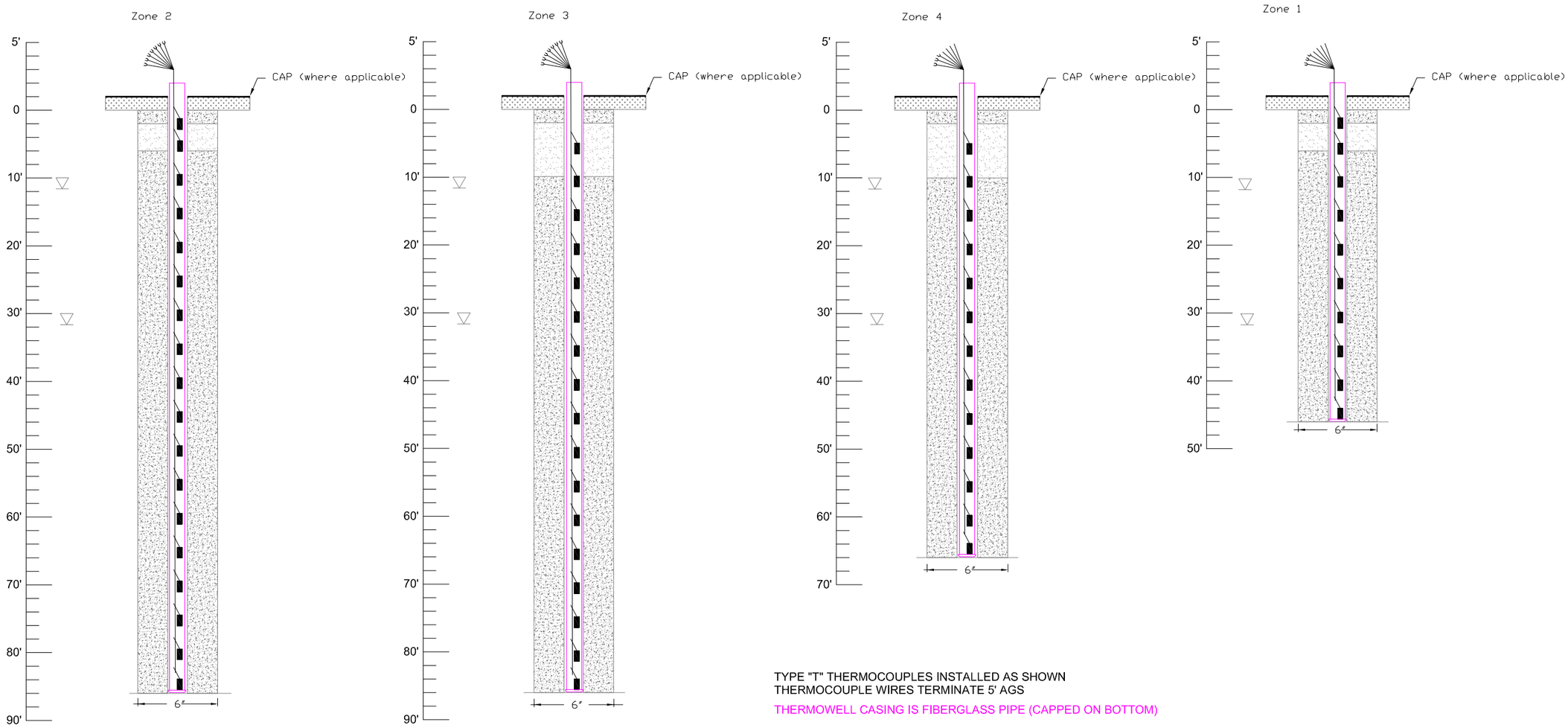
ELECTRODE LAYOUT

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 5

THERMOWELL DETAIL
ZONES 1-4 (TYPICAL)



TYPE "T" THERMOCOUPLES INSTALLED AS SHOWN
THERMOCOUPLE WIRES TERMINATE 5' AGS

THERMOWELL CASING IS FIBERGLASS PIPE (CAPPED ON BOTTOM)

GROUT - FROM GRADE TO DEPTH AS SHOWN
- FROM BELOW GRADE TO DEPTH AS SHOWN

FINE CLEAN SAND FROM 2' TO DEPTH AS SHOWN

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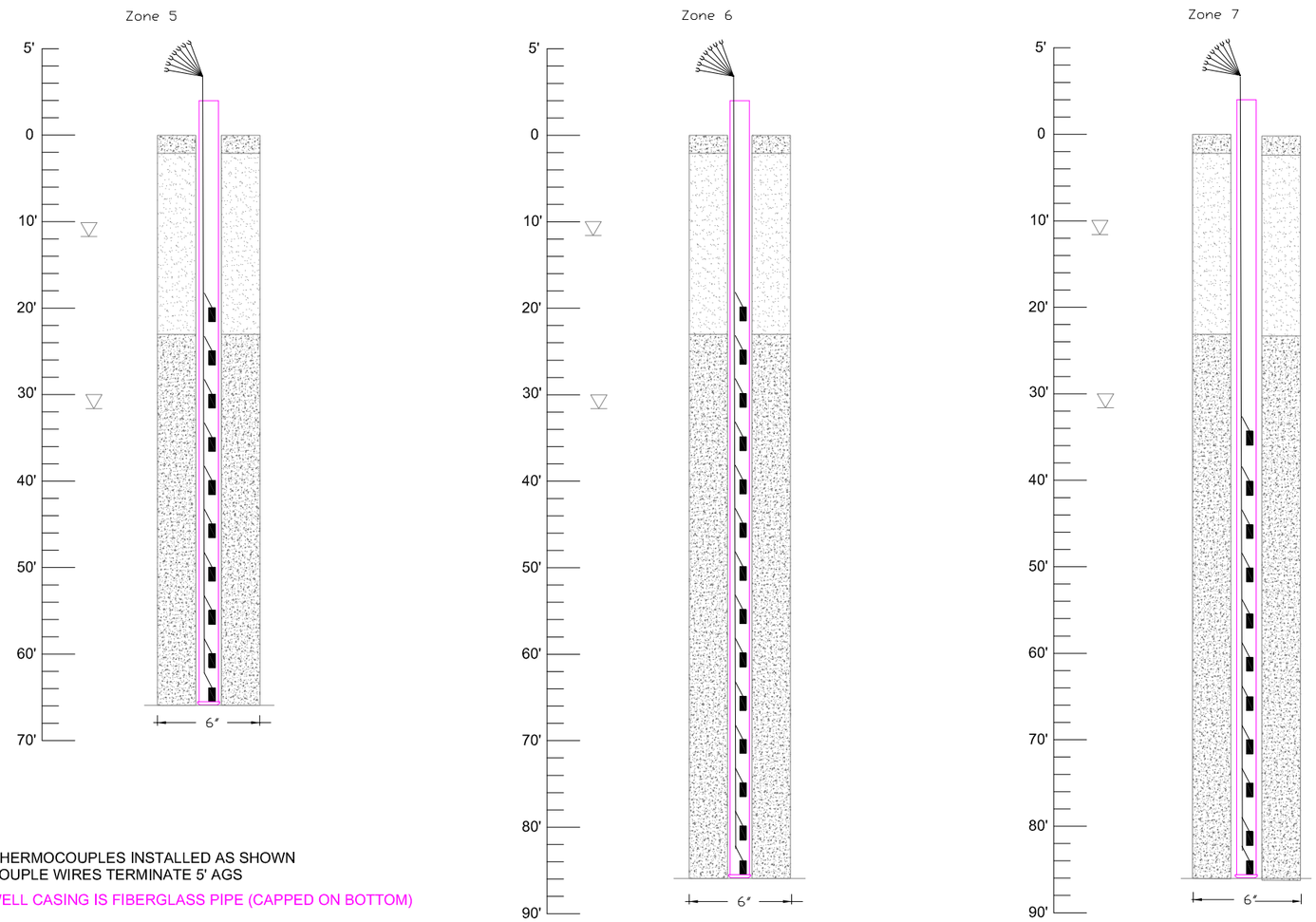
THERMOWELL DETAIL ZONES 1-4

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 6

THERMOWELL DETAIL
ZONES 5-7 (TYPICAL)



TYPE "T" THERMOCOUPLES INSTALLED AS SHOWN
THERMOCOUPLE WIRES TERMINATE 5' AGS

THERMOWELL CASING IS FIBERGLASS PIPE (CAPPED ON BOTTOM)

GROUT - FROM GRADE TO 2' AS SHOWN
- FROM 23' TO DEPTH AS SHOWN

FINE CLEAN SAND - FROM 2' TO 23' AS SHOWN

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THERMOWELL DETAIL ZONES 5-7

ISTT, FRONTIER FERTILIZER NPL SITE

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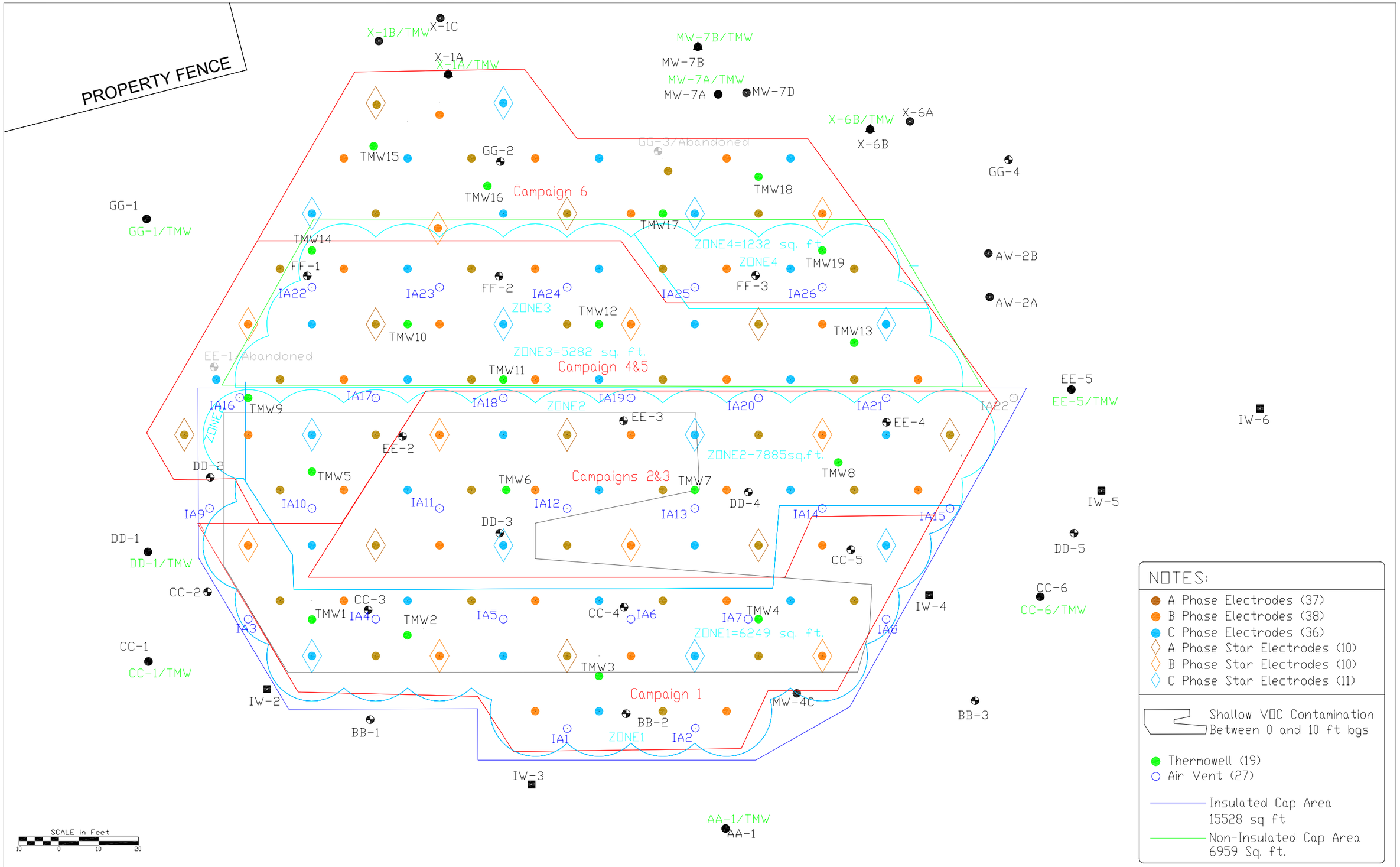
Figure# 7



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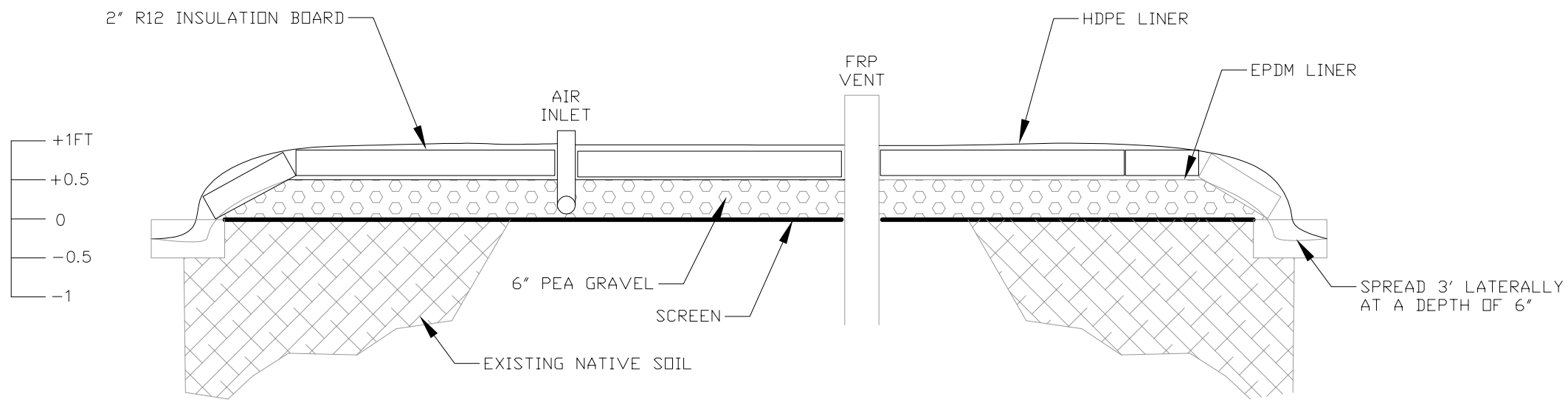
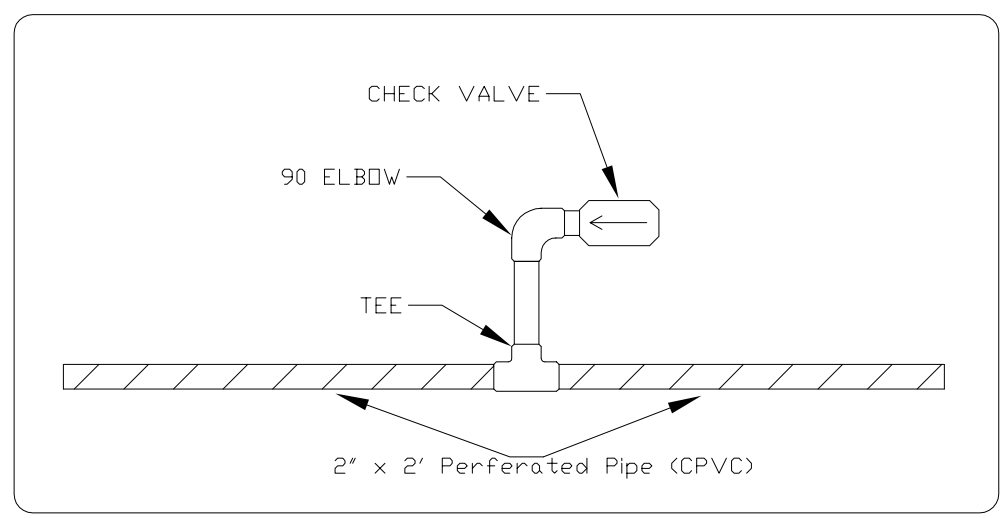
CAP LAYOUT

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 8A





AIR INLET DETAIL
(SIDE VIEW)

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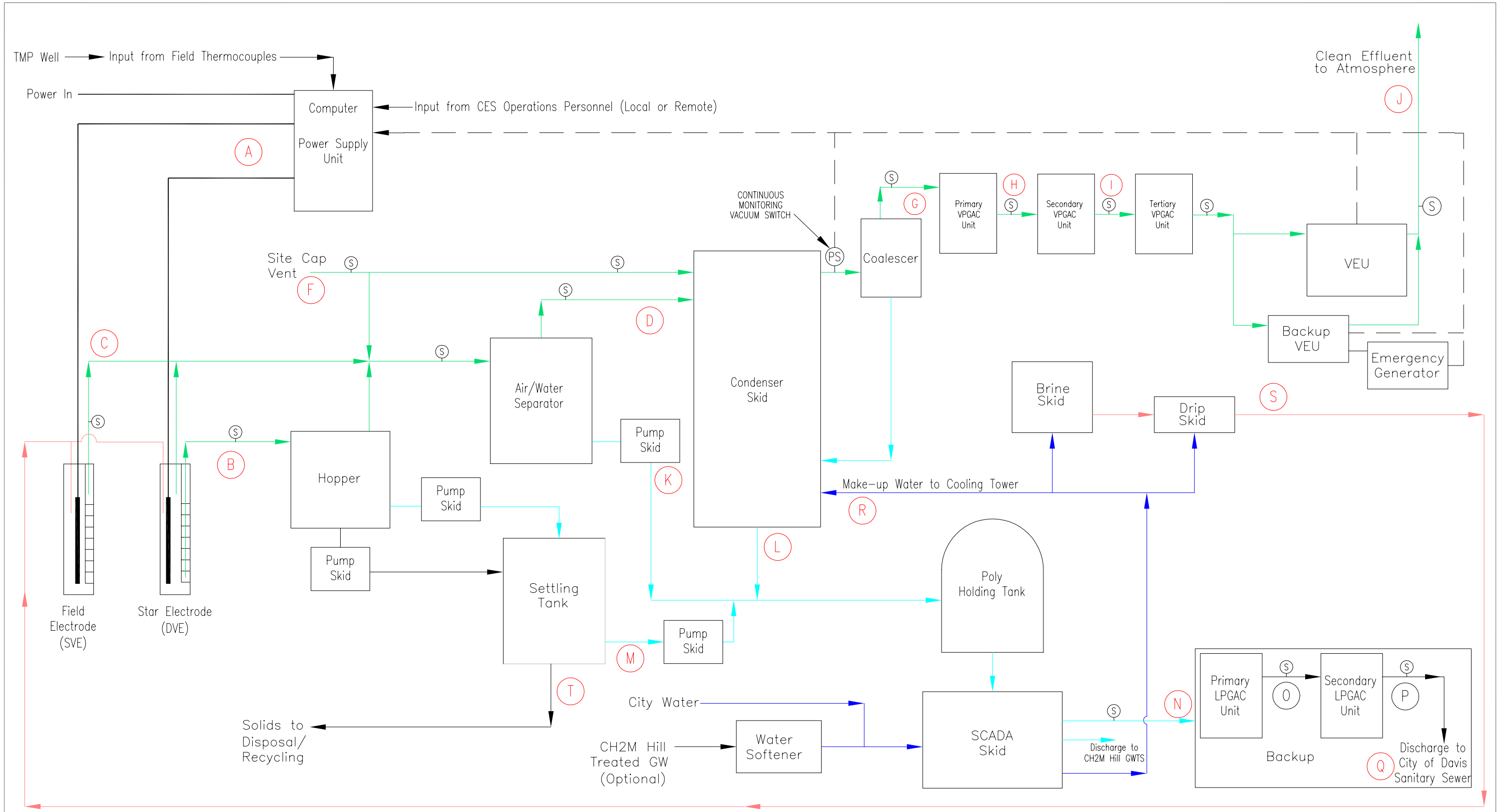
CAP AND AIR INLET DETAIL
ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033
Figure# 8B



LEGEND

(S) Sample Port	VEU Vacuum Extraction Unit	LPGAC Liquid Phase Granular Activated Carbon	(A)-(T): See Process Stream Analysis Table
(PS) Pressure Switch	VPGAC Vapor Phase Granular Activated Carbon	—— —— Electrical Shut Down Interlocks	

CURRENT ENVIRONMENTAL SOLUTIONS

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Approved By: Jim Malot PE
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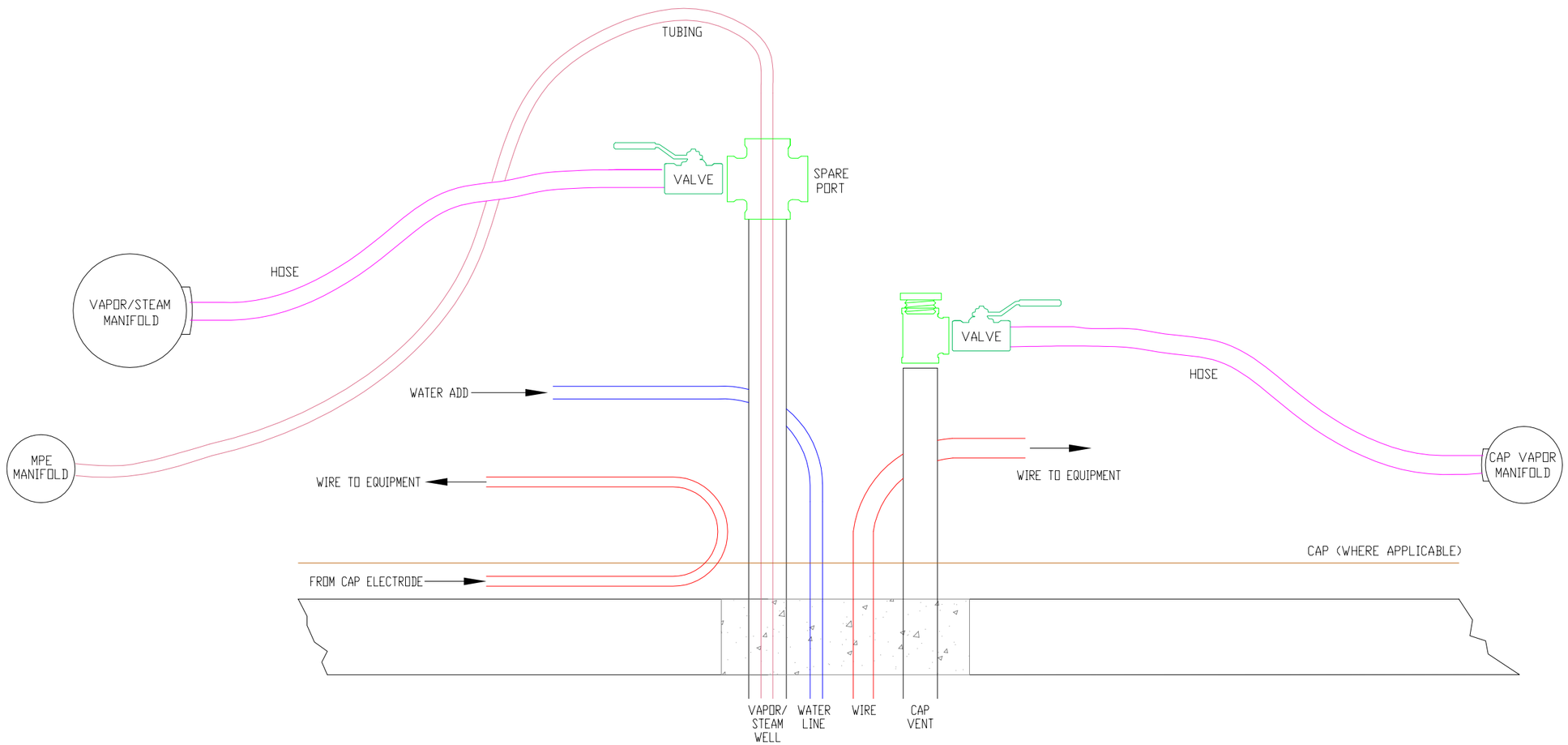
PROCESS AND INSTRUMENTATION DIAGRAM

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 9



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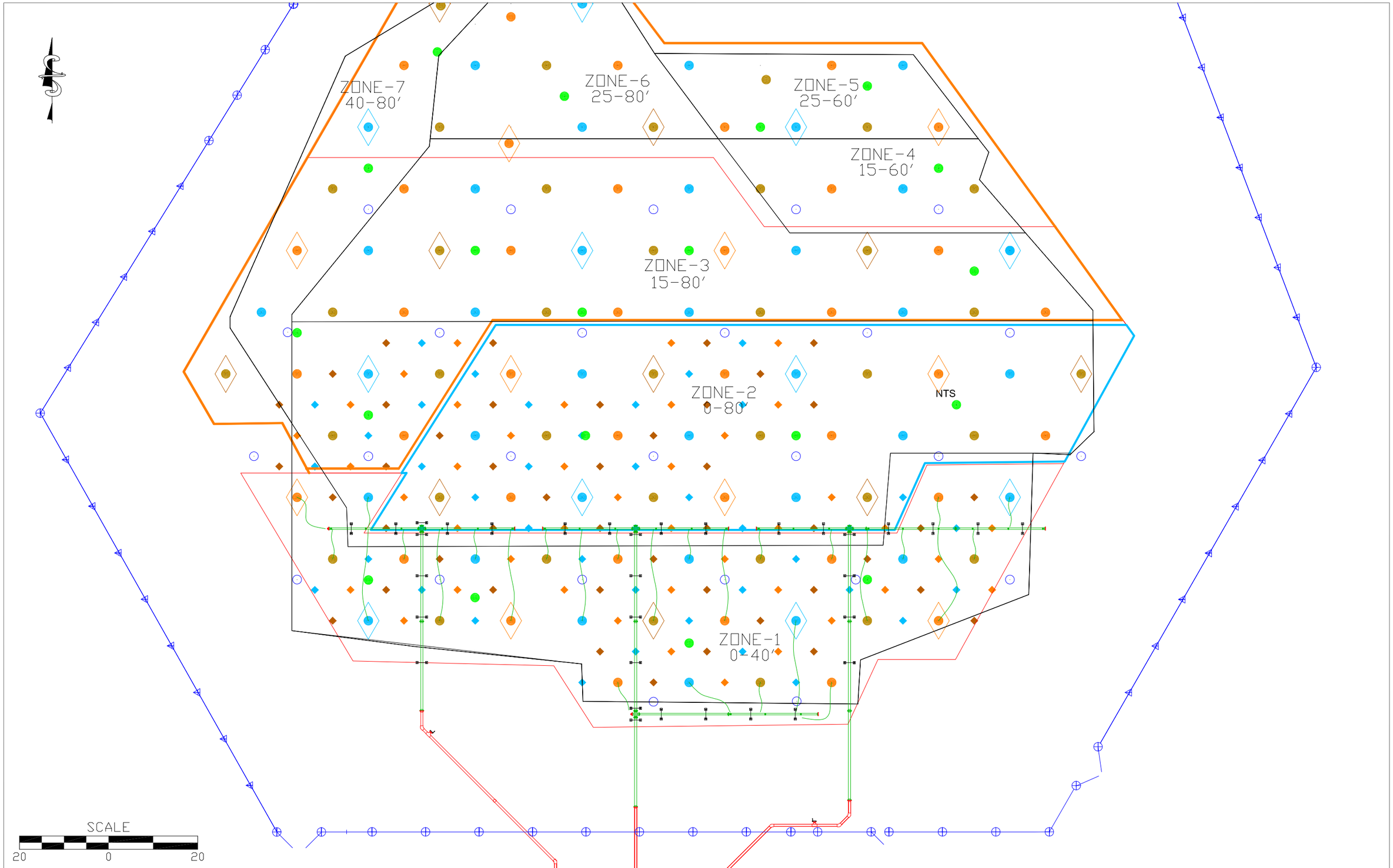
WELLHEAD DETAIL

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 10



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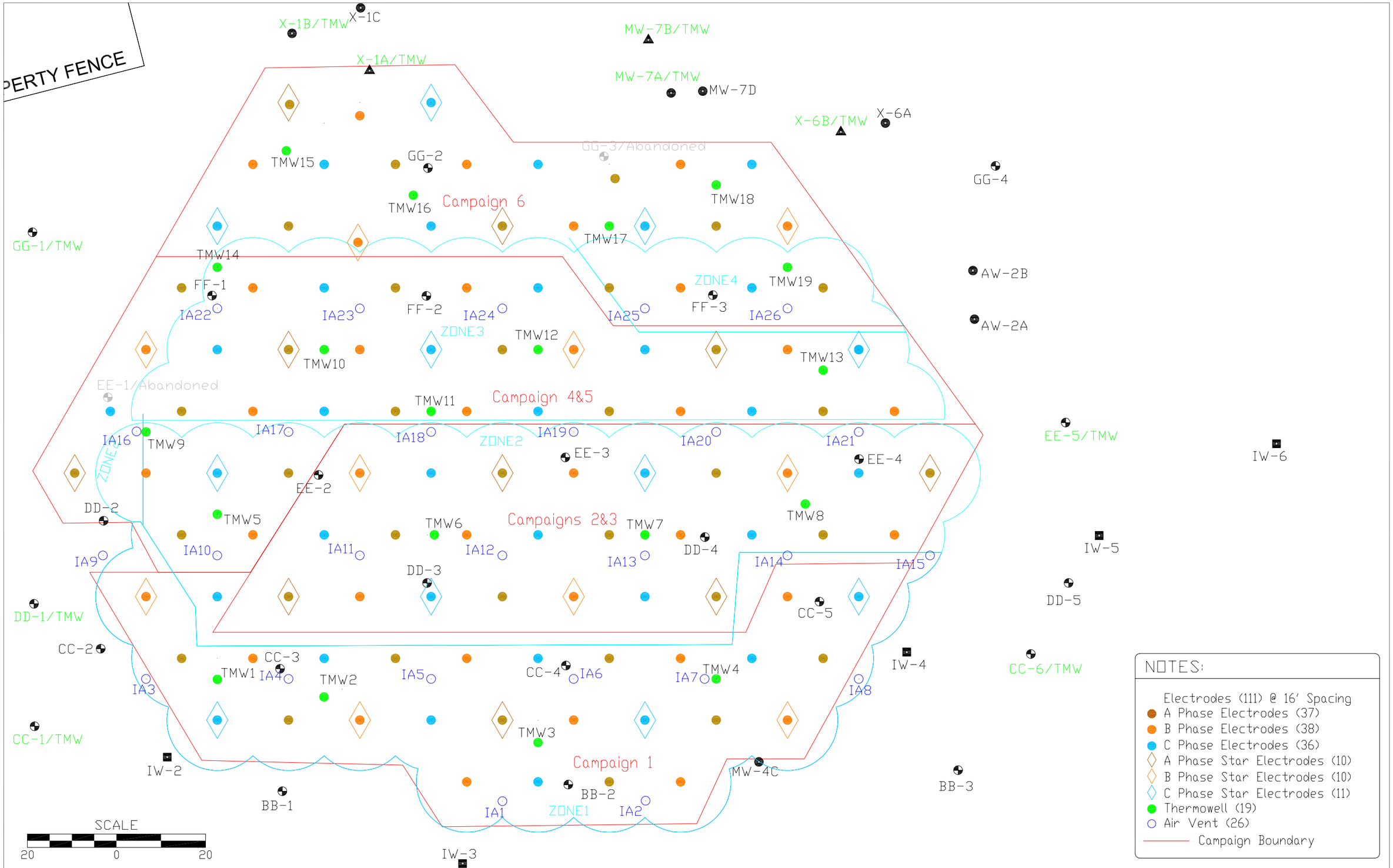
PIPING LAYOUT

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 11



NOTES:

Electrodes (111) @ 16' Spacing
- A Phase Electrodes (37)
- B Phase Electrodes (38)
- C Phase Electrodes (36)
- A Phase Star Electrodes (10)
- B Phase Star Electrodes (10)
- C Phase Star Electrodes (11)
- Thermowell (19)
- Air Vent (26)
- Campaign Boundary

CURRENT ENVIRONMENTAL SOLUTIONS

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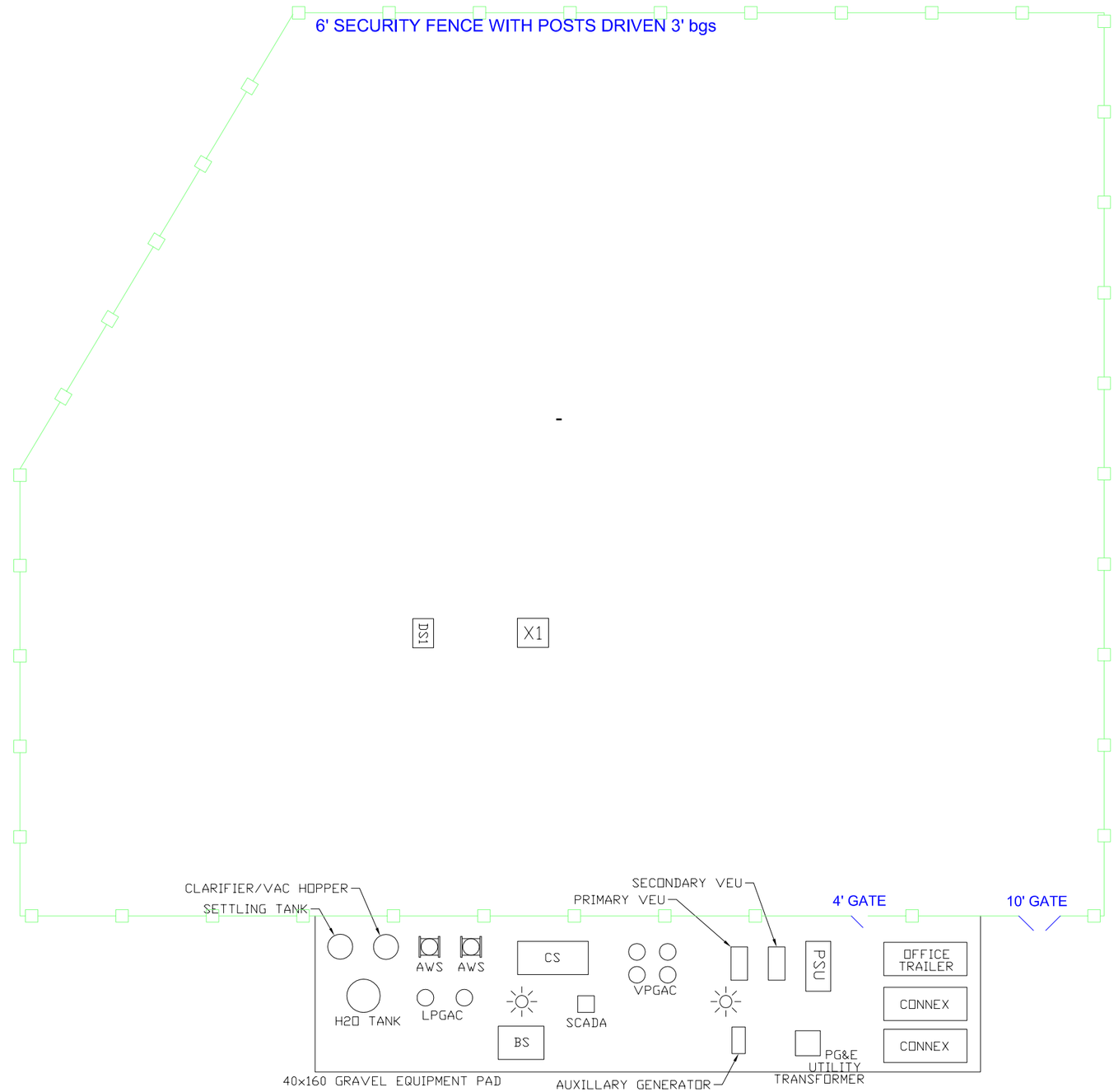
Approved By: Jim Malot PE
PE #CA59088

TREATMENT CAMPAIGNS

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 12



SCALE

15 0 15 30

LEGEND

- A Phase Electrodes (37)
- B Phase Electrodes (38)
- C Phase Electrodes (36)
- A Phase Star Electrodes (10)
- B Phase Star Electrodes (10)
- C Phase Star Electrodes (11)
- Thermowell (19)
- Air Vent (27)
- Campaign Boundary

PSU	POWER SUPPLY UNIT
X1	ISOLATION TRANSFORMER
VEU	VACUUM EXTRACTION UNIT
LPGAC	LIQUID PHASE GRANULAR ACTIVATED CARBON
VPGAC	VAPOR PHASE GRANULAR ACTIVATED CARBON
AWS	AIR WATER SEPERATOR
BS	BRINE SKID
DS	DRIP SKID
CS	CONDENSING SKID
	LIGHT POLE

CURRENT ENVIRONMENTAL SOLUTIONS
316 AVOCET AVE
DAVIS, CA 95616

CH2M HILL Contract: EP-S9-08-04 Task Order: 002 Project Number: 384210.F.D.01

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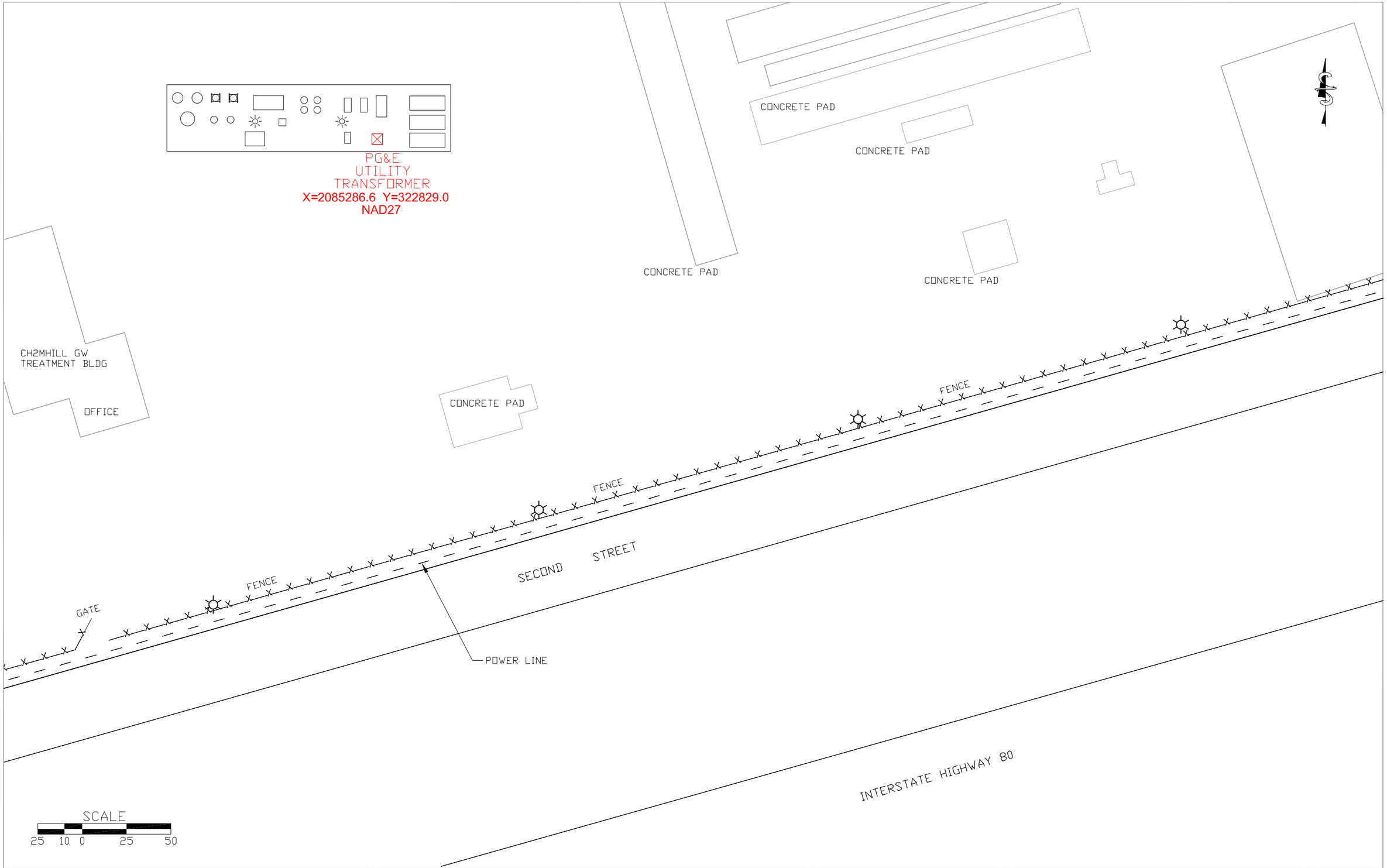
Scale: NTS
Date: 7/16/10
Drawn By: R.Somosky
Designed By: William Heath
Approved By: Jim Nalet PE
PE #CA59088

EQUIPMENT LAYOUT

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 13



CURRENT ENVIRONMENTAL SOLUTIONS

316 AVOCET AVE
DAVIS, CA 95616

CH2M HILL Contract: EP-S9-08-04 Task Order: 002 Project Number: 384210.FD.01

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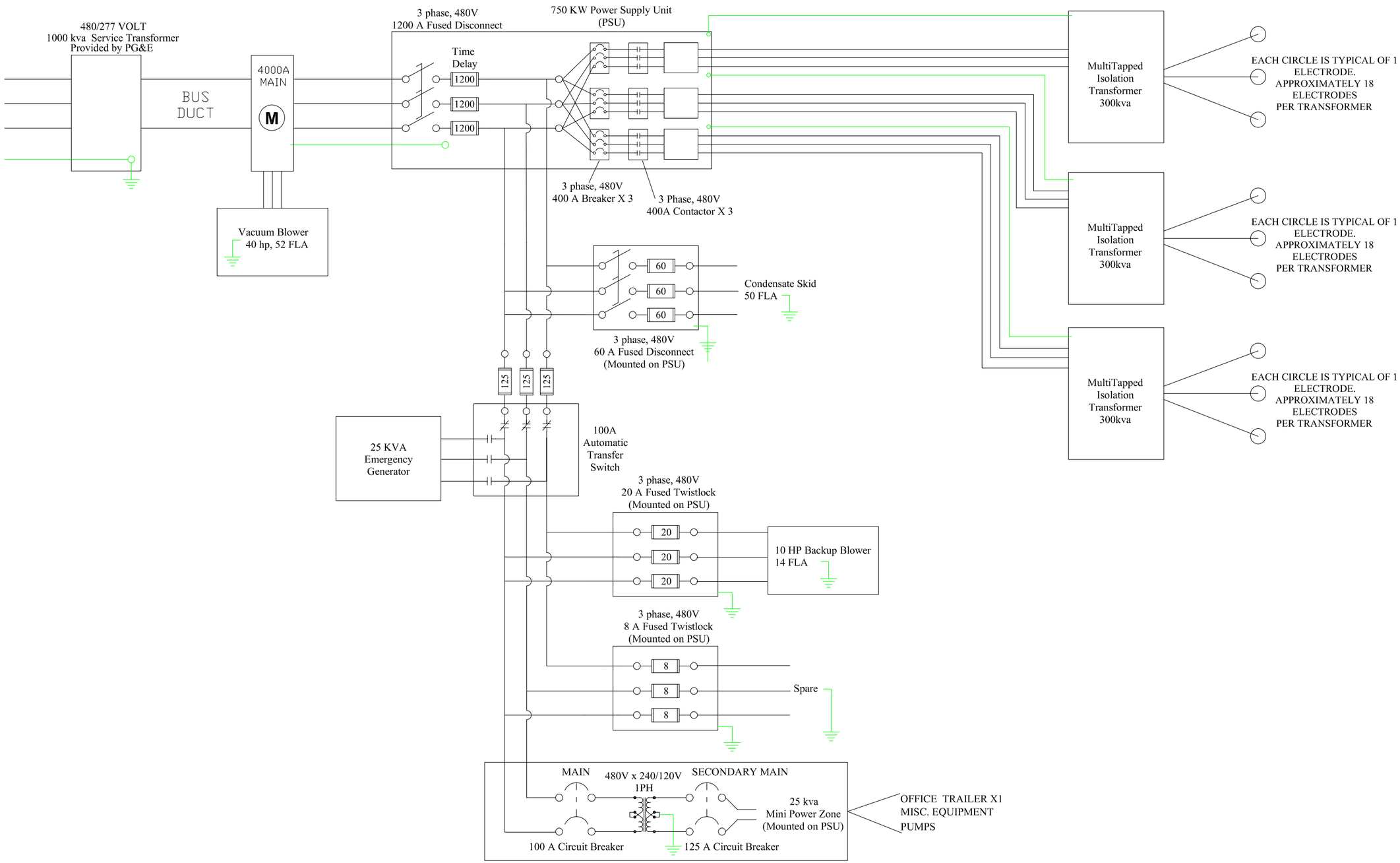
Scale: as shown
Date: 7/19/2010
Drawn By: R.Somosky
Designed By: William Heath
Approved By: Jim Malone
PE #CA59088

UTILITY LOCATION PLAN

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 14



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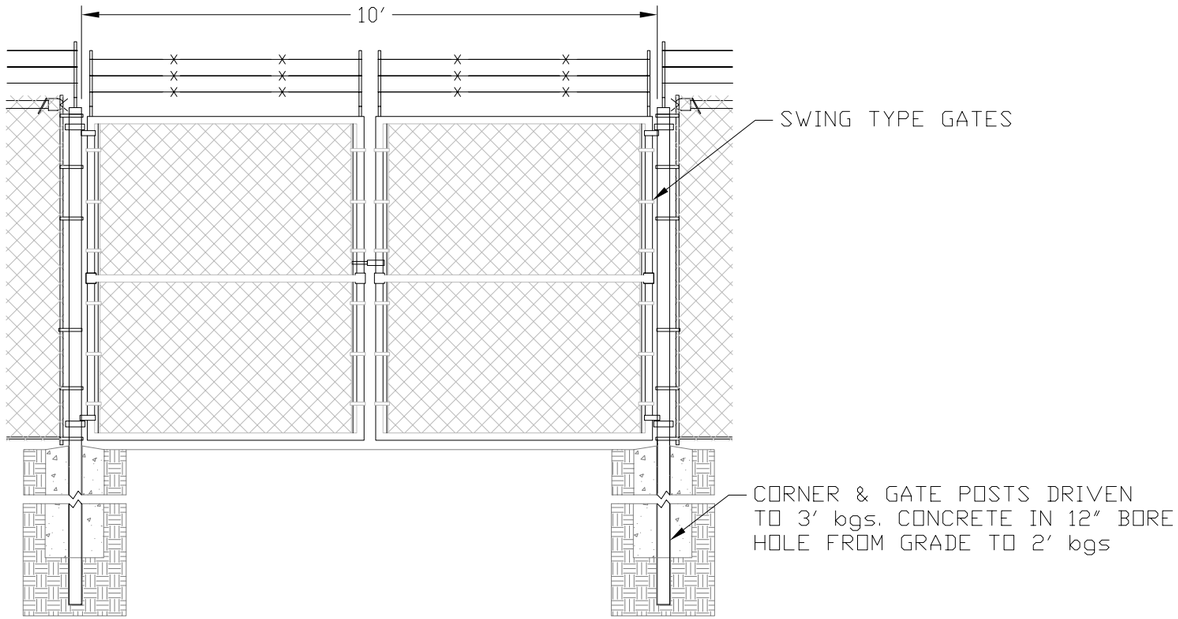
Designed By: William Heath
Approved By: Jim Young PE
PE #CA59088

ELECTRICAL ONE-LINE

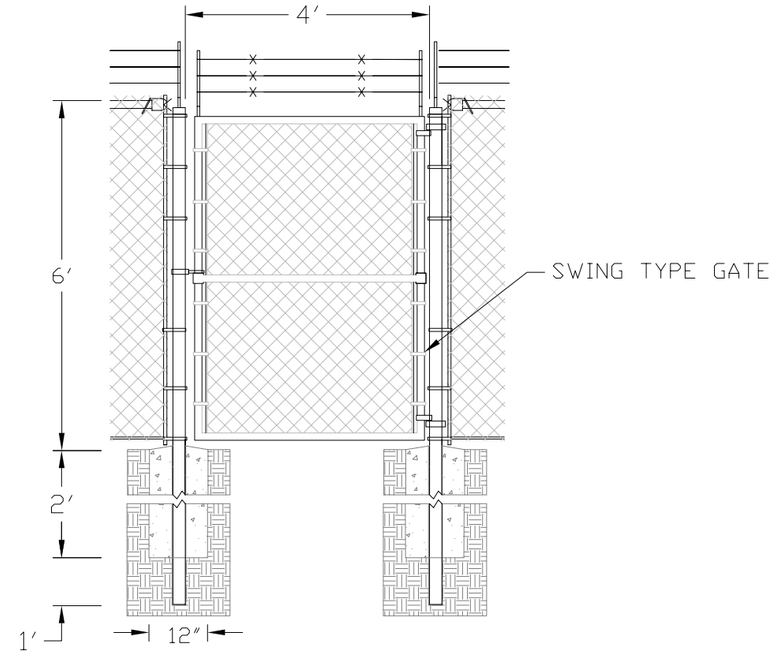
ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

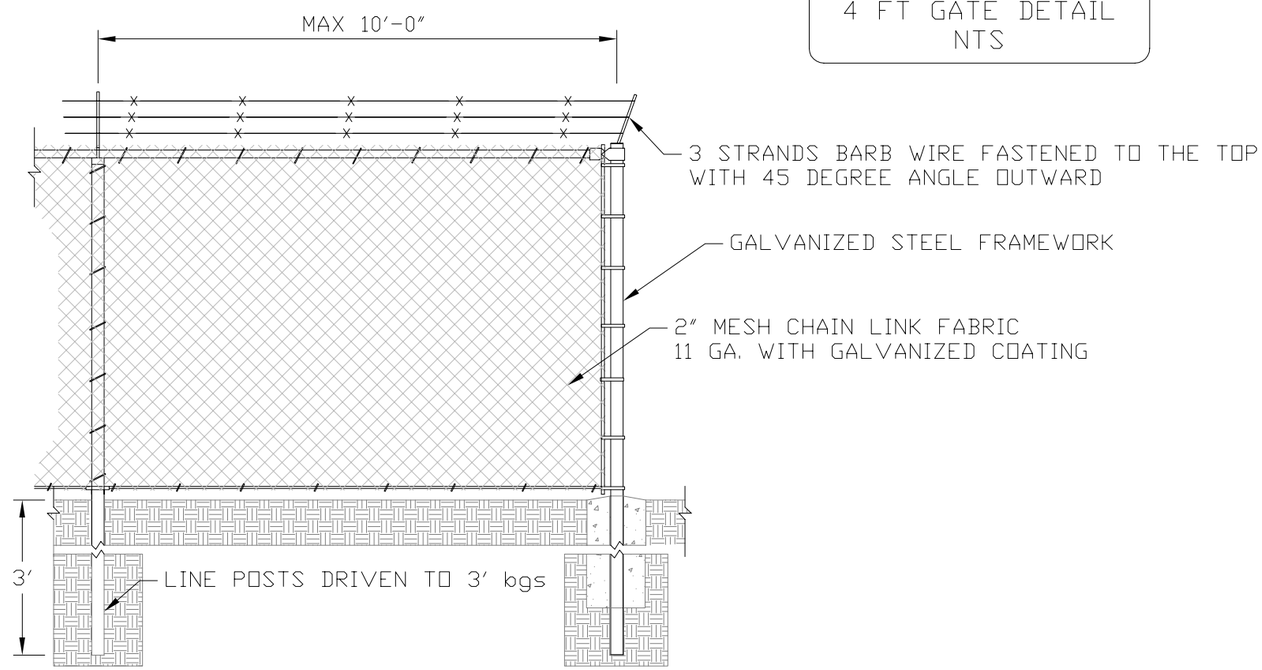
Figure# 15



10 FT GATE DETAIL
NTS



4 FT GATE DETAIL
NTS



FENCE SECTION DETAIL
NTS

CURRENT ENVIRONMENTAL SOLUTIONS
316 AVOCET AVE
DAVIS, CA 95616

CH2M HILL Contract: EP-S9-08-04 Task Order: 002 Project Number: 384210.FD.01

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Scale: as shown
Date: 7/19/2010
Drawn By: R.Somosky
Designed By: William Heath
Approved By: Jim Malat PE
PE #CA59088

FENCE CONSTRUCTION DETAIL

ISTT, FRONTIER FERTILIZER NPL SITE

Project# 78-0033

Figure# 16

APPENDIX A

ISTT Frontier Fertilizer, Davis, CA

PRE-FINAL RAMP : Typical 0 to 40 FT EDB

Campaign 1

CES Project: 78-0033

Prepared for:

CH2MHill
2485 Natomas Park Dr.
Suite 600
Sacramento, CA 95833
T: (916) 920-0300
F: (916) 920-8463

Contract: EP-S9-08-04
CH2M Hill Proj: 384210.ID.01
Submittal: 006
Specification: 01400
Revision: 2
RAMP: PRE-FINAL
Treatment Zone: 0 to 40 FT BGS

Site Specifics & Design Overview

State?	CA
Site Zip Code?	65803
Six Phase Heating Treatment Area (ft^2):	5,941
Shape of Treatment Area (circle, rectangle, oval):	rectangle
Treatment Area Length (ft):	120
Treatment Area Width/Diameter (ft):	44
Treatment Area Perimeter (ft):	328
Shallow Extent of Six Phase Heating (ft):	6
Deep Extent of Six Phase Heating (ft):	42
Typical Depth to Groundwater (ft):	26
Treated Volume (yd^3):	8,361
Compare to Excavation Option (tons):	11,100
Annual Rainfall (in):	15
Groundwater Flow Velocity (ft/day):	0.01
Ambient Air Temperature(˚C):	27
Ambient Groundwater Temperature (˚C):	17
Proposed Treatment Temperature (˚C):	115
Treat Sequentially as # Sections:	1
Per-cent of site under building/pavement?	0%
What per-cent of cover material is concrete?	0%
What per-cent of site is public access?	0%
Is this a single array pilot test?	no
Vapor Extraction Required?	yes
Are Vents in Same Boreholes as Electrodes?	yes
Insulating Surface Cover Required?	yes
Impermeable Surface Seal Required?	yes
Separate Electrode Interval for Saturated Zone ?	no
Does Vadose Zone Need to be Pre-Heated?	no
Does Vadose Zone Need to be Pre-Dried?	no
Air Sparging?	no
Multiphase Extraction Required?	yes
Account for In Situ Degradation?	yes
Degradation Mechanism:	hydrolysis

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Site Hydrogeology

Layer Model	Soil Type	Top, ft bgs	Thickness, ft	Zone	Hydraulic Conduct. cm/sec
Upper Layer 1	Sandy Clay Loam	0.0	3.0	Vadose	3.53E-04
Upper Layer 2	Clay	3.0	3.0	Vadose	1.08E-04
Heated Layer 1	Clay	6.0	7.2	Vadose	1.08E-04
Heated Layer 2	Clay	13.2	6.8	Vadose	1.08E-04
Heated Layer 3	Clay	20.0	6.0	Vadose	1.08E-04
Heated Layer 4	Clay2	26.0	9.0	Saturated	2.73E-05
Heated Layer 5	Sandy Clay	35.0	7.0	Saturated	7.34E-05
Lower Layer 1	Sandy Clay	42.0	5.0	Saturated	7.34E-05
Lower Layer 2	Sandy Clay	47.0	5.0	Saturated	7.34E-05

Layer Model	Groundwater Conductivity 25˚C (µS/cm):	Soil Resitivity (ohm-m)	Soil TOC (wt %)	Soil TPH (mg/kg)	Sorption Coefficient (Kd, L/Kg)
Upper Layer 1	1,733.3	76.1	0.09%	0	0.04
Upper Layer 2	1,733.3	26.2	0.09%	0	0.05
Heated Layer 1	1,733.3	26.0	0.09%	0	0.05
Heated Layer 2	1,733.3	24.8	0.09%	0	0.05
Heated Layer 3	2,600.0	16.8	0.09%	0	0.05
Heated Layer 4	2,600.0	18.0	0.09%	0	0.05
Heated Layer 5	2,080.0	22.2	0.09%	0	0.05
Lower Layer 1	2,080.0	22.2	0.09%	0	0.05
Lower Layer 2	2,080.0	22.2	0.09%	0	0.05

Layer Model	Intrinsic Permeability (cm2)	Soil Moisture Content (wt %)	Soil Total Porosity	Soil Dry Density (kg/L)	Soil Wet Density (kg/L)
Upper Layer 1	3.25E-09	9.1%	39.6%	1.63	1.79
Upper Layer 2	9.99E-10	22.6%	46.0%	1.46	1.88
Heated Layer 1	9.99E-10	23.3%	46.0%	1.46	1.90
Heated Layer 2	9.99E-10	24.8%	46.0%	1.46	1.94
Heated Layer 3	9.99E-10	27.8%	46.0%	1.46	2.02
Heated Layer 4	2.51E-10	22.7%	37.8%	1.68	2.17
Heated Layer 5	6.76E-10	23.1%	38.4%	1.66	2.16
Lower Layer 1	6.76E-10	23.1%	38.4%	1.66	2.16
Lower Layer 2	6.76E-10	23.1%	38.4%	1.66	2.16

Layer Model	Specific Yield (dimless)	Layer Transmissivity (m2/sec)	Sand Fraction (%)	Silt Fraction (%)	Clay Fraction (%)
Upper Layer 1	0.16	3.23E-06	58%	15%	27%
Upper Layer 2	0.05	9.92E-07	14%	6%	81%
Heated Layer 1	0.05	2.38E-06	14%	6%	81%
Heated Layer 2	0.05	2.25E-06	14%	6%	81%
Heated Layer 3	0.05	1.98E-06	14%	6%	81%
Heated Layer 4	0.06	7.48E-07	20%	30%	50%
Heated Layer 5	0.14	1.57E-06	49%	13%	37%
Lower Layer 1	0.14	1.12E-06	49%	13%	37%
Lower Layer 2	0.14	1.12E-06	49%	13%	37%

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Contaminant Properties

Controlling Contaminants:	DBCP	EDB	DCP	TCP
Contaminant CAS Number:	96-12-8	8003-07-04	78-87-05	96-18-4
Contaminant Molecular Weight (g/mol):	236.36	187.88	112.99	147.44
ıtaminant Boiling Temperature at 1 atm (°C):	196.0	131.6	96.8	156
Vapor Pressure (mmHg @25C)	0.6	11	53.3	3.1

Total Contaminant Mass (lb):	20
Total Contaminant Volume (gallons):	1

	Ambient (at 17°C)	Heated (at 115°C)
Weighted Ave.(W/A) Contaminant Water Solubility (mg/l):	4503.0	5850.0
W/A Contaminant Vapor Pressure (Torr):	8.6	475.6
W/A Contaminant Henry's Constant (mg/L air / mg/L aq):	0.03	0.43
W/A Contaminant NAPL Density (kg/L):	2.185	1.983
W/A Contaminant NAPL Dynamic Viscosity (cP):	1.811	0.584
W/A Contaminant NAPL Kinematic Viscosity (cSt):	0.829	0.294

Contaminant Distribution and Cleanup Targets

	Heated Layer 1	Heated Layer 2	Heated Layer 3	Heated Layer 4	Heated Layer 5
Zone:	Vadose	Vadose	Vadose	Saturated	Saturated
Volume (yd^3):	1,406.1	1,328.0	1,171.8	1,757.7	1,367.1
Initial Soil Concentrations, Dry Basis (mg/kg)					
Peak:	61	15	2	1	1
Average:	4	1	0	0	0
Target:	0.01	0.01	0.01	0.01	0.01
Initial Groundwater Concentrations (µg/L)					
Estimated Ave:	n/a	n/a	n/a	360	354
Target:	n/a	n/a	n/a	0	0
Initial Mass Distribution (lb)					
NAPL present?:	no	no	no	no	no
Sorbed:	2.4	0.8	0.0	0.1	0.1
Dissolved:	11.3	3.7	0.2	0.4	0.3
Vapor:	0.1	0.0	0.0	0.0	0.0
NAPL:	0.0	0.0	0.0	0.0	0.0
Total Mass:	13.8	4.6	0.3	0.5	0.4
Initial Saturations (v/v)					
Water	33.6%	35.7%	39.9%	37.6%	38.0%
Air	12.5%	10.4%	6.1%	0.2%	0.5%
NAPL	0.0%	0.0%	0.0%	0.0%	0.0%

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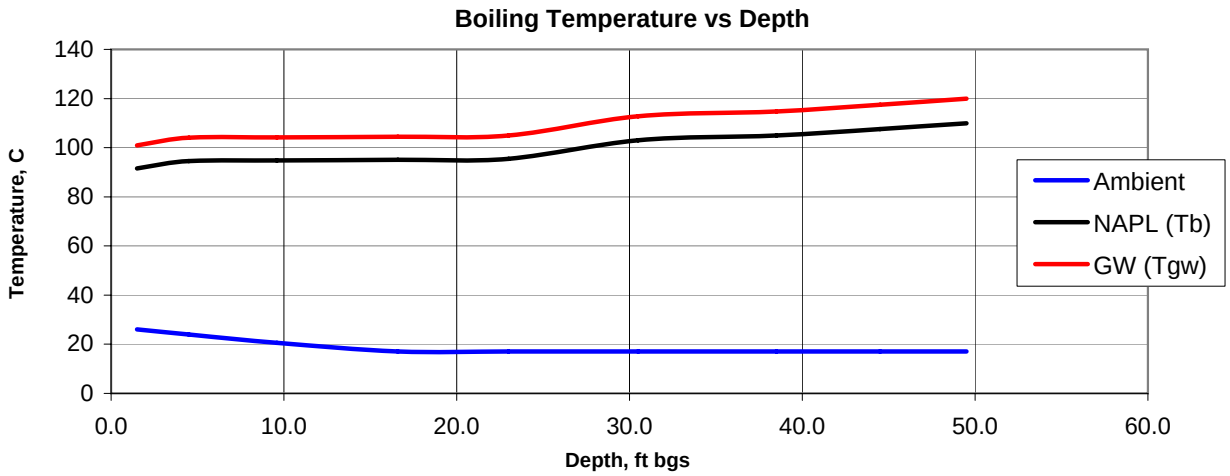
Estimated Treatment Temperatures & Pressure



	GW (˚C) Boiling Temperature	NAPL (˚C) Boiling Temperature	Ambient (˚C) Subsurface Temperature	Pressure at Boiling mm Hg	Layer Midpoint ft bgs
Upper Layer 1	100.9	91.5	26.0	784	1.5
Upper Layer 2	104.0	94.6	24.0	876	4.5
Heated Layer 1	104.2	94.7	20.6	881	9.6
Heated Layer 2	104.5	95.0	17.0	889	16.6
Heated Layer 3	105.0	95.5	17.0	905	23.0
Heated Layer 4	112.8	103.1	17.0	1,178	30.5
Heated Layer 5	114.8	105.0	17.0	1,257	38.5
Lower Layer 1	117.4	107.6	17.0	1,370	44.5
Lower Layer 2	119.9	110.0	17.0	1,484	49.5

Electrode Design Specifications

Number of Vertical Heating Intervals:	1	
Electrode and Extraction Well Terminations:	100% above grade	
Number of Temperature Monitoring Wells:	11	
Soil Cuttings from Electrode Installation:	56.1	tons
Average Wetting Rate (all Electrodes):	0.14	gpm
Total Volume of Drip Water Added:	40,243	gallons
Total Amount of Electrolyte Required:	2,507	Lb

	Primary	Upper
Electrode Diameter (inches):	3.0	n/a
Borehole Diameter (inches):	12.00	n/a
Array to Electrode Ratio (D/d):	32	n/a
Distance between Electrodes (ft):	16.0	n/a
Total Number of Electrodes:	27	n/a
Depth to Top of Electrode (ft):	6.0	n/a
Total Depth of Electrode (ft):	44.0	n/a
Conductive Zone Length (ft):	38.0	n/a
Length of Electrode in Vadose Zone (ft):	20.0	n/a
Length of Electrode in Groundwater (ft):	18.0	n/a
Number of Drip Intervals per Primary Electrode:	3	n/a
Electrode Drill Cuttings (tons):	56.1	n/a

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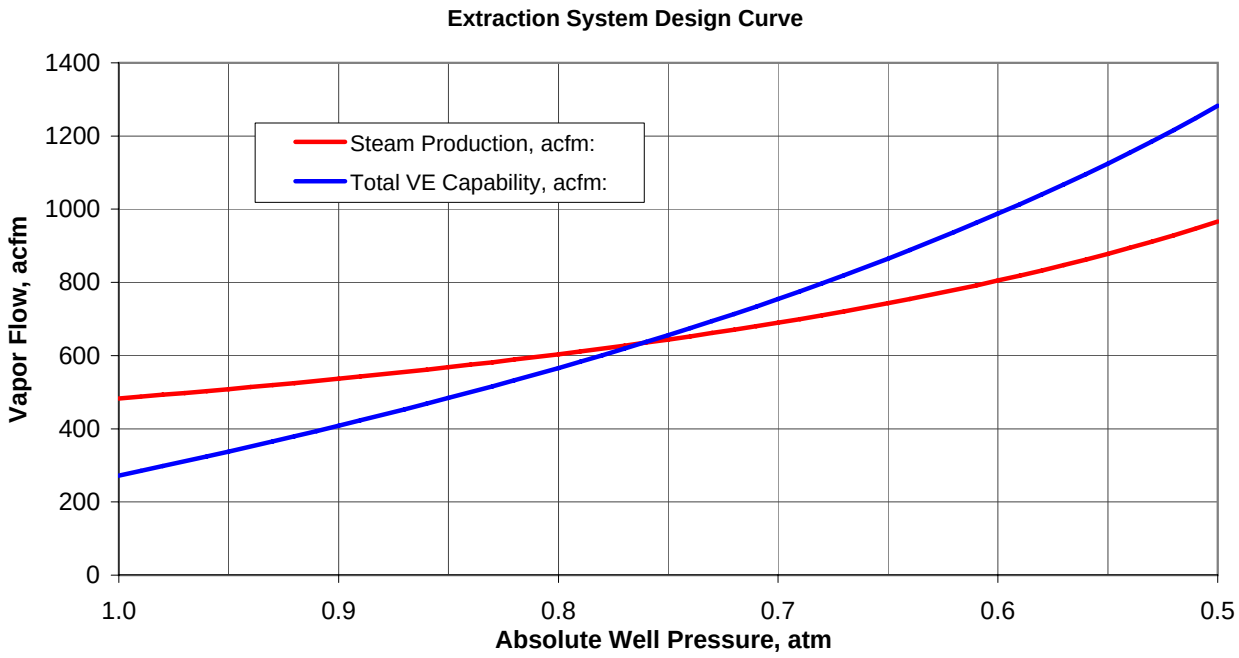
Extraction System Design

Design Extraction Vaccum:	0.77	atm
Well Vacuum:	7	in. Hg
Peak Steam Production Rate:	321	scfm
Peak Air Flow Rate:	77	scfm
Vapor Extraction Design Flow Rate:	340	scfm
Recommended Blower Vacuum:	10	in. Hg
Vapor Extraction Blower:	30	hp
SVE/DVE Wells Co-Located with Electrodes?	yes	
Average Condensate Production Rate:	2.84	gpm
Total Condensate Produced:	341,900	gallons
Peak Vapor Extraction Rate:	0.0	lb/day
Peak In Situ Degradation Rate:	0.7	lb/day
Average Total Cleanup Rate:	0.1	lb/day
Final Extraction Rate:	0.0	lb/day
Soil Cuttings from VE Well Installation:	0.0	tons
Vapor Treatment Method:	carbon	
Secondary Acid Gas Stack Scrubber:	not required	

	Shallow/VE	Horizontal	Deep/DVE
Type of Vents Required:	yes	yes	yes
Vent Spacing (ft):	16	32	16
Number of Vents:	27	5	27
Wellbore/Trench Diameter (in.):	12.00	12.00	12.00
Screened Length per Vent (ft):	23.0	30.0	18.0
Peak Design Flow per Vent (acfm):	14.6	12.5	5.7
Wellscreen Diameter (in.):	3.0	1.0	3.0
Well Drill/Trenching Cuttings (tons):	0.0	0.0	0.0



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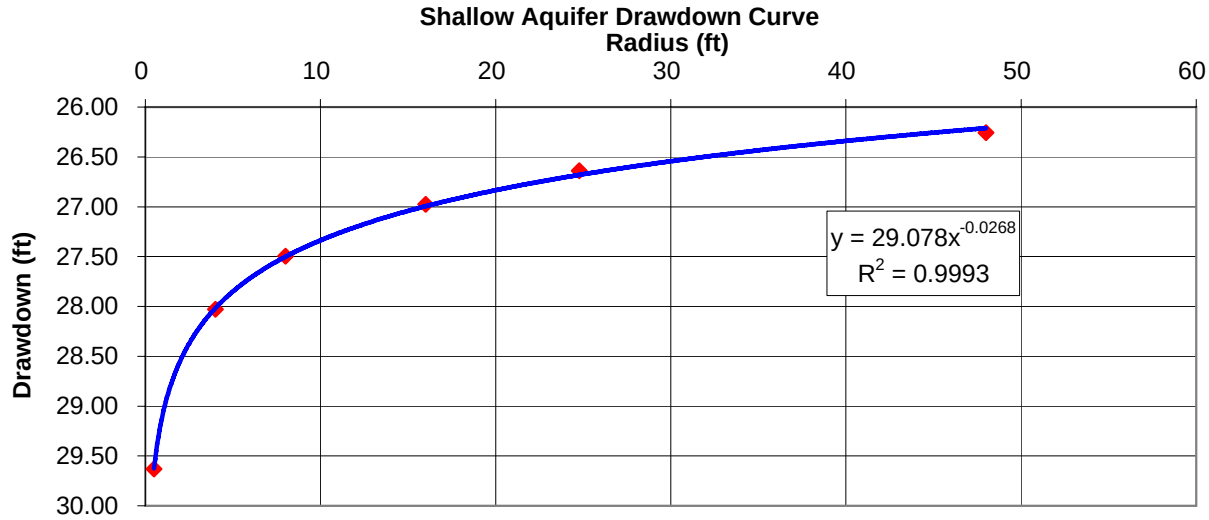
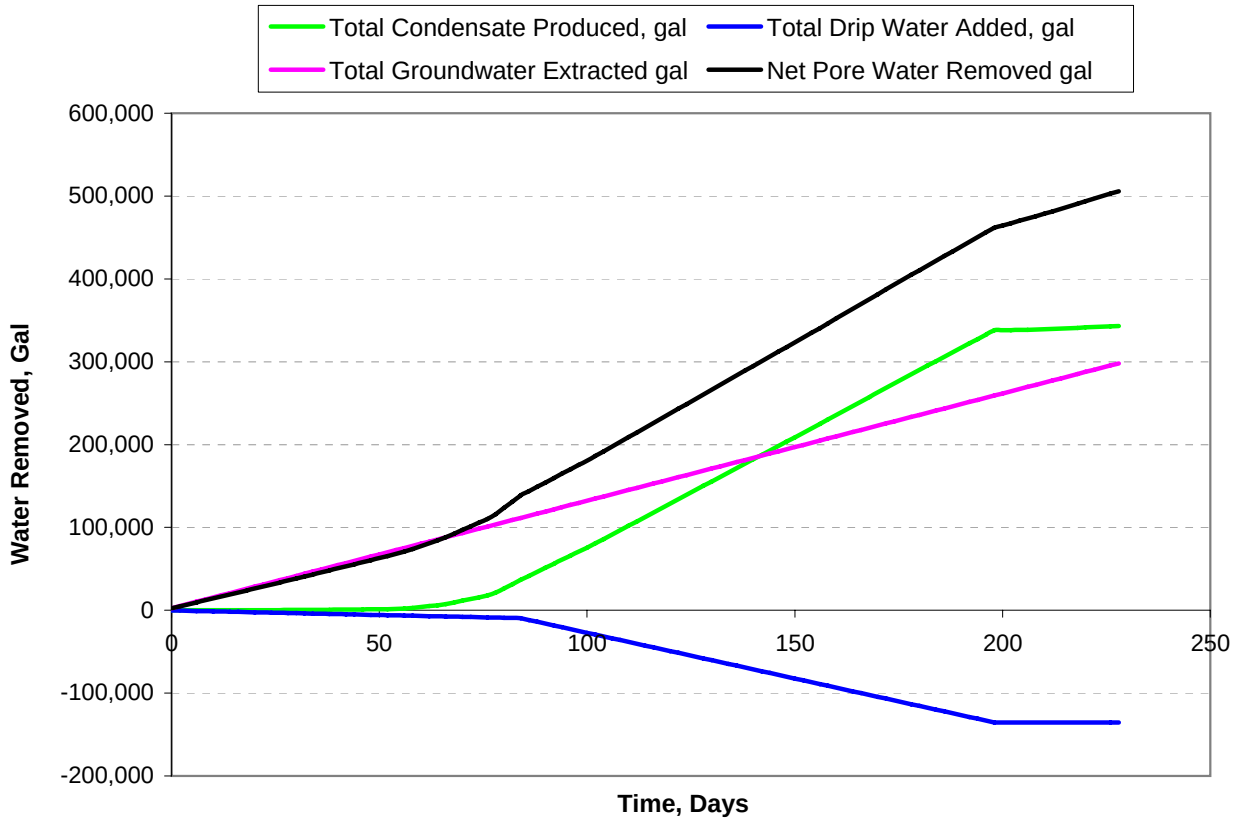
Groundwater Extraction & Overall Water Balance



Typical Depth to Groundwater: 26 ft bgs

			Peak (gpm)
Total Groundwater Extracted:	298,080	gallons	0.9
Total Condensate Produced:	341,900	gallons	1.9
Total Volume of Drip Water Added:	40,243	gallons	1.04
Total NAPL Extracted:	0	lb	



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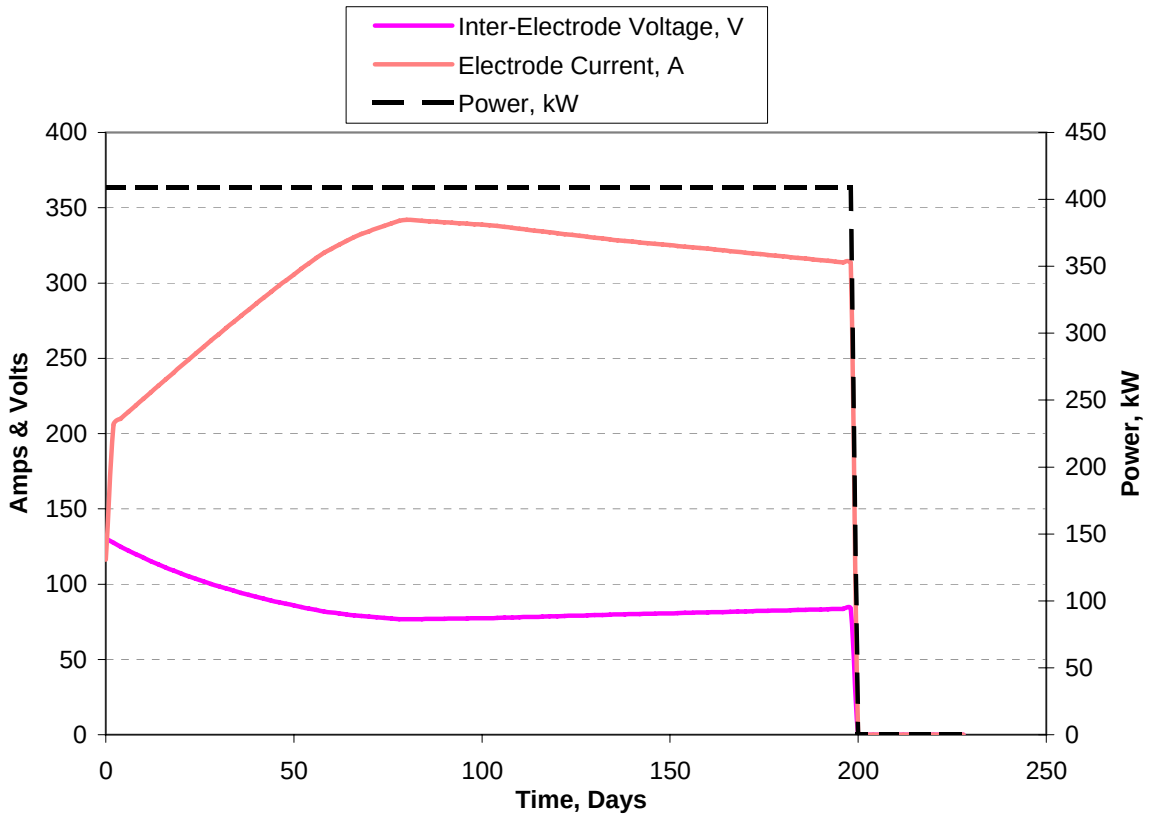
Estimated Treatment Time & Energy Requirements

Time to Pre-Heat/Dry Vadose Zone:	0	days
Time to Heat-up Site:	85	days
Time to Treat Site:	115	days
Extra Time for Multiphase Extraction:	0	days
Total Treatment Time:	200	days
Subsurface Energy Estimate:	1,961,900	kW-hr
Subsurface Energy Density:	248	kw hr/yd3
Total Energy Estimate:	2,139,246	kW-hr

Power Supply Specifications & Electrical Requirements



Site Electrical Power Requirement:	1,000	kW
Site Service Requirement at 480V, 3-Phase:	1,100	Amps
Power Supply Rating:	750	kW
Peak Electrode Voltage:	130	Volts
Peak Phase Current:	3,078	Amps
Number of Electrode Phases:	3	

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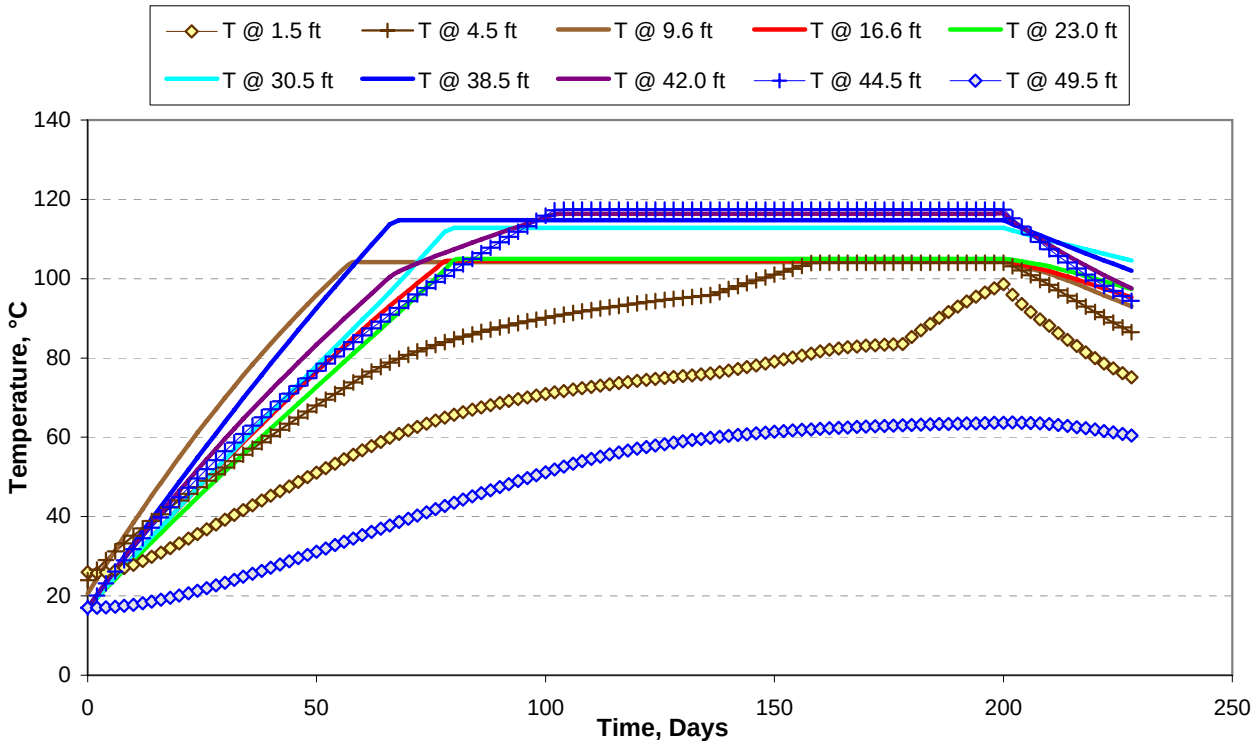
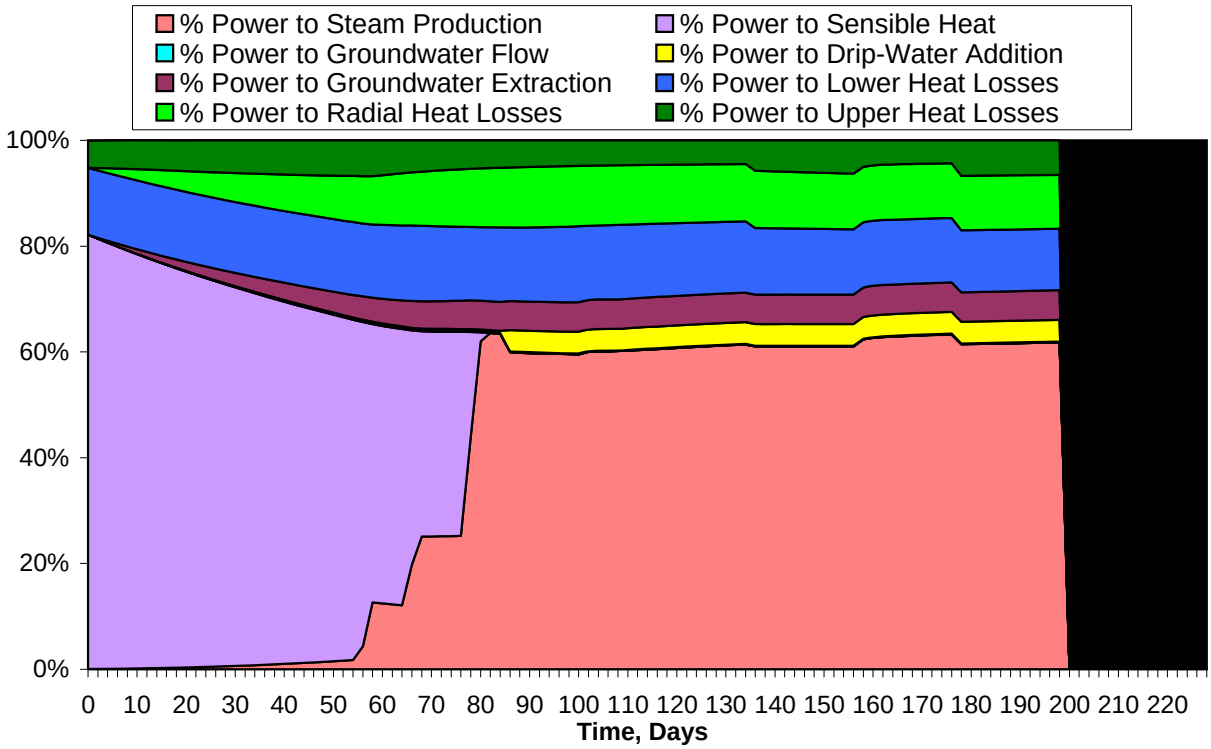
Predicted Subsurface Temperature Trends



Estimated Subsurface Energy Distribution



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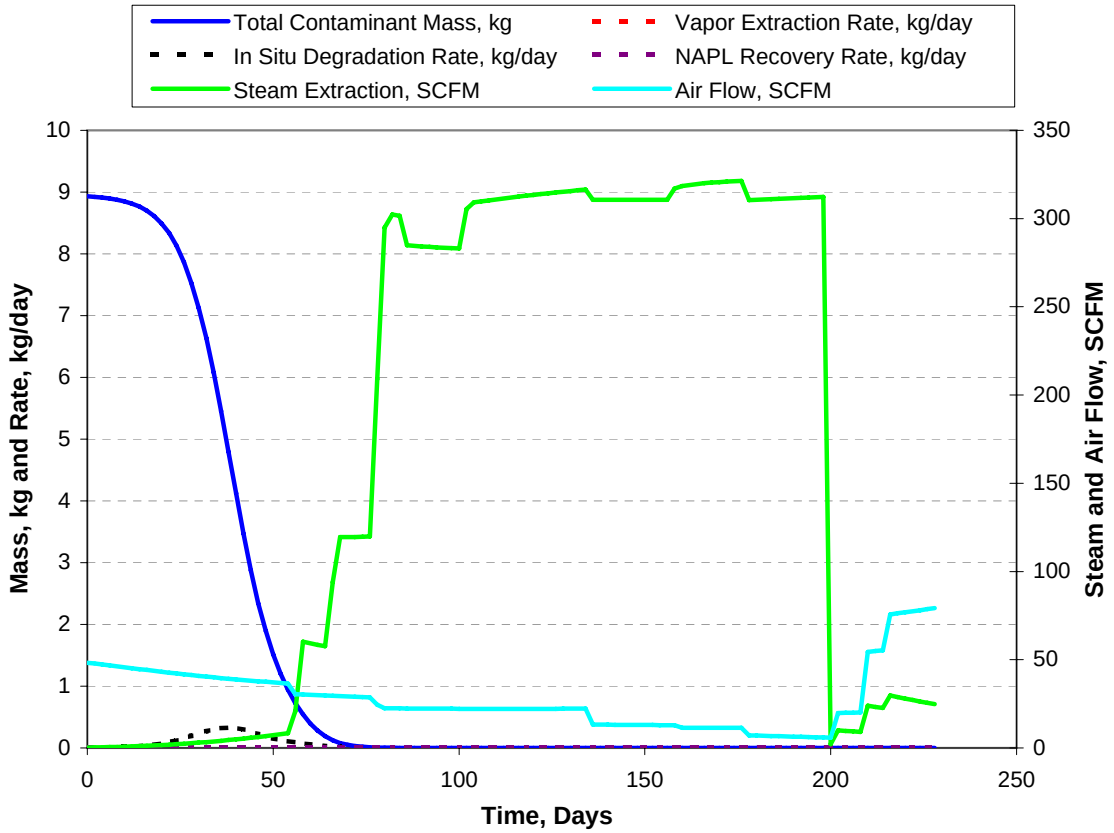
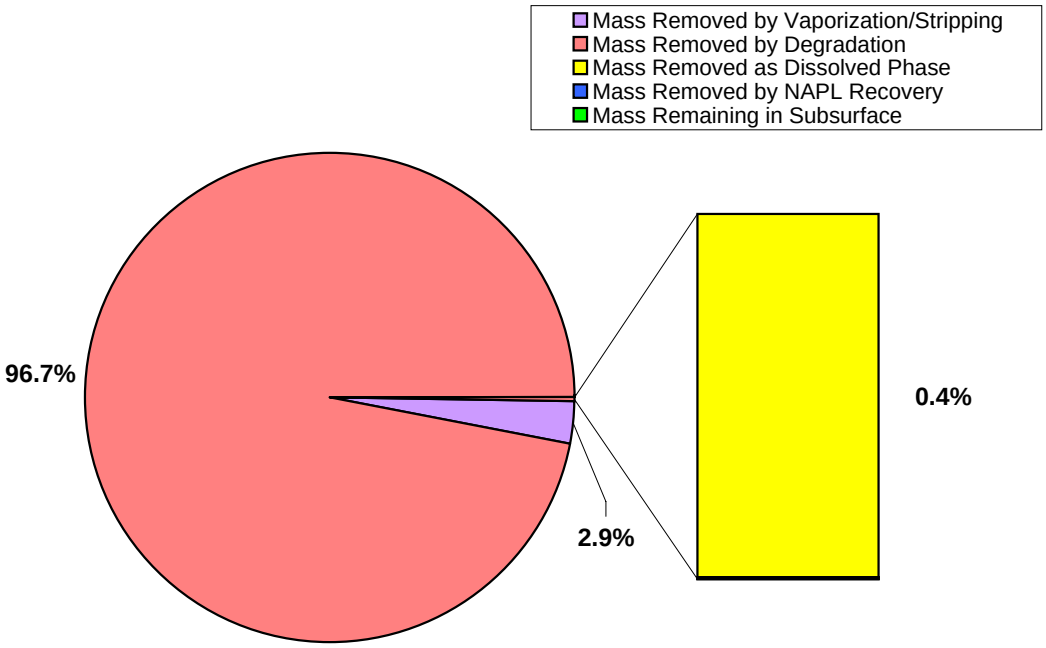
Projected Treatment Performance and Removal rates



Contaminant Fate Projection



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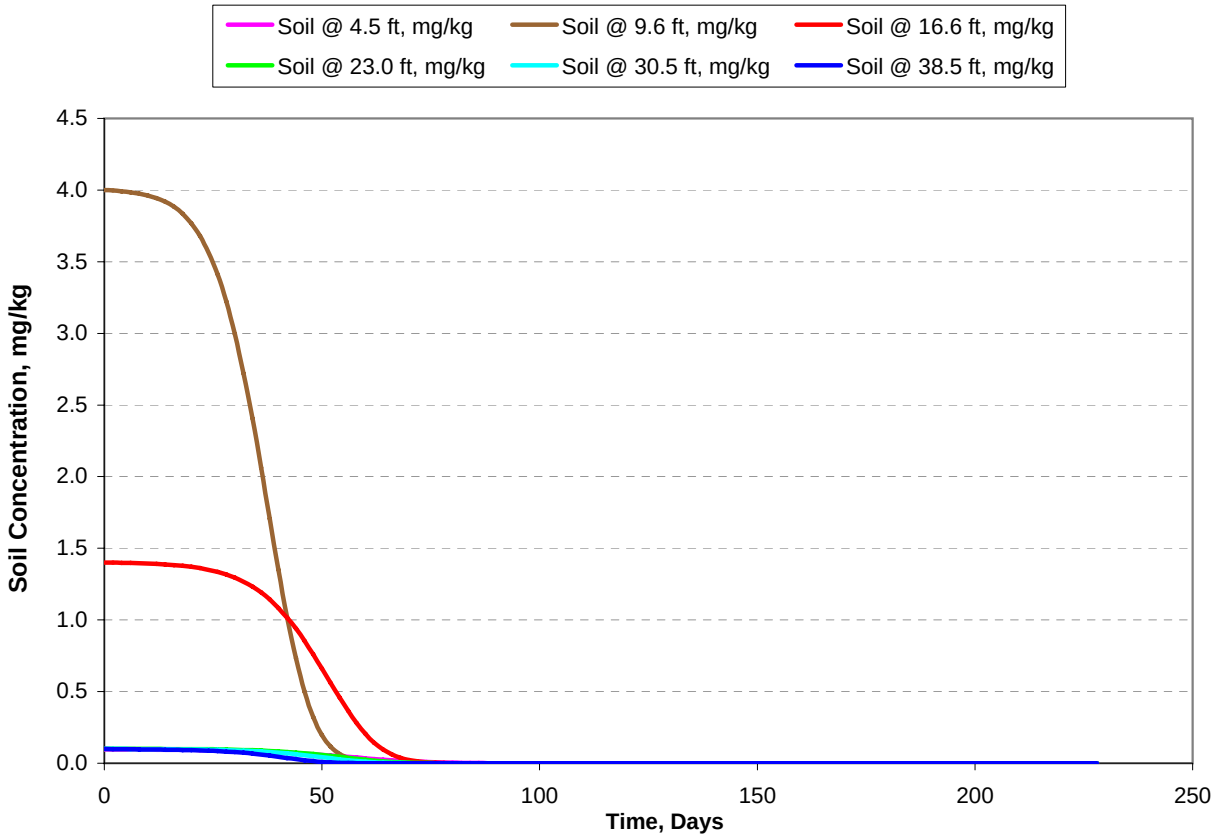
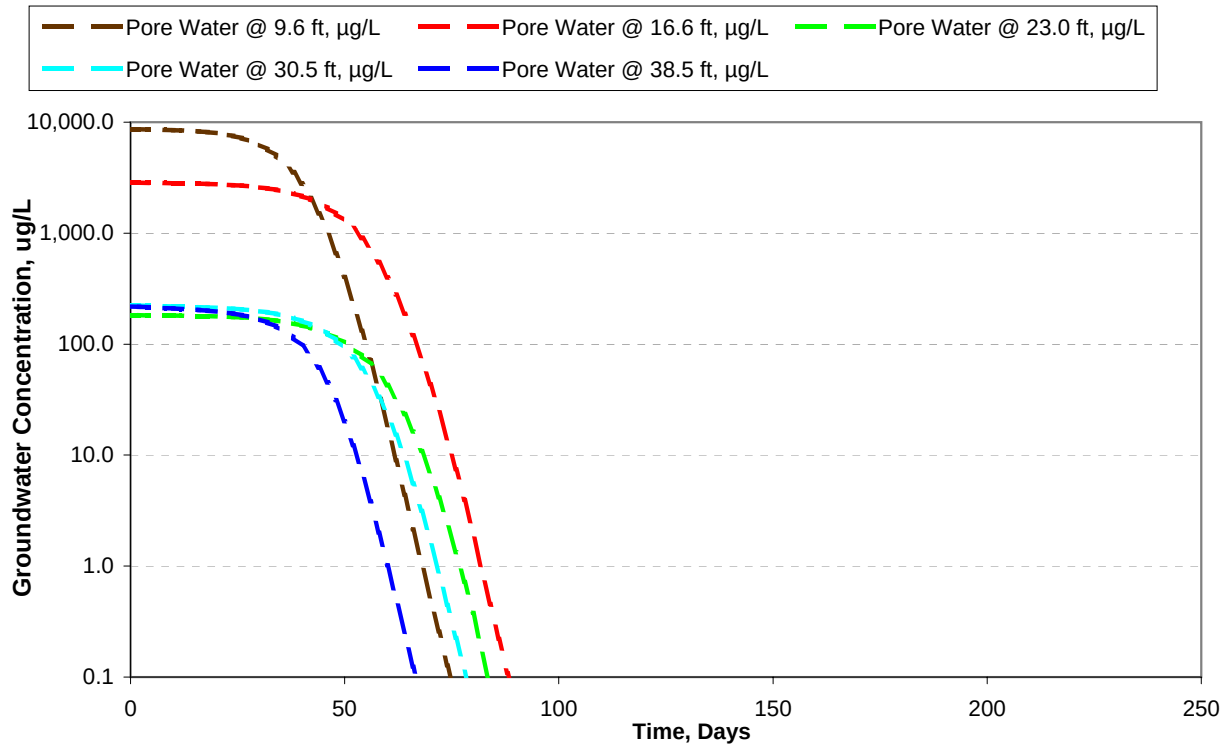
Predicted Soil and Groundwater Concentrations





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ISTT Frontier Fertilizer, Davis, CA

PRE-FINAL RAMP: Typical 40 to 80 FT EDB

Campaign 2

CES Project: 78-0033

Prepared for:

CH2MHill
2485 Natomas Park Dr.
Suite 600
Sacramento, CA 95833
T: (916) 920-0300
F: (916) 920-8463

Contract: EP-S9-08-04
CH2M Hill Proj: 384210.ID.01
Submittal: 006
Specification: 01400
Revision: 2
RAMP: PRE-FINAL
Treatment Zone: 40 to 80 FT BGS

Site Specifics & Design Overview

State?	CA
Site Zip Code?	65803
Six Phase Heating Treatment Area (ft^2):	6,507
Shape of Treatment Area (circle, rectangle, oval):	rectangle
Treatment Area Length (ft):	120
Treatment Area Width/Diameter (ft):	54
Treatment Area Perimeter (ft):	348
Shallow Extent of Six Phase Heating (ft):	36
Deep Extent of Six Phase Heating (ft):	82
Typical Depth to Groundwater (ft):	26
Treated Volume (yd^3):	11,568
Compare to Excavation Option (tons):	26,700
Annual Rainfall (in):	15
Groundwater Flow Velocity (ft/day):	0.01
Ambient Air Temperature(˚C):	27
Ambient Groundwater Temperature (˚C):	17
Proposed Treatment Temperature (˚C):	132
Treat Sequentially as # Sections:	1
Per-cent of site under building/pavement?	0%
What per-cent of cover material is concrete?	0%
What per-cent of site is public access?	0%
Is this a single array pilot test?	no
Vapor Extraction Required?	yes
Are Vents in Same Boreholes as Electrodes?	yes
Insulating Surface Cover Required?	yes
Impermeable Surface Seal Required?	yes
Separate Electrode Interval for Saturated Zone ?	no
Does Vadose Zone Need to be Pre-Heated?	no
Does Vadose Zone Need to be Pre-Dried?	no
Air Sparging?	no
Multiphase Extraction Required?	yes
Account for In Situ Degradation?	yes
Degradation Mechanism:	hydrolysis

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Site Hydrogeology

Layer Model	Soil Type	Top, ft bgs	Thickness, ft	Zone	Hydraulic Conduct. cm/sec
Upper Layer 1	Clay2	26.0	5.0	Saturated	2.73E-05
Upper Layer 2	Clay2	31.0	5.0	Saturated	2.73E-05
Heated Layer 1	Sandy Clay	36.0	13.0	Saturated	7.34E-05
Heated Layer 2	Clay2	49.0	8.0	Saturated	2.73E-05
Heated Layer 3	Clay	57.0	9.2	Saturated	1.08E-04
Heated Layer 4	Clay	66.2	5.8	Saturated	1.08E-04
Heated Layer 5	Sandy Clay	72.0	10.0	Saturated	7.34E-05
Lower Layer 1	Clay	82.0	5.0	Saturated	1.08E-04
Lower Layer 2	Clay	87.0	5.0	Saturated	1.08E-04

Layer Model	Groundwater Conductivity 25˚C (µS/cm):	Soil Resitivity (ohm-m)	Soil TOC (wt %)	Soil TPH (mg/kg)	Sorption Coefficient (Kd, L/Kg)
Upper Layer 1	2,600.0	18.0	0.09%	0	0.05
Upper Layer 2	2,600.0	18.0	0.09%	0	0.05
Heated Layer 1	2,600.0	19.1	0.09%	0	0.05
Heated Layer 2	2,600.0	18.0	0.09%	0	0.05
Heated Layer 3	2,600.0	13.7	0.09%	0	0.05
Heated Layer 4	2,600.0	13.7	0.09%	0	0.05
Heated Layer 5	2,600.0	19.1	0.09%	0	0.05
Lower Layer 1	2,600.0	13.7	0.09%	0	0.05
Lower Layer 2	2,600.0	13.7	0.09%	0	0.05

Layer Model	Intrinsic Permeability (cm2)	Soil Moisture Content (wt %)	Soil Total Porosity	Soil Dry Density (kg/L)	Soil Wet Density (kg/L)
Upper Layer 1	2.51E-10	22.7%	37.8%	1.68	2.17
Upper Layer 2	2.51E-10	22.7%	37.8%	1.68	2.17
Heated Layer 1	6.76E-10	23.1%	38.4%	1.66	2.16
Heated Layer 2	2.51E-10	22.7%	37.8%	1.68	2.17
Heated Layer 3	9.99E-10	31.9%	46.0%	1.46	2.14
Heated Layer 4	9.99E-10	31.9%	46.0%	1.46	2.14
Heated Layer 5	6.76E-10	23.1%	38.4%	1.66	2.16
Lower Layer 1	9.99E-10	31.9%	46.0%	1.46	2.14
Lower Layer 2	9.99E-10	31.9%	46.0%	1.46	2.14

Layer Model	Specific Yield (dimless)	Layer Transmissivity (m2/sec)	Sand Fraction (%)	Silt Fraction (%)	Clay Fraction (%)
Upper Layer 1	0.06	4.16E-07	20%	30%	50%
Upper Layer 2	0.06	4.16E-07	20%	30%	50%
Heated Layer 1	0.14	2.91E-06	49%	13%	37%
Heated Layer 2	0.06	6.65E-07	20%	30%	50%
Heated Layer 3	0.05	3.04E-06	14%	6%	81%
Heated Layer 4	0.05	1.92E-06	14%	6%	81%
Heated Layer 5	0.14	2.24E-06	49%	13%	37%
Lower Layer 1	0.05	1.65E-06	14%	6%	81%
Lower Layer 2	0.05	1.65E-06	14%	6%	81%

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Contaminant Properties

Controlling Contaminants:	DBCP	EDB	DCP	TCP
Contaminant CAS Number:	96-12-8	8003-07-04	78-87-05	96-18-4
Contaminant Molecular Weight (g/mol):	236.36	187.88	112.99	147.44
ıtaminant Boiling Temperature at 1 atm (°C):	196.0	131.6	96.8	156
Vapor Pressure (mmHg @25C)	0.6	11	53.3	3.1

Total Contaminant Mass (lb):	44
Total Contaminant Volume (gallons):	2

	Ambient (at 17°C)	Heated (at 132°C)
Weighted Ave.(W/A) Contaminant Water Solubility (mg/l):	4503.0	3465.6
W/A Contaminant Vapor Pressure (Torr):	8.6	781.9
W/A Contaminant Henry's Constant (mg/L air / mg/L aq):	0.03	0.63
W/A Contaminant NAPL Density (kg/L):	2.185	1.944
W/A Contaminant NAPL Dynamic Viscosity (cP):	1.811	0.509
W/A Contaminant NAPL Kinematic Viscosity (cSt):	0.829	0.262

Contaminant Distribution and Cleanup Targets

	Heated Layer 1	Heated Layer 2	Heated Layer 3	Heated Layer 4	Heated Layer 5
Zone:	Saturated	Saturated	Saturated	Saturated	Saturated
Volume (yd^3):	3,133.0	1,928.0	2,217.2	1,397.8	2,410.0
	Initial Soil Concentrations, Dry Basis (mg/kg)				
Peak:	61	15	2	1	1
Average:	4	1	0	0	0
Target:	0.01	0.01	0.01	0.01	0.01
	Initial Groundwater Concentrations (µg/L)				
Estimated Ave:	14,171.8	5,036.7	271	271	354
Target:	500.0	0.2	0	0	0
	Initial Mass Distribution (lb)				
NAPL present?:	no	no	no	no	no
Sorbed:	6.7	1.5	0.1	0.1	0.1
Dissolved:	28.4	6.2	0.5	0.3	0.5
Vapor:	0.0	0.0	0.0	0.0	0.0
NAPL:	0.0	0.0	0.0	0.0	0.0
Total Mass:	35.1	7.6	0.5	0.3	0.7
	Initial Saturations (v/v)				
Water	38.0%	37.6%	45.9%	45.9%	38.0%
Air	0.5%	0.2%	0.1%	0.1%	0.5%
NAPL	0.0%	0.0%	0.0%	0.0%	0.0%

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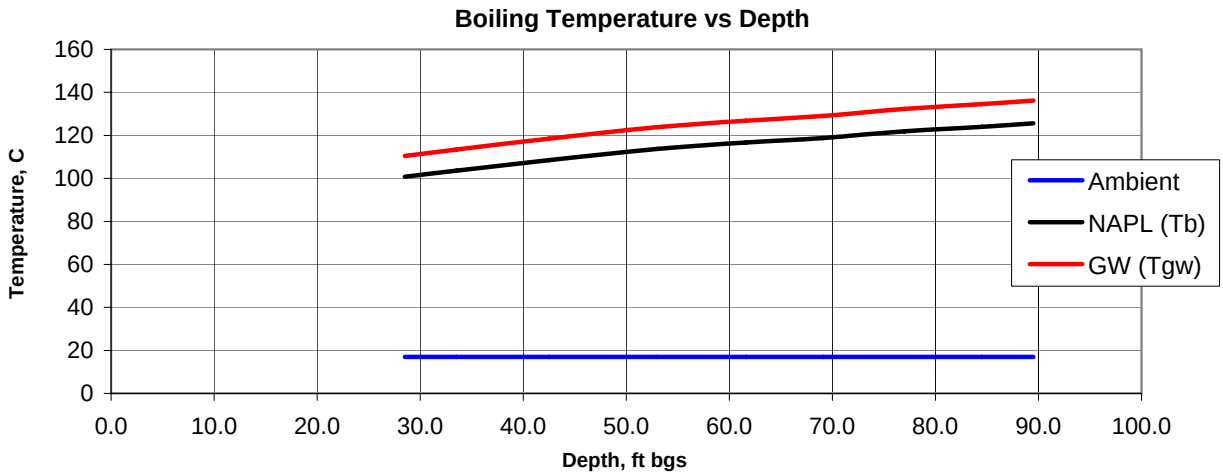
Estimated Treatment Temperatures & Pressure



	GW (˚C) Boiling Temperature	NAPL (˚C) Boiling Temperature	Ambient (˚C) Subsurface Temperature	Pressure at Boiling mm Hg	Layer Midpoint ft bgs
Upper Layer 1	110.4	100.7	17.0	1,087	28.5
Upper Layer 2	113.4	103.6	17.0	1,201	33.5
Heated Layer 1	118.4	108.5	17.0	1,416	42.5
Heated Layer 2	123.8	113.7	17.0	1,677	53.0
Heated Layer 3	126.8	116.6	17.0	1,838	61.6
Heated Layer 4	129.1	118.8	17.0	1,970	69.1
Heated Layer 5	132.3	121.9	17.0	2,164	77.0
Lower Layer 1	134.5	124.0	17.0	2,310	84.5
Lower Layer 2	136.1	125.6	17.0	2,423	89.5

Electrode Design Specifications

Number of Vertical Heating Intervals:	1	
Electrode and Extraction Well Terminations:	100% above grade	
Number of Temperature Monitoring Wells:	11	
Soil Cuttings from Electrode Installation:	80.1	tons
Average Wetting Rate (all Electrodes):	0.09	gpm
Total Volume of Drip Water Added:	25,116	gallons
Total Amount of Electrolyte Required:	1,564	Lb

	Primary	Upper
Electrode Diameter (inches):	3.0	n/a
Borehole Diameter (inches):	12.00	n/a
Array to Electrode Ratio (D/d):	32	n/a
Distance between Electrodes (ft):	16.0	n/a
Total Number of Electrodes:	27	n/a
Depth to Top of Electrode (ft):	36.0	n/a
Total Depth of Electrode (ft):	84.0	n/a
Conductive Zone Length (ft):	48.0	n/a
Length of Electrode in Vadose Zone (ft):	0.0	n/a
Length of Electrode in Groundwater (ft):	48.0	n/a
Number of Drip Intervals per Primary Electrode:	3	n/a
Electrode Drill Cuttings (tons):	80.1	n/a

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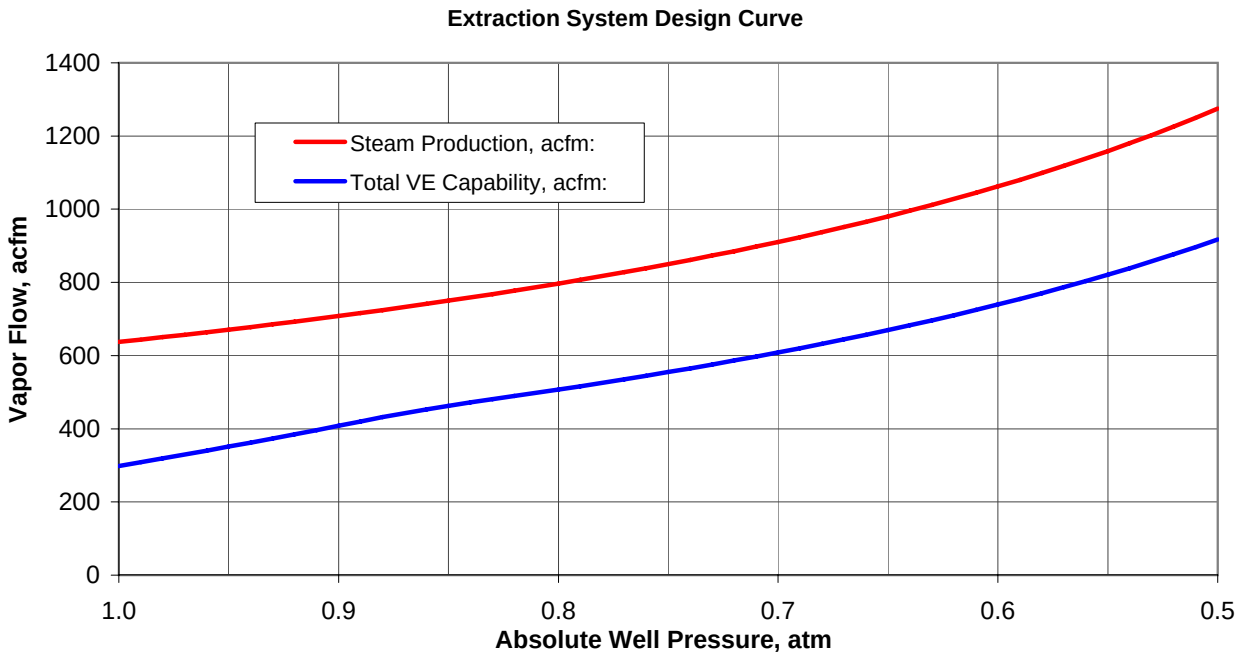
Extraction System Design

Design Extraction Vaccum:	0.80	atm
Well Vacuum:	6	in. Hg
Peak Steam Production Rate:	363	scfm
Peak Air Flow Rate:	0	scfm
Vapor Extraction Design Flow Rate:	370	scfm
Recommended Blower Vacuum:	10	in. Hg
Vapor Extraction Blower:	40	hp
SVE/DVE Wells Co-Located with Electrodes?	yes	
Average Condensate Production Rate:	3.66	gpm
Total Condensate Produced:	315,000	gallons
Peak Vapor Extraction Rate:	0.0	lb/day
Peak In Situ Degradation Rate:	0.8	lb/day
Average Total Cleanup Rate:	0.3	lb/day
Final Extraction Rate:	0.0	lb/day
Soil Cuttings from VE Well Installation:	0.0	tons
Vapor Treatment Method:	carbon	
Secondary Acid Gas Stack Scrubber:	not required	

	Shallow/VE	Horizontal	Deep/DVE
Type of Vents Required:	no	yes	yes
Vent Spacing (ft):	n/a	32	16
Number of Vents:	n/a	5	27
Wellbore/Trench Diameter (in.):	n/a	12.00	12.00
Screened Length per Vent (ft):	n/a	30.0	48.0
Peak Design Flow per Vent (acfm):	n/a	0.0	16.3
Wellscreen Diameter (in.):	n/a	1.0	3.0
Well Drill/Trenching Cuttings (tons):	n/a	0.0	0.0



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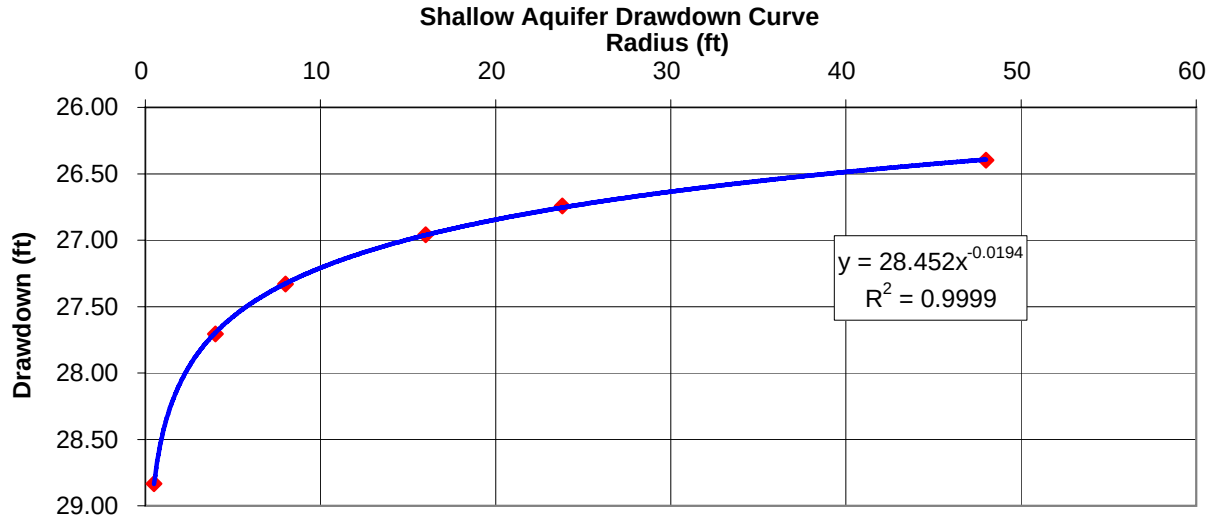
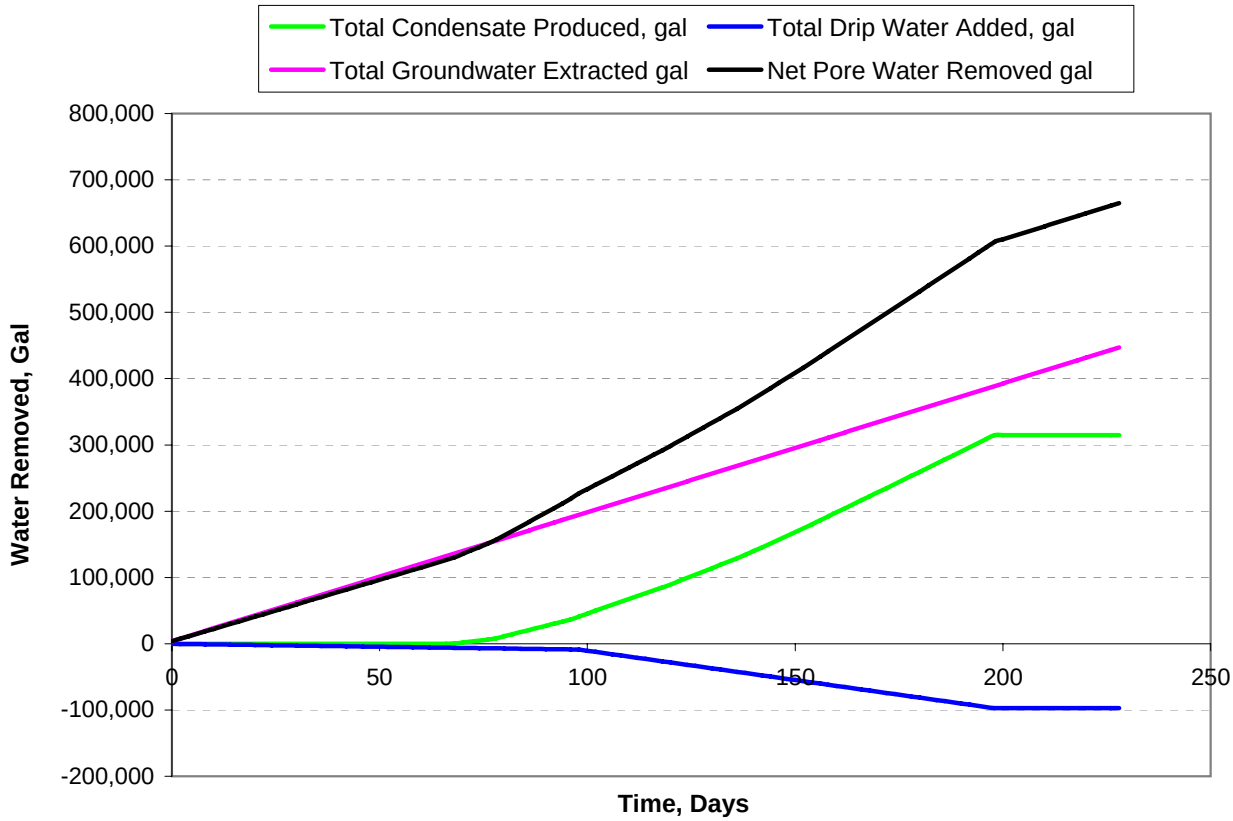
Groundwater Extraction & Overall Water Balance



Typical Depth to Groundwater: 26 ft bgs

			Peak (gpm)
Total Groundwater Extracted:	447,120	gallons	1.35
Total Condensate Produced:	315,000	gallons	2.15
Total Volume of Drip Water Added:	25,116	gallons	0.78
Total NAPL Extracted:	0	lb	



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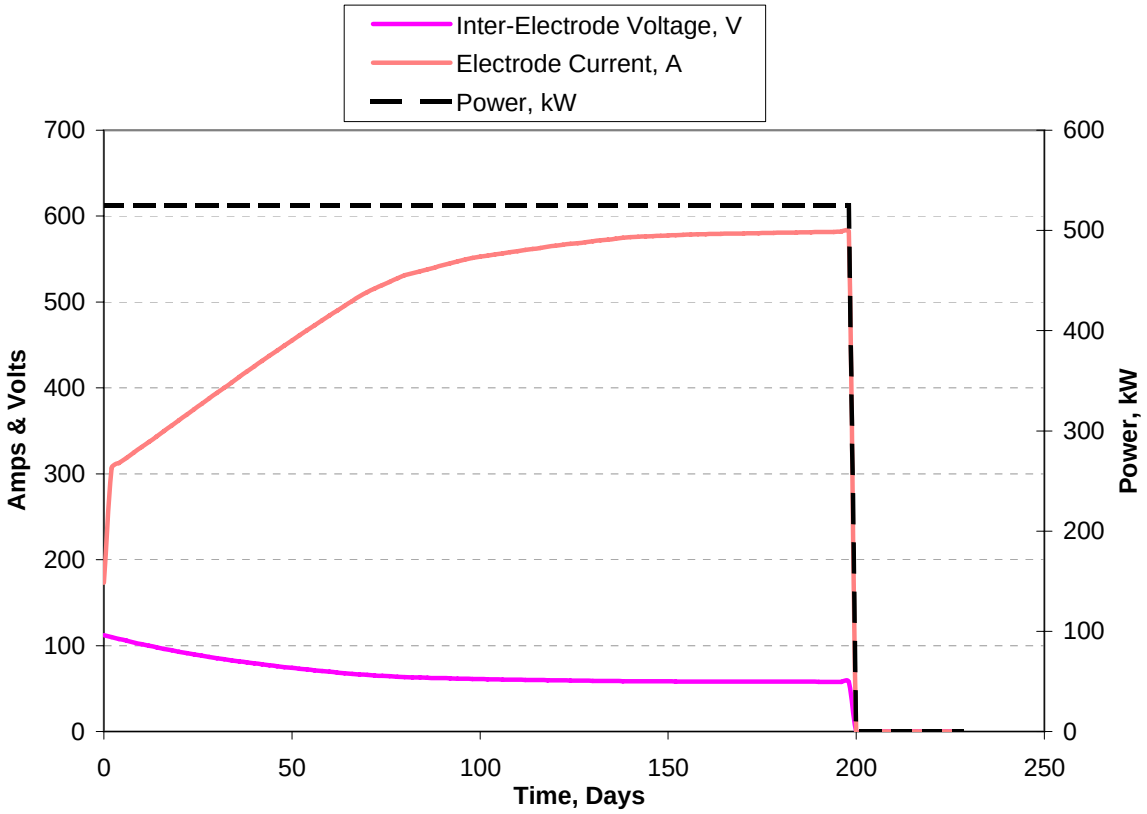
Estimated Treatment Time & Energy Requirements

Time to Pre-Heat/Dry Vadose Zone:	0	days
Time to Heat-up Site:	98	days
Time to Treat Site:	102	days
Extra Time for Multiphase Extraction:	0	days
Total Treatment Time:	200	days
Subsurface Energy Estimate:	2,520,000	kW-hr
Subsurface Energy Density:	227	kw hr/yd3
Total Energy Estimate:	2,748,343	kW-hr

Power Supply Specifications & Electrical Requirements



Site Electrical Power Requirement:	1,000	kW
Site Service Requirement at 480V, 3-Phase:	1,100	Amps
Power Supply Rating:	750	kW
Peak Electrode Voltage:	112	Volts
Peak Phase Current:	5,237	Amps
Number of Electrode Phases:	3	

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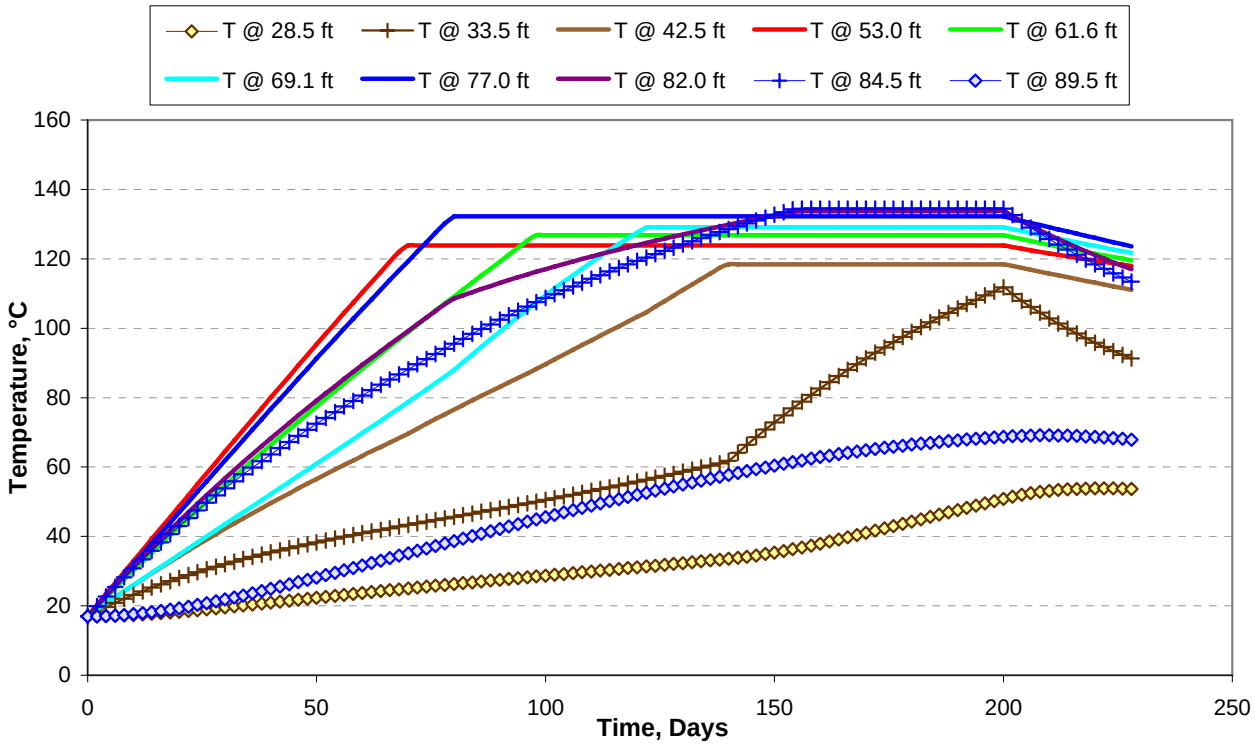
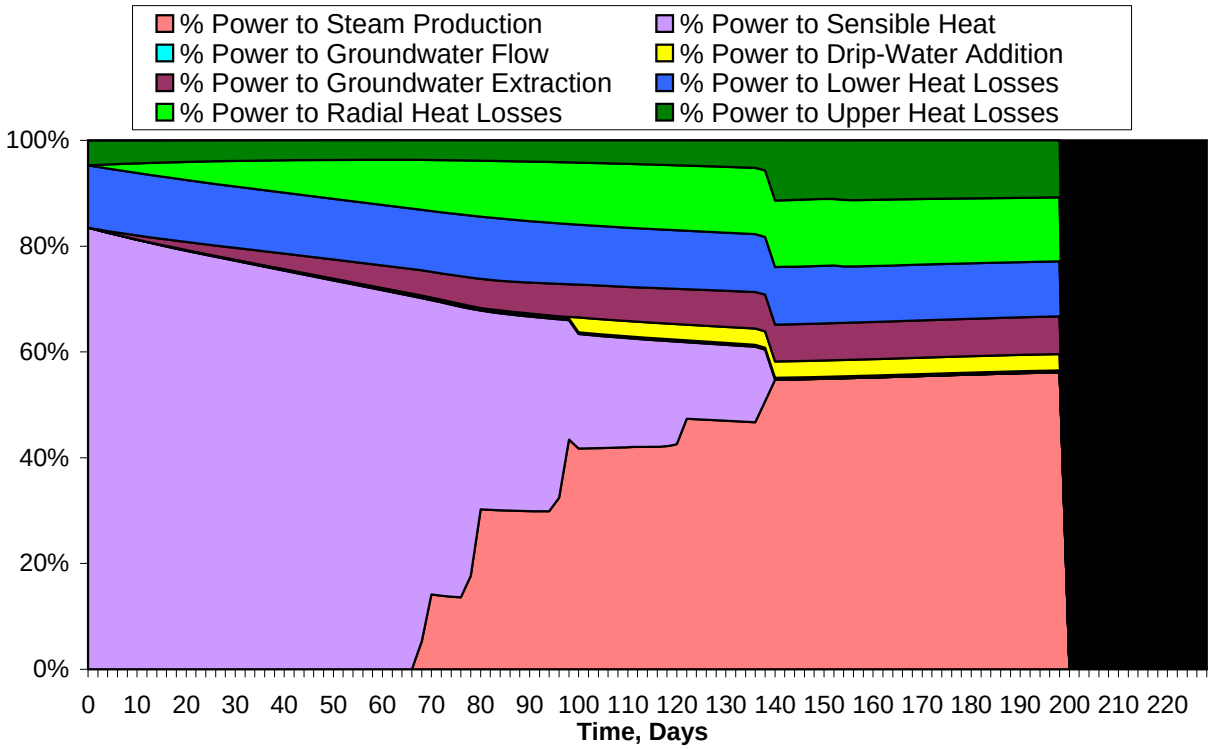
Predicted Subsurface Temperature Trends



Estimated Subsurface Energy Distribution



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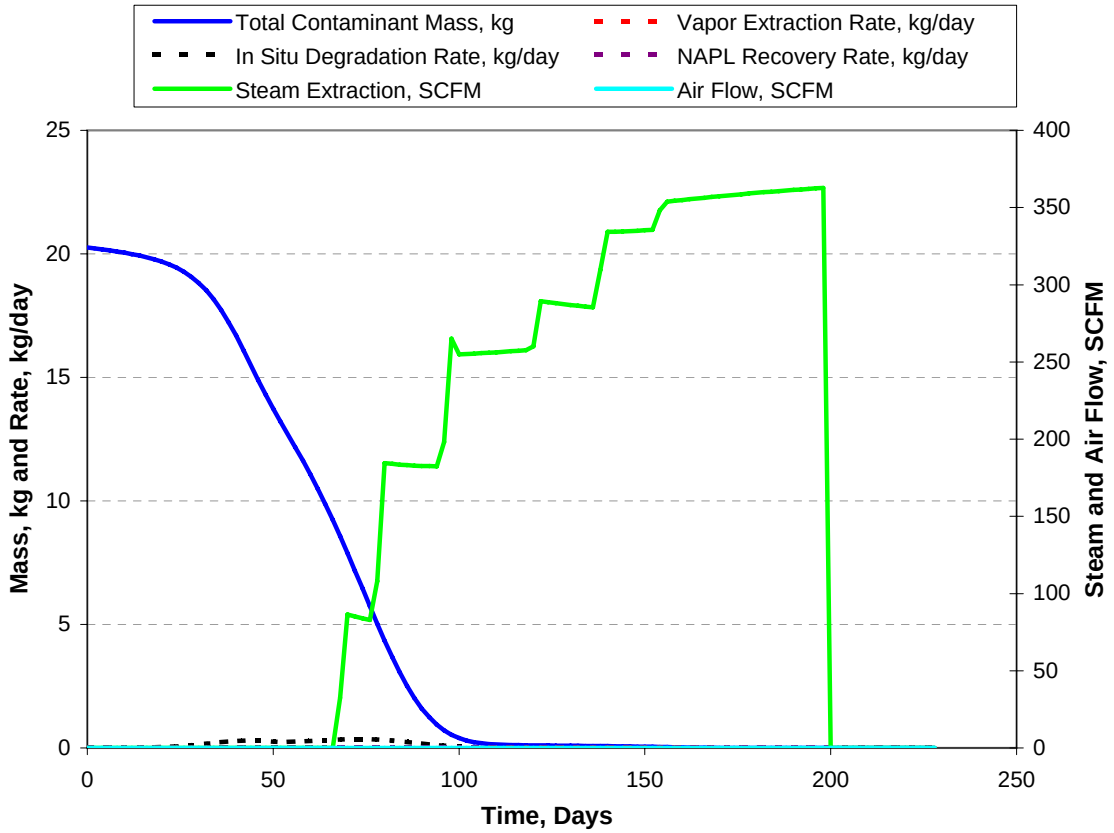
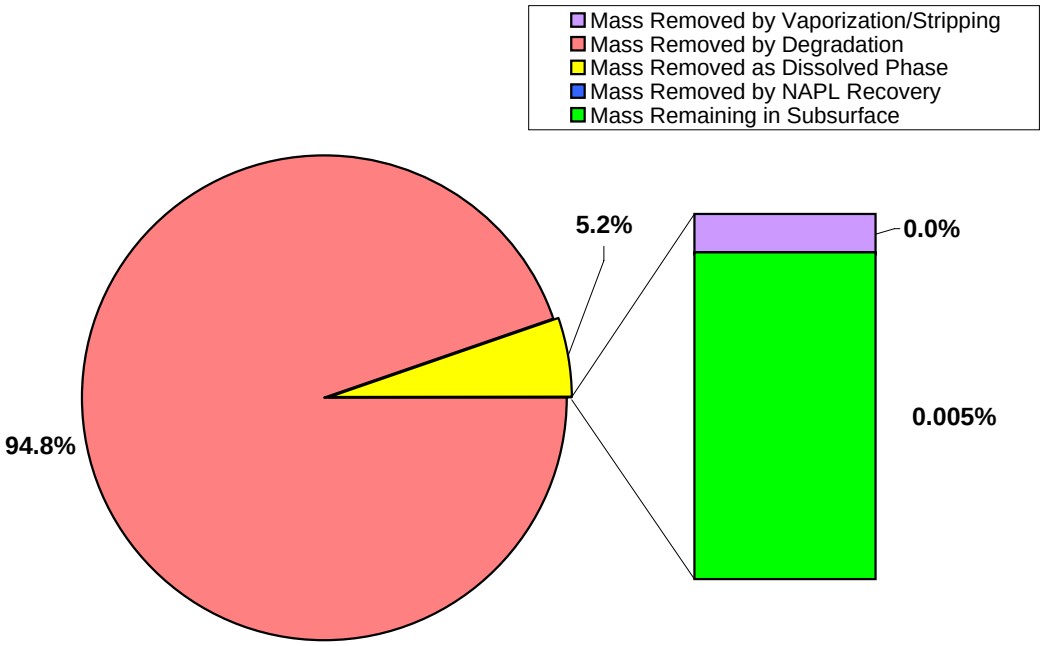
Projected Treatment Performance and Removal rates



Contaminant Fate Projection



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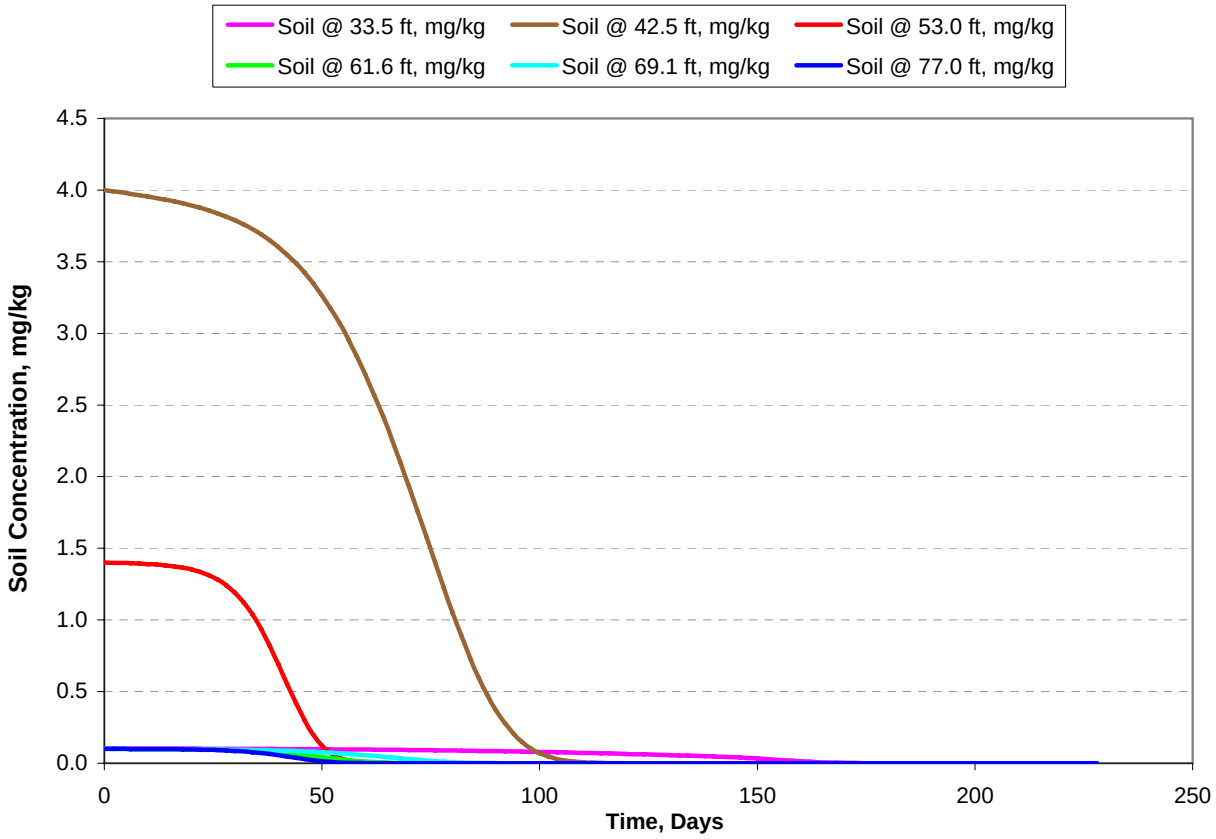
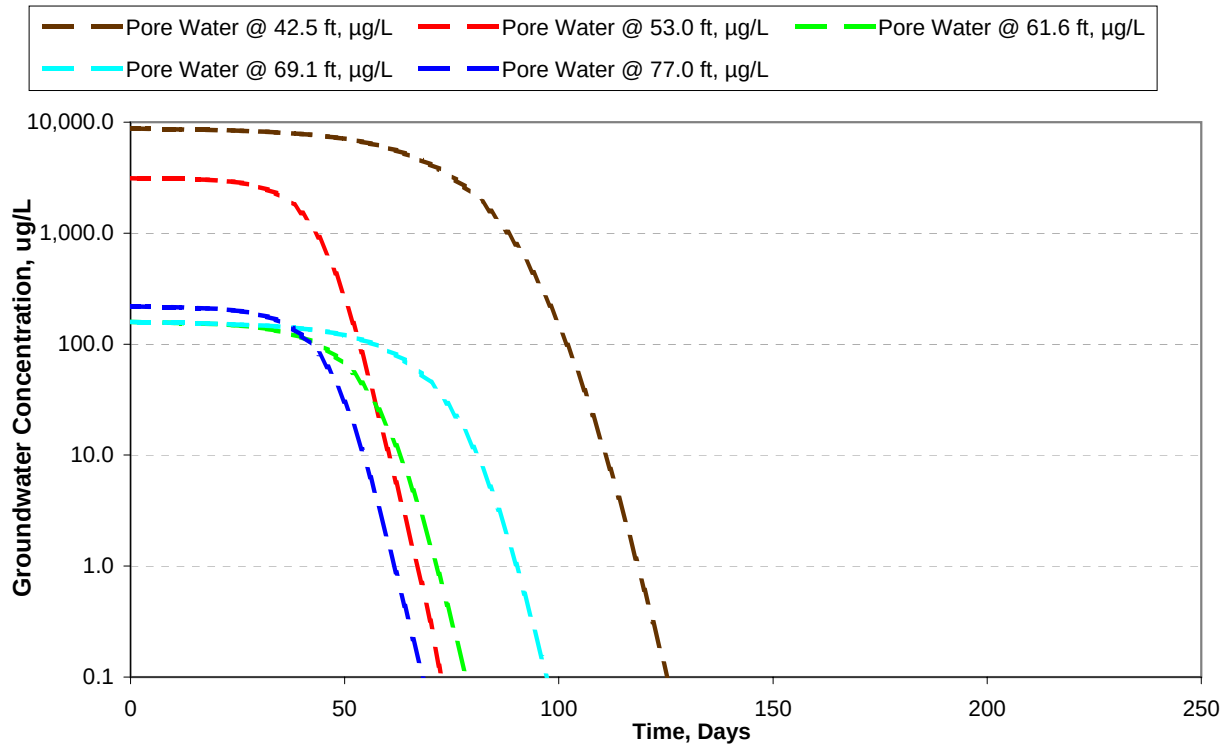
Predicted Soil and Groundwater Concentrations





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ISTT Frontier Fertilizer, Davis, CA

PRE-FINAL RAMP: 0-40 ISTT Design, DBCP

CES Project: 78-0033

Prepared for:

CH2MHill
2485 Natomas Park Dr.
Suite 600
Sacramento, CA 95833
T: (916) 920-0300
F: (916) 920-8463

Contract: EP-S9-o8-04
CH2M Hill Proj: 384210.ID.01
Submittal 0006
Specification 01400
Revision 2
RAMP Pre-final
Treatment Zone 0-40 ft bgs

Site Specifics & Design Overview

State?	CA
Site Zip Code?	65803
Six Phase Heating Treatment Area (ft^2):	5,941
Shape of Treatment Area (circle, rectangle, oval):	rectangle
Treatment Area Length (ft):	120
Treatment Area Width/Diameter (ft):	44
Treatment Area Perimeter (ft):	328
Shallow Extent of Six Phase Heating (ft):	6
Deep Extent of Six Phase Heating (ft):	42
Typical Depth to Groundwater (ft):	26
Treated Volume (yd^3):	8,361
Compare to Excavation Option (tons):	11,100
Annual Rainfall (in):	15
Groundwater Flow Velocity (ft/day):	0.01
Ambient Air Temperature(˚C):	27
Ambient Groundwater Temperature (˚C):	17
Proposed Treatment Temperature (˚C):	115
Treat Sequentially as # Sections:	1
Per-cent of site under building/pavement?	0%
What per-cent of cover material is concrete?	0%
What per-cent of site is public access?	0%
Is this a single array pilot test?	no
Vapor Extraction Required?	yes
Are Vents in Same Boreholes as Electrodes?	yes
Insulating Surface Cover Required?	yes
Impermeable Surface Seal Required?	yes
Separate Electrode Interval for Saturated Zone ?	no
Does Vadose Zone Need to be Pre-Heated?	no
Does Vadose Zone Need to be Pre-Dried?	no
Air Sparging?	no
Multiphase Extraction Required?	yes
Account for In Situ Degradation?	yes
Degradation Mechanism:	tests needed

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Site Hydrogeology

Layer Model	Soil Type	Top, ft bgs	Thickness, ft	Zone	Hydraulic Conduct. cm/sec
Upper Layer 1	Sandy Clay Loam	0.0	3.0	Vadose	3.53E-04
Upper Layer 2	Clay	3.0	3.0	Vadose	1.08E-04
Heated Layer 1	Clay	6.0	7.2	Vadose	1.08E-04
Heated Layer 2	Clay	13.2	6.8	Vadose	1.08E-04
Heated Layer 3	Clay	20.0	6.0	Vadose	1.08E-04
Heated Layer 4	Clay2	26.0	9.0	Saturated	2.73E-05
Heated Layer 5	Sandy Clay	35.0	7.0	Saturated	7.34E-05
Lower Layer 1	Sandy Clay	42.0	5.0	Saturated	7.34E-05
Lower Layer 2	Sandy Clay	47.0	5.0	Saturated	7.34E-05

Layer Model	Groundwater Conductivity 25˚C (µS/cm):	Soil Resitivity (ohm-m)	Soil TOC (wt %)	Soil TPH (mg/kg)	Sorption Coefficient (Kd, L/Kg)
Upper Layer 1	1,733.3	76.1	0.09%	0	7.98
Upper Layer 2	1,733.3	26.2	0.09%	0	8.30
Heated Layer 1	1,733.3	26.0	0.09%	0	8.89
Heated Layer 2	1,733.3	24.8	0.09%	0	9.58
Heated Layer 3	2,600.0	16.8	0.09%	0	9.58
Heated Layer 4	2,600.0	18.0	0.09%	0	9.58
Heated Layer 5	2,080.0	22.2	0.09%	0	9.58
Lower Layer 1	2,080.0	22.2	0.09%	0	9.58
Lower Layer 2	2,080.0	22.2	0.09%	0	9.58

Layer Model	Intrinsic Permeability (cm2)	Soil Moisture Content (wt %)	Soil Total Porosity	Soil Dry Density (kg/L)	Soil Wet Density (kg/L)
Upper Layer 1	3.25E-09	9.1%	39.6%	1.63	1.79
Upper Layer 2	9.99E-10	22.6%	46.0%	1.46	1.88
Heated Layer 1	9.99E-10	23.3%	46.0%	1.46	1.90
Heated Layer 2	9.99E-10	24.8%	46.0%	1.46	1.94
Heated Layer 3	9.99E-10	27.8%	46.0%	1.46	2.02
Heated Layer 4	2.51E-10	22.7%	37.8%	1.68	2.17
Heated Layer 5	6.76E-10	23.1%	38.4%	1.66	2.16
Lower Layer 1	6.76E-10	23.1%	38.4%	1.66	2.16
Lower Layer 2	6.76E-10	23.1%	38.4%	1.66	2.16

Layer Model	Specific Yield (dimless)	Layer Transmissivity (m2/sec)	Sand Fraction (%)	Silt Fraction (%)	Clay Fraction (%)
Upper Layer 1	0.16	3.23E-06	58%	15%	27%
Upper Layer 2	0.05	9.92E-07	14%	6%	81%
Heated Layer 1	0.05	2.38E-06	14%	6%	81%
Heated Layer 2	0.05	2.25E-06	14%	6%	81%
Heated Layer 3	0.05	1.98E-06	14%	6%	81%
Heated Layer 4	0.06	7.48E-07	20%	30%	50%
Heated Layer 5	0.14	1.57E-06	49%	13%	37%
Lower Layer 1	0.14	1.12E-06	49%	13%	37%
Lower Layer 2	0.14	1.12E-06	49%	13%	37%

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Contaminant Properties

Controlling Contaminants:	DBCP	EDB	DCP	TCP
Contaminant CAS Number:	96-12-8	8003-07-04	78-87-05	96-18-4
Contaminant Molecular Weight (g/mol):	236.36	187.88	112.99	147.44
ıtaminant Boiling Temperature at 1 atm (°C):	196.0	131.6	96.8	156
Vapor Pressure (mmHg @25C)	0.6	11	53.3	3.1

Total Contaminant Mass (lb):	20
Total Contaminant Volume (gallons):	1

	Ambient (at 17°C)	Heated (at 115°C)
Weighted Ave.(W/A) Contaminant Water Solubility (mg/l):	61.8	65.2
W/A Contaminant Vapor Pressure (Torr):	0.5	94.5
W/A Contaminant Henry's Constant (mg/L air / mg/L aq):	0.10	9.63
W/A Contaminant NAPL Density (kg/L):	1.967	1.792
W/A Contaminant NAPL Dynamic Viscosity (cP):	3.323	0.810
W/A Contaminant NAPL Kinematic Viscosity (cSt):	1.689	0.452

Contaminant Distribution and Cleanup Targets

	Heated Layer 1	Heated Layer 2	Heated Layer 3	Heated Layer 4	Heated Layer 5
Zone:	Vadose	Vadose	Vadose	Saturated	Saturated
Volume (yd^3):	1,406.1	1,328.0	1,171.8	1,757.7	1,367.1
	Initial Soil Concentrations, Dry Basis (mg/kg)				
Peak:	61	15	2	1	1
Average:	4	1	0	0	0
Target:	0.01	0.01	0.01	0.01	0.01
	Initial Groundwater Concentrations (µg/L)				
Estimated Ave:	n/a	n/a	n/a	10	10
Target:	n/a	n/a	n/a	0	0
	Initial Mass Distribution (lb)				
NAPL present?:	no	no	no	no	no
Sorbed:	13.4	4.4	0.3	0.5	0.4
Dissolved:	0.3	0.1	0.0	0.0	0.0
Vapor:	0.0	0.0	0.0	0.0	0.0
NAPL:	0.0	0.0	0.0	0.0	0.0
Total Mass:	13.8	4.6	0.3	0.5	0.4
	Initial Saturations (v/v)				
Water	33.6%	35.7%	39.9%	37.6%	38.0%
Air	12.5%	10.4%	6.1%	0.2%	0.5%
NAPL	0.0%	0.0%	0.0%	0.0%	0.0%

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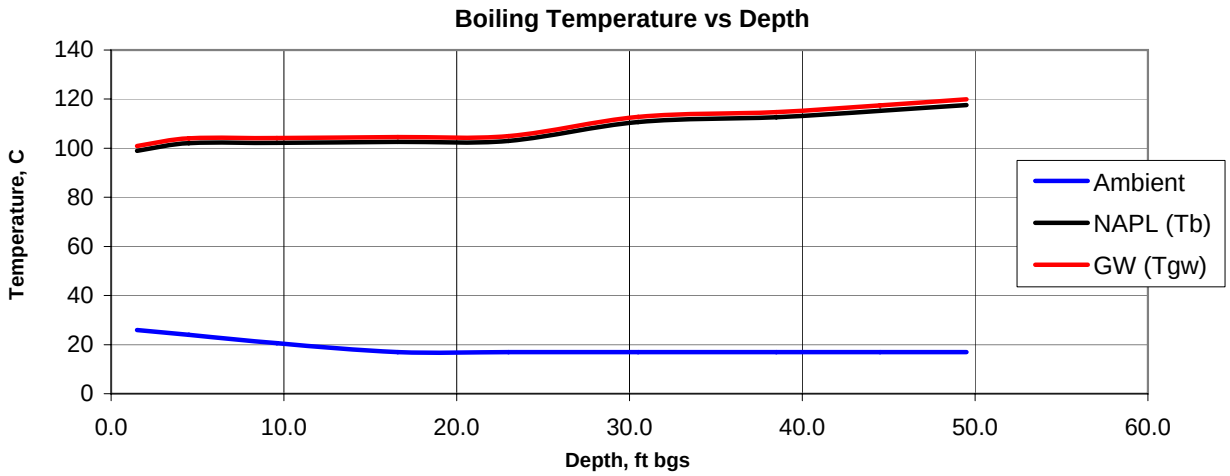
Estimated Treatment Temperatures & Pressure



	GW (˚C) Boiling Temperature	NAPL (˚C) Boiling Temperature	Ambient (˚C) Subsurface Temperature	Pressure at Boiling mm Hg	Layer Midpoint ft bgs
Upper Layer 1	100.9	99.0	26.0	784	1.5
Upper Layer 2	104.0	102.1	24.0	876	4.5
Heated Layer 1	104.2	102.2	20.6	881	9.6
Heated Layer 2	104.5	102.5	17.0	889	16.6
Heated Layer 3	105.0	103.0	17.0	905	23.0
Heated Layer 4	112.8	110.6	17.0	1,178	30.5
Heated Layer 5	114.8	112.6	17.0	1,257	38.5
Lower Layer 1	117.4	115.2	17.0	1,370	44.5
Lower Layer 2	119.9	117.6	17.0	1,484	49.5

Electrode Design Specifications

Number of Vertical Heating Intervals:	1	
Electrode and Extraction Well Terminations:	100% above grade	
Number of Temperature Monitoring Wells:	11	
Soil Cuttings from Electrode Installation:	56.1	tons
Average Wetting Rate (all Electrodes):	0.36	gpm
Total Volume of Drip Water Added:	103,659	gallons
Total Amount of Electrolyte Required:	6,457	Lb

	Primary	Upper
Electrode Diameter (inches):	3.0	n/a
Borehole Diameter (inches):	12.00	n/a
Array to Electrode Ratio (D/d):	32	n/a
Distance between Electrodes (ft):	16.0	n/a
Total Number of Electrodes:	27	n/a
Depth to Top of Electrode (ft):	6.0	n/a
Total Depth of Electrode (ft):	44.0	n/a
Conductive Zone Length (ft):	38.0	n/a
Length of Electrode in Vadose Zone (ft):	20.0	n/a
Length of Electrode in Groundwater (ft):	18.0	n/a
Number of Drip Intervals per Primary Electrode:	3	n/a
Electrode Drill Cuttings (tons):	56.1	n/a

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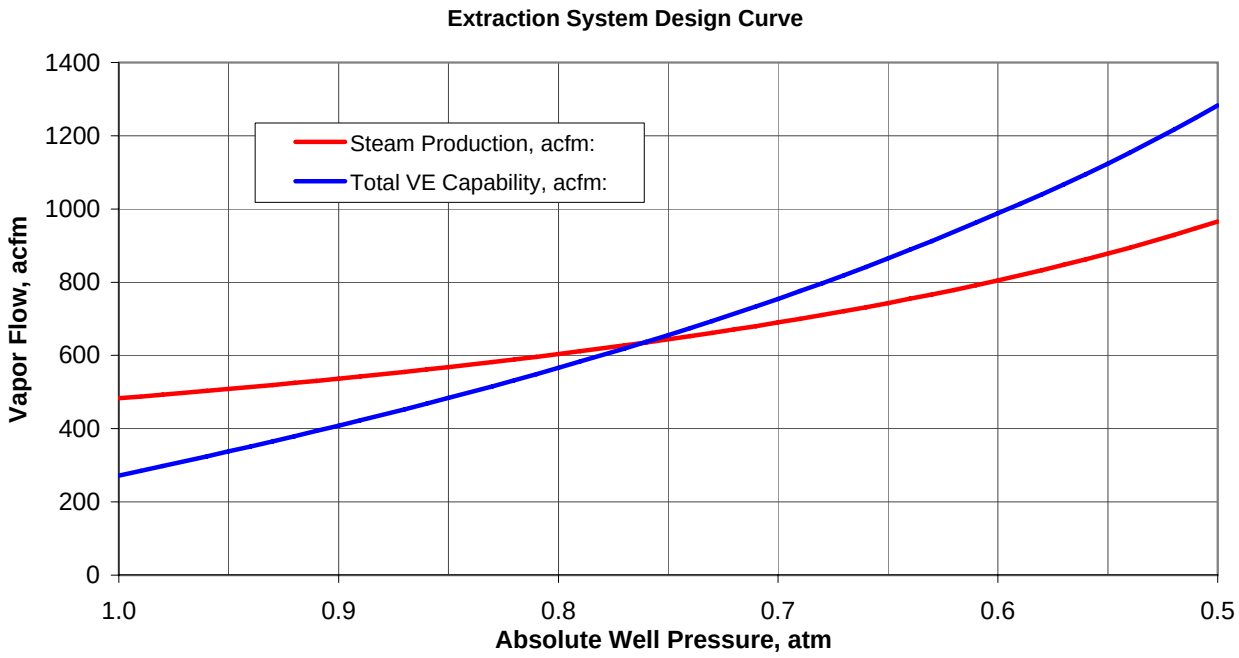
Extraction System Design

Design Extraction Vaccum:	0.77	atm
Well Vacuum:	7	in. Hg
Peak Steam Production Rate:	321	scfm
Peak Air Flow Rate:	77	scfm
Vapor Extraction Design Flow Rate:	340	scfm
Recommended Blower Vacuum:	10	in. Hg
Vapor Extraction Blower:	30	hp
SVE/DVE Wells Co-Located with Electrodes?	yes	
Average Condensate Production Rate:	2.00	gpm
Total Condensate Produced:	347,200	gallons
Peak Vapor Extraction Rate:	0.9	lb/day
Peak In Situ Degradation Rate:	0.1	lb/day
Average Total Cleanup Rate:	0.1	lb/day
Final Extraction Rate:	0.0	lb/day
Soil Cuttings from VE Well Installation:	0.0	tons
Vapor Treatment Method:	carbon	
Secondary Acid Gas Stack Scrubber:	not required	

	Shallow/VE	Horizontal	Deep/DVE
Type of Vents Required:	yes	yes	yes
Vent Spacing (ft):	16	32	16
Number of Vents:	27	5	27
Wellbore/Trench Diameter (in.):	12.00	12.00	12.00
Screened Length per Vent (ft):	23.0	30.0	18.0
Peak Design Flow per Vent (acfm):	14.6	12.5	5.7
Wellscreen Diameter (in.):	3.0	1.0	3.0
Well Drill/Trenching Cuttings (tons):	0.0	0.0	0.0



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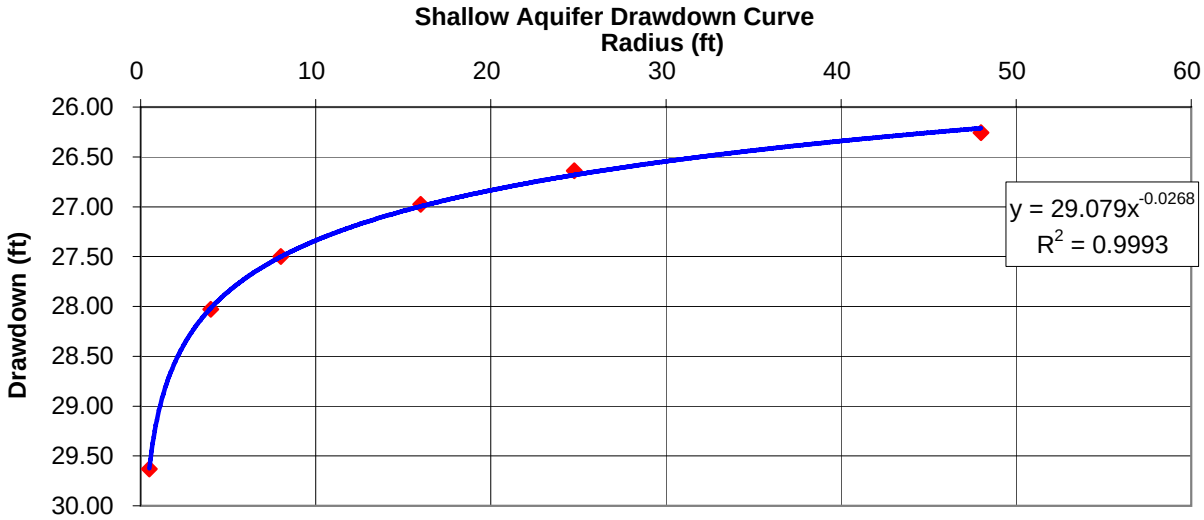
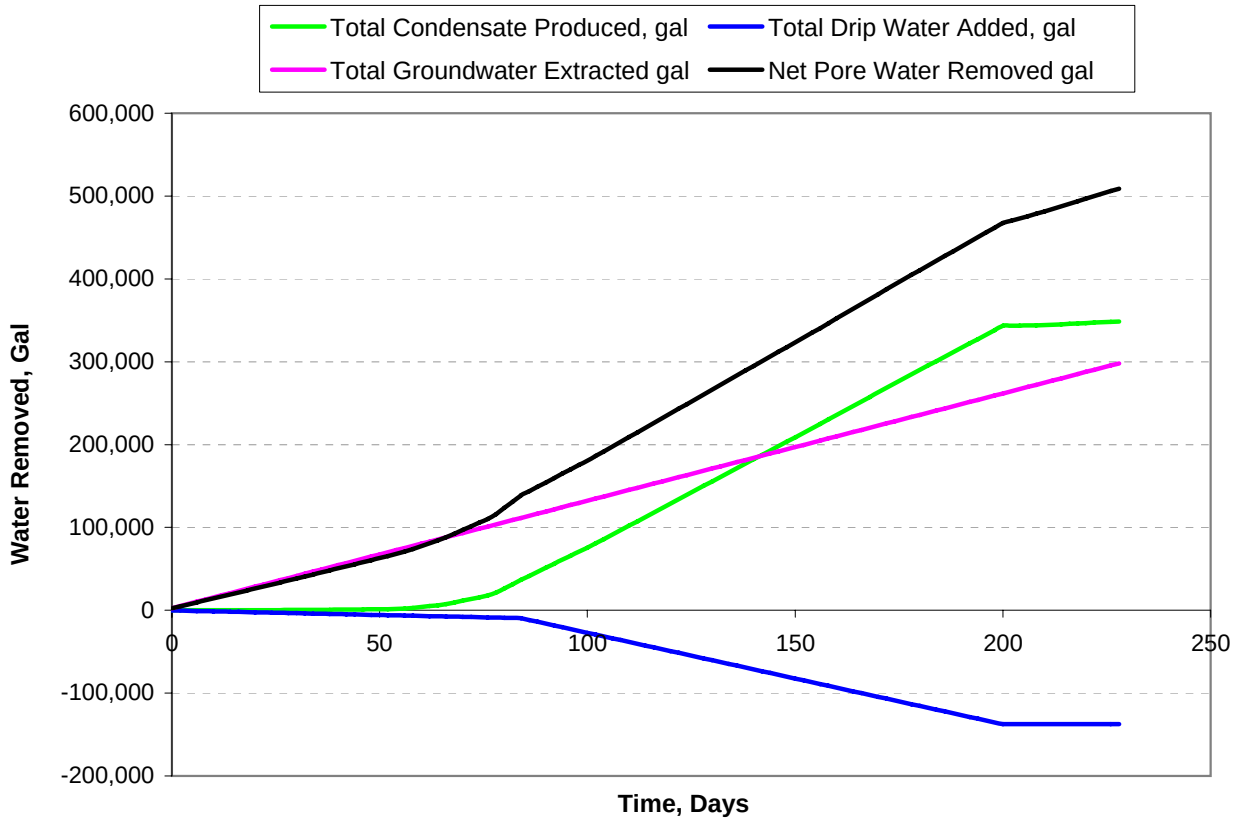
Groundwater Extraction & Overall Water Balance



Typical Depth to Groundwater: 26 ft bgs

Total Groundwater Extracted:	298,080	gallons
Total Condensate Produced:	347,200	gallons
Total Volume of Drip Water Added:	103,659	gallons
Total NAPL Extracted:	0	lb



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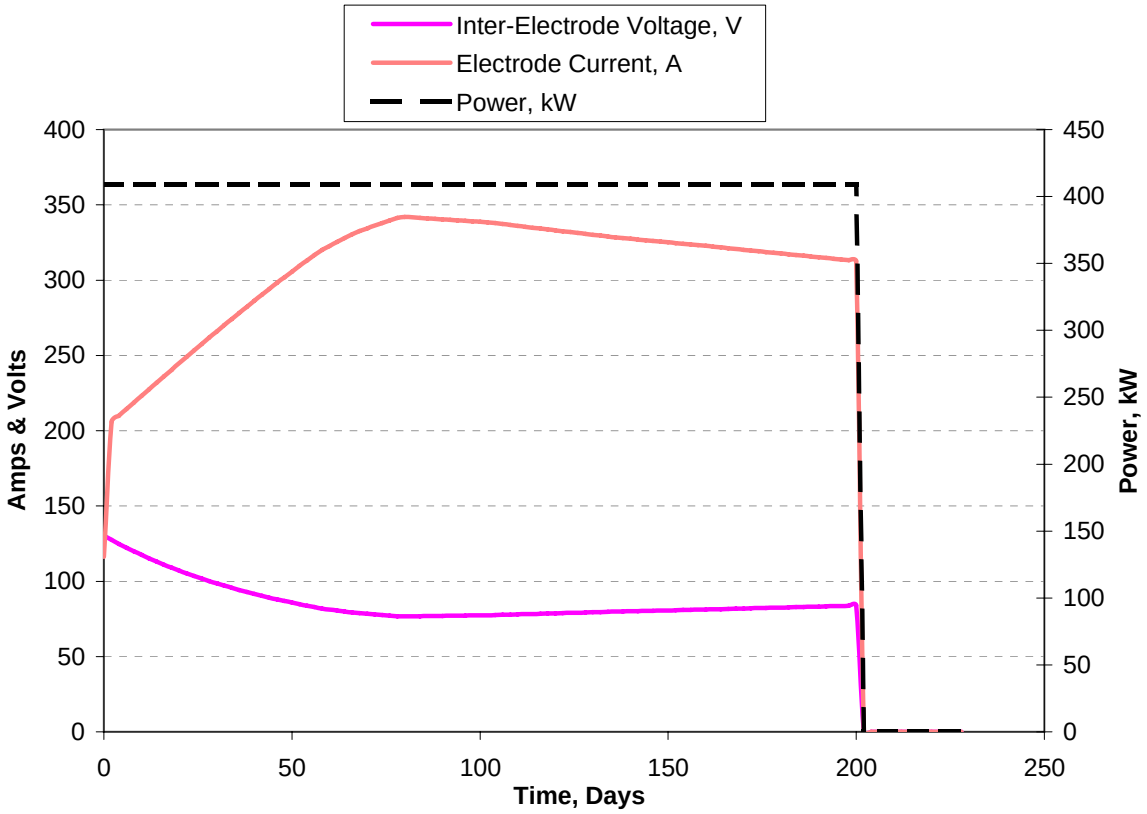
Estimated Treatment Time & Energy Requirements

Time to Pre-Heat/Dry Vadose Zone:	0	days
Time to Heat-up Site:	85	days
Time to Treat Site:	115	days
Extra Time for Multiphase Extraction:	0	days
Total Treatment Time:	200	days
Subsurface Energy Estimate:	1,981,500	kW-hr
Subsurface Energy Density:	250	kw hr/yd3
Total Energy Estimate:	2,167,421	kW-hr

Power Supply Specifications & Electrical Requirements



Site Electrical Power Requirement:	1,000	kW
Site Service Requirement at 480V, 3-Phase:	1,100	Amps
Power Supply Rating:	750	kW
Peak Electrode Voltage:	130	Volts
Peak Phase Current:	3,078	Amps
Number of Electrode Phases:	3	

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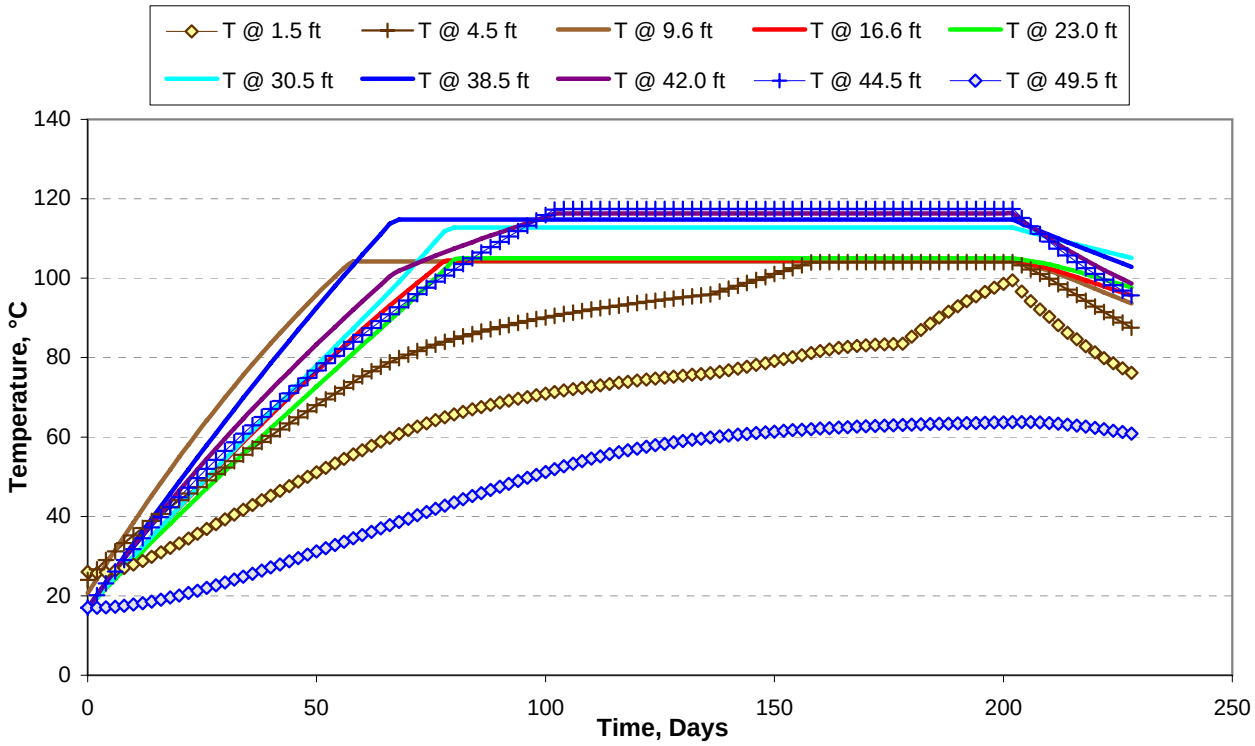
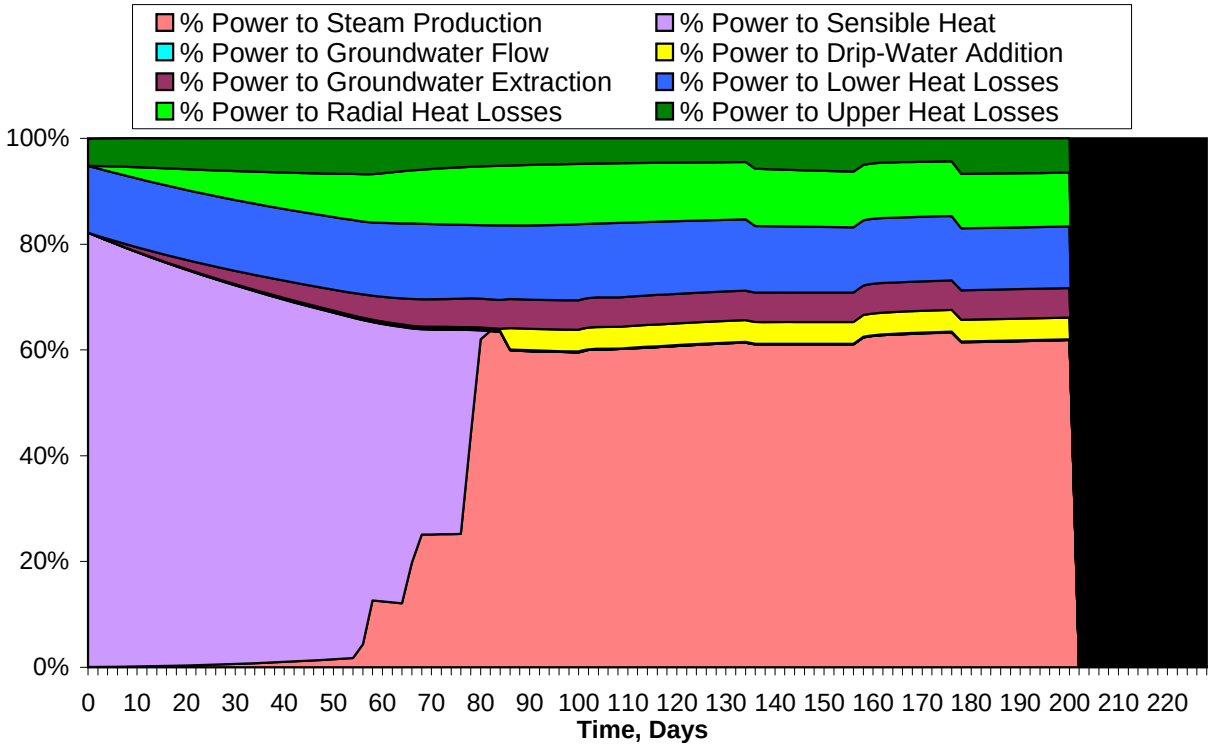
Predicted Subsurface Temperature Trends



Estimated Subsurface Energy Distribution



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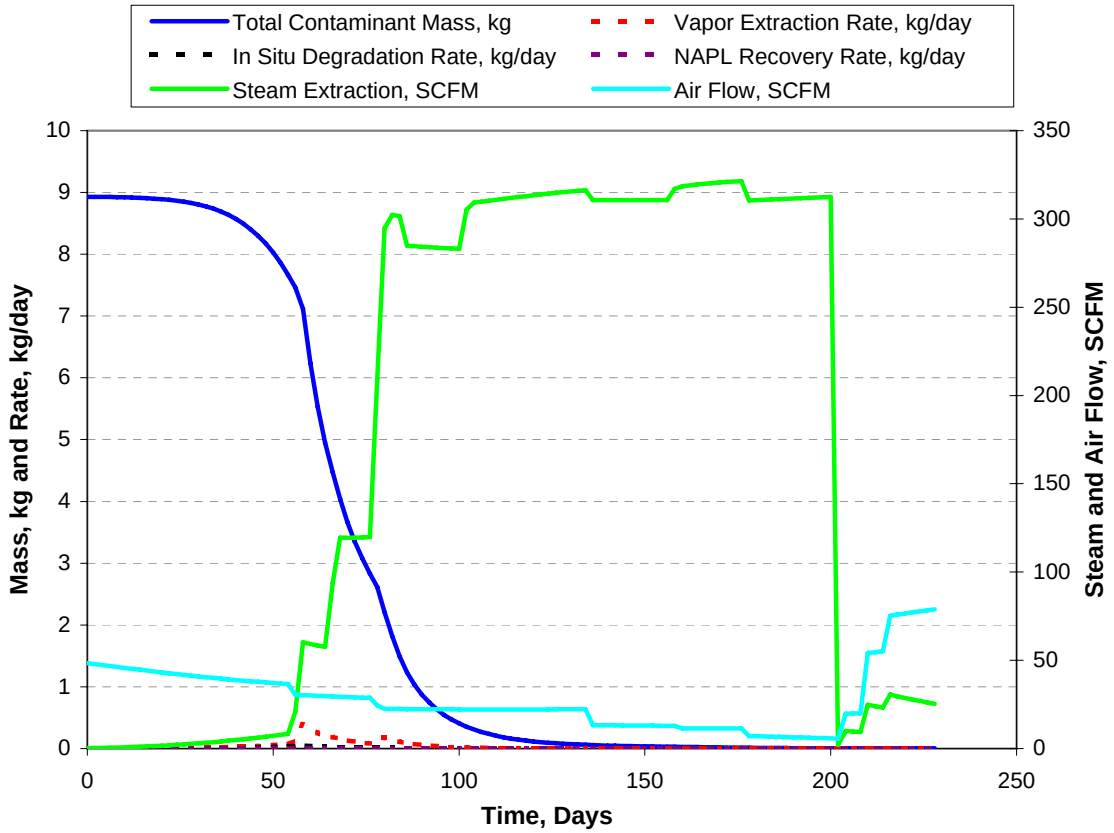
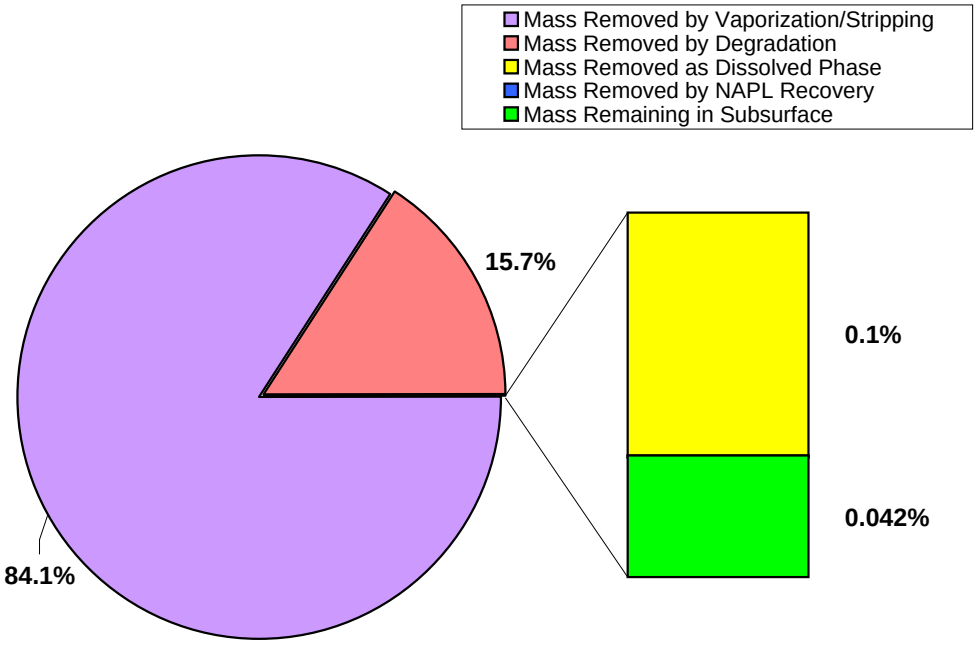
Projected Treatment Performance and Removal rates



Contaminant Fate Projection



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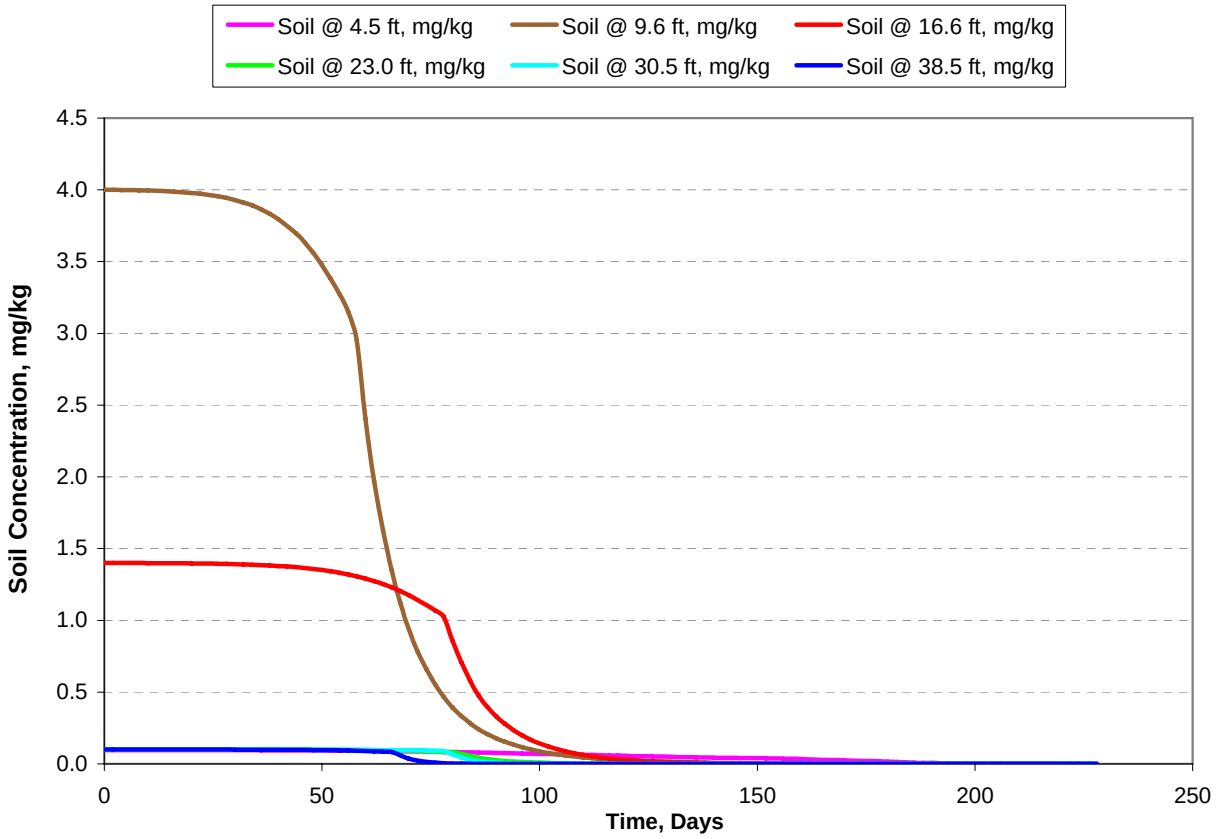
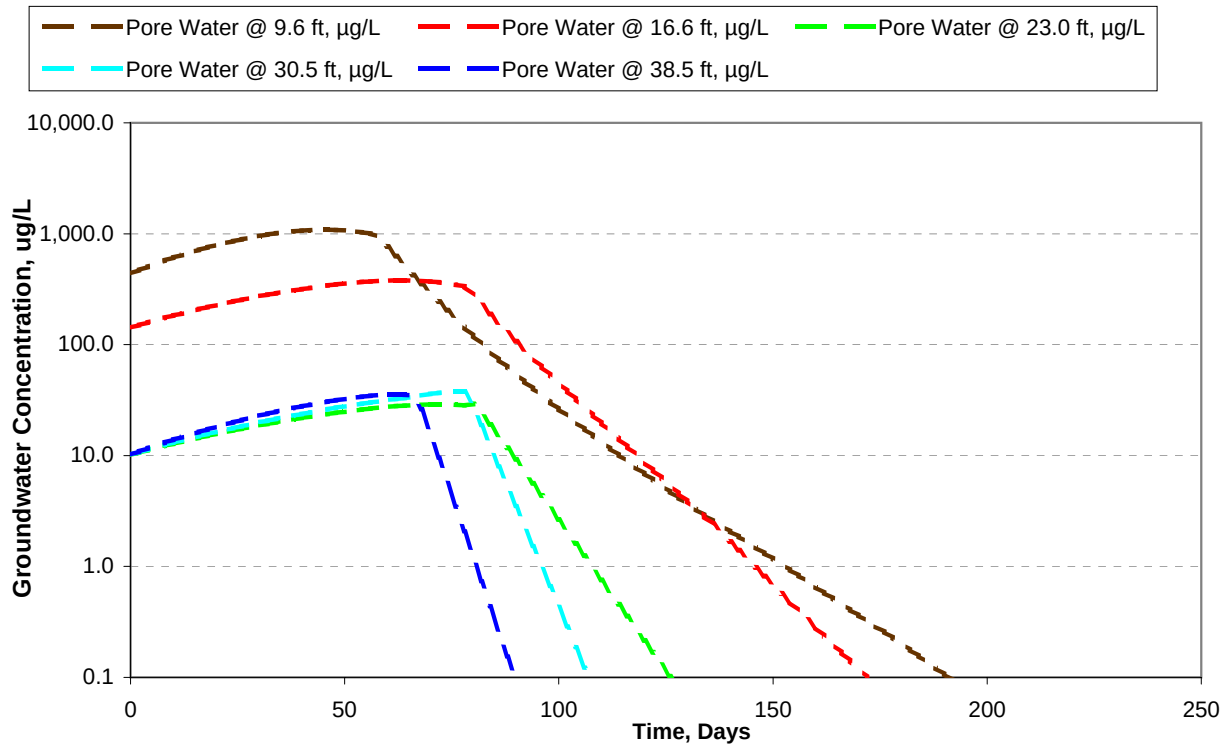
Predicted Soil and Groundwater Concentrations





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ISTT Frontier Fertilizer, Davis, CA

PRE-FINAL RAMP: 40-80 FT ISTT DESIGN-DBCP

CES Project: 78-0033

Prepared for: CH2MHill
2485 Natomas Park Dr.
Suite 600
Sacramento, CA 95833
T: (916) 920-0300
F: (916) 920-8463

Contract: EP-S9-08-04
CH2MHill No. 384210.ID.01
Submittal 6
Specification 01400
Revision 2
RAMP Pre-final
Treatment zone 40-80 ft BGS

Site Specifics & Design Overview

State?	CA
Site Zip Code?	65803
Six Phase Heating Treatment Area (ft^2):	6,507
Shape of Treatment Area (circle, rectangle, oval):	rectangle
Treatment Area Length (ft):	120
Treatment Area Width/Diameter (ft):	54
Treatment Area Perimeter (ft):	348
Shallow Extent of Six Phase Heating (ft):	36
Deep Extent of Six Phase Heating (ft):	82
Typical Depth to Groundwater (ft):	26
Treated Volume (yd^3):	11,568
Compare to Excavation Option (tons):	26,700
Annual Rainfall (in):	15
Groundwater Flow Velocity (ft/day):	0.01
Ambient Air Temperature(˚C):	27
Ambient Groundwater Temperature (˚C):	17
Proposed Treatment Temperature (˚C):	132
Treat Sequentially as # Sections:	1
Per-cent of site under building/pavement?	0%
What per-cent of cover material is concrete?	0%
What per-cent of site is public access?	0%
Is this a single array pilot test?	no
Vapor Extraction Required?	yes
Are Vents in Same Boreholes as Electrodes?	yes
Insulating Surface Cover Required?	yes
Impermeable Surface Seal Required?	yes
Separate Electrode Interval for Saturated Zone ?	no
Does Vadose Zone Need to be Pre-Heated?	no
Does Vadose Zone Need to be Pre-Dried?	no
Air Sparging?	no
Multiphase Extraction Required?	yes
Account for In Situ Degradation?	yes
Degradation Mechanism:	hydrolysis

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Site Hydrogeology

Layer Model	Soil Type	Top, ft bgs	Thickness, ft	Zone	Hydraulic Conduct. cm/sec
Upper Layer 1	Clay2	26.0	5.0	Saturated	2.73E-05
Upper Layer 2	Clay2	31.0	5.0	Saturated	2.73E-05
Heated Layer 1	Sandy Clay	36.0	13.0	Saturated	7.34E-05
Heated Layer 2	Clay2	49.0	8.0	Saturated	2.73E-05
Heated Layer 3	Clay	57.0	9.2	Saturated	1.08E-04
Heated Layer 4	Clay	66.2	5.8	Saturated	1.08E-04
Heated Layer 5	Sandy Clay	72.0	10.0	Saturated	7.34E-05
Lower Layer 1	Clay	82.0	5.0	Saturated	1.08E-04
Lower Layer 2	Clay	87.0	5.0	Saturated	1.08E-04

Layer Model	Groundwater Conductivity 25˚C (µS/cm):	Soil Resitivity (ohm-m)	Soil TOC (wt %)	Soil TPH (mg/kg)	Sorption Coefficient (Kd, L/Kg)
Upper Layer 1	3,250.0	15.5	0.09%	0	9.58
Upper Layer 2	3,250.0	15.5	0.09%	0	9.58
Heated Layer 1	3,250.0	16.2	0.09%	0	9.58
Heated Layer 2	2,080.0	20.6	0.09%	0	9.58
Heated Layer 3	2,080.0	15.5	0.09%	0	9.58
Heated Layer 4	2,363.6	14.5	0.09%	0	9.58
Heated Layer 5	2,363.6	20.4	0.09%	0	9.58
Lower Layer 1	2,363.6	14.5	0.09%	0	9.58
Lower Layer 2	2,363.6	14.5	0.09%	0	9.58

Layer Model	Intrinsic Permeability (cm2)	Soil Moisture Content (wt %)	Soil Total Porosity	Soil Dry Density (kg/L)	Soil Wet Density (kg/L)
Upper Layer 1	2.51E-10	22.7%	37.8%	1.68	2.17
Upper Layer 2	2.51E-10	22.7%	37.8%	1.68	2.17
Heated Layer 1	6.76E-10	23.1%	38.4%	1.66	2.16
Heated Layer 2	2.51E-10	22.7%	37.8%	1.68	2.17
Heated Layer 3	9.99E-10	31.9%	46.0%	1.46	2.14
Heated Layer 4	9.99E-10	31.9%	46.0%	1.46	2.14
Heated Layer 5	6.76E-10	23.1%	38.4%	1.66	2.16
Lower Layer 1	9.99E-10	31.9%	46.0%	1.46	2.14
Lower Layer 2	9.99E-10	31.9%	46.0%	1.46	2.14

Layer Model	Specific Yield (dimless)	Layer Transmissivity (m2/sec)	Sand Fraction (%)	Silt Fraction (%)	Clay Fraction (%)
Upper Layer 1	0.06	4.16E-07	20%	30%	50%
Upper Layer 2	0.06	4.16E-07	20%	30%	50%
Heated Layer 1	0.14	2.91E-06	49%	13%	37%
Heated Layer 2	0.06	6.65E-07	20%	30%	50%
Heated Layer 3	0.05	3.04E-06	14%	6%	81%
Heated Layer 4	0.05	1.92E-06	14%	6%	81%
Heated Layer 5	0.14	2.24E-06	49%	13%	37%
Lower Layer 1	0.05	1.65E-06	14%	6%	81%
Lower Layer 2	0.05	1.65E-06	14%	6%	81%

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Contaminant Properties

Controlling Contaminants:	DBCP	EDB	DCP	TCP
Contaminant CAS Number:	96-12-8	8003-07-04	78-87-05	96-18-4
Contaminant Molecular Weight (g/mol):	236.36	187.88	112.99	147.44
ıtaminant Boiling Temperature at 1 atm (°C):	196.0	131.6	96.8	156
Vapor Pressure (mmHg @25C)	0.6	11	53.3	3.1

Total Contaminant Mass (lb):	44
Total Contaminant Volume (gallons):	3

	Ambient (at 17°C)	Heated (at 132°C)
Weighted Ave.(W/A) Contaminant Water Solubility (mg/l):	61.8	35.9
W/A Contaminant Vapor Pressure (Torr):	0.5	174.2
W/A Contaminant Henry's Constant (mg/L air / mg/L aq):	0.03	17.21
W/A Contaminant NAPL Density (kg/L):	1.967	1.758
W/A Contaminant NAPL Dynamic Viscosity (cP):	3.323	0.676
W/A Contaminant NAPL Kinematic Viscosity (cSt):	1.689	0.385

Contaminant Distribution and Cleanup Targets

	Heated Layer 1	Heated Layer 2	Heated Layer 3	Heated Layer 4	Heated Layer 5
Zone:	Saturated	Saturated	Saturated	Saturated	Saturated
Volume (yd^3):	3,133.0	1,928.0	2,217.2	1,397.8	2,410.0
	Initial Soil Concentrations, Dry Basis (mg/kg)				
Peak:	61	15	2	1	1
Average:	4	1	0	0	0
Target:	0.01	0.01	0.01	0.01	0.01
	Initial Groundwater Concentrations (µg/L)				
Estimated Ave:	407.9	142.8	10	10	10
Target:	500.0	0.2	0	0	0
	Initial Mass Distribution (lb)				
NAPL present?:	no	no	no	no	no
Sorbed:	34.3	7.5	0.5	0.3	0.7
Dissolved:	0.8	0.2	0.0	0.0	0.0
Vapor:	0.0	0.0	0.0	0.0	0.0
NAPL:	0.0	0.0	0.0	0.0	0.0
Total Mass:	35.1	7.6	0.5	0.3	0.7
	Initial Saturations (v/v)				
Water	38.0%	37.6%	45.9%	45.9%	38.0%
Air	0.5%	0.2%	0.1%	0.1%	0.5%
NAPL	0.0%	0.0%	0.0%	0.0%	0.0%

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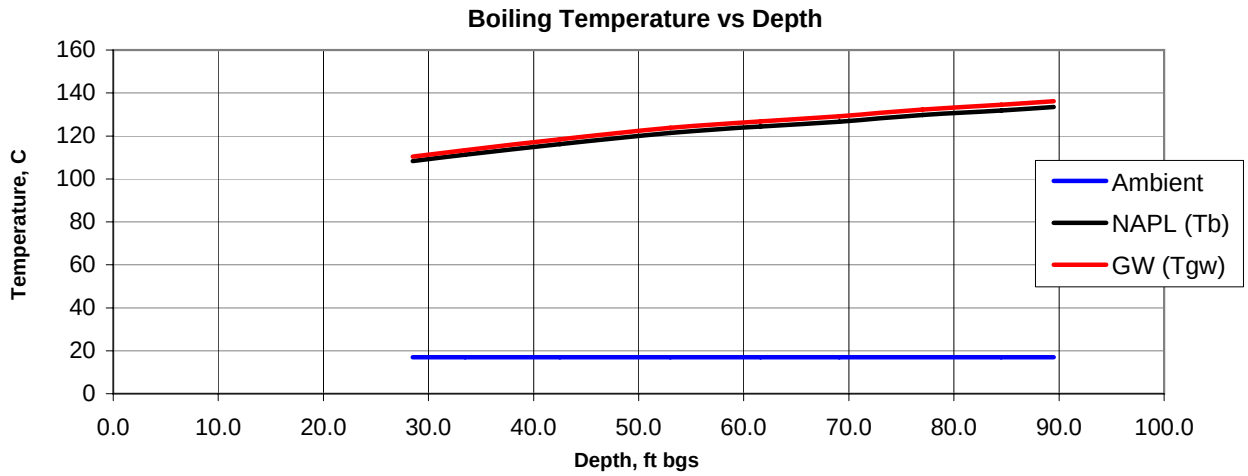
Estimated Treatment Temperatures & Pressure



	GW (˚C) Boiling Temperature	NAPL (˚C) Boiling Temperature	Ambient (˚C) Subsurface Temperature	Pressure at Boiling mm Hg	Layer Midpoint ft bgs
Upper Layer 1	110.4	108.3	17.0	1,087	28.5
Upper Layer 2	113.4	111.2	17.0	1,201	33.5
Heated Layer 1	118.4	116.2	17.0	1,416	42.5
Heated Layer 2	123.8	121.4	17.0	1,677	53.0
Heated Layer 3	126.8	124.4	17.0	1,838	61.6
Heated Layer 4	129.1	126.6	17.0	1,970	69.1
Heated Layer 5	132.3	129.7	17.0	2,164	77.0
Lower Layer 1	134.5	131.9	17.0	2,310	84.5
Lower Layer 2	136.1	133.5	17.0	2,423	89.5

Electrode Design Specifications

Number of Vertical Heating Intervals:	1	
Electrode and Extraction Well Terminations:	100% above grade	
Number of Temperature Monitoring Wells:	11	
Soil Cuttings from Electrode Installation:	80.1	tons
Average Wetting Rate (all Electrodes):	0.17	gpm
Total Volume of Drip Water Added:	52,106	gallons
Total Amount of Electrolyte Required:	3,245	Lb

	Primary	Upper
Electrode Diameter (inches):	3.0	n/a
Borehole Diameter (inches):	12.00	n/a
Array to Electrode Ratio (D/d):	32	n/a
Distance between Electrodes (ft):	16.0	n/a
Total Number of Electrodes:	27	n/a
Depth to Top of Electrode (ft):	36.0	n/a
Total Depth of Electrode (ft):	84.0	n/a
Conductive Zone Length (ft):	48.0	n/a
Length of Electrode in Vadose Zone (ft):	0.0	n/a
Length of Electrode in Groundwater (ft):	48.0	n/a
Number of Drip Intervals per Primary Electrode:	3	n/a
Electrode Drill Cuttings (tons):	80.1	n/a

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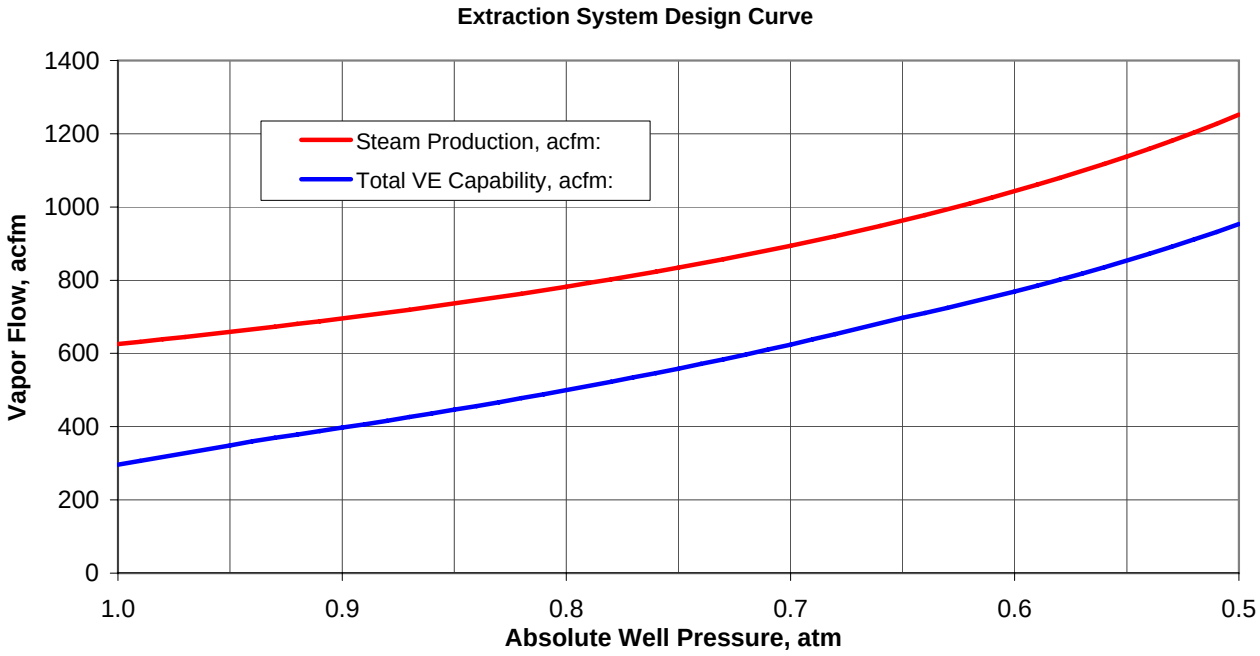
Extraction System Design

Design Extraction Vaccum:	0.80	atm
Well Vacuum:	6	in. Hg
Peak Steam Production Rate:	357	scfm
Peak Air Flow Rate:	0	scfm
Vapor Extraction Design Flow Rate:	360	scfm
Recommended Blower Vacuum:	10	in. Hg
Vapor Extraction Blower:	30	hp
SVE/DVE Wells Co-Located with Electrodes?	yes	
Average Condensate Production Rate:	4.12	gpm
Total Condensate Produced:	320,300	gallons
Peak Vapor Extraction Rate:	2.2	lb/day
Peak In Situ Degradation Rate:	0.7	lb/day
Average Total Cleanup Rate:	0.2	lb/day
Final Extraction Rate:	0.0	lb/day
Soil Cuttings from VE Well Installation:	0.0	tons
Vapor Treatment Method:	carbon	
Secondary Acid Gas Stack Scrubber:	not required	

	Shallow/VE	Horizontal	Deep/DVE
Type of Vents Required:	no	yes	yes
Vent Spacing (ft):	n/a	32	16
Number of Vents:	n/a	5	27
Wellbore/Trench Diameter (in.):	n/a	12.00	12.00
Screened Length per Vent (ft):	n/a	30.0	48.0
Peak Design Flow per Vent (acfm):	n/a	0.0	17.0
Wellscreen Diameter (in.):	n/a	1.0	3.0
Well Drill/Trenching Cuttings (tons):	n/a	0.0	0.0



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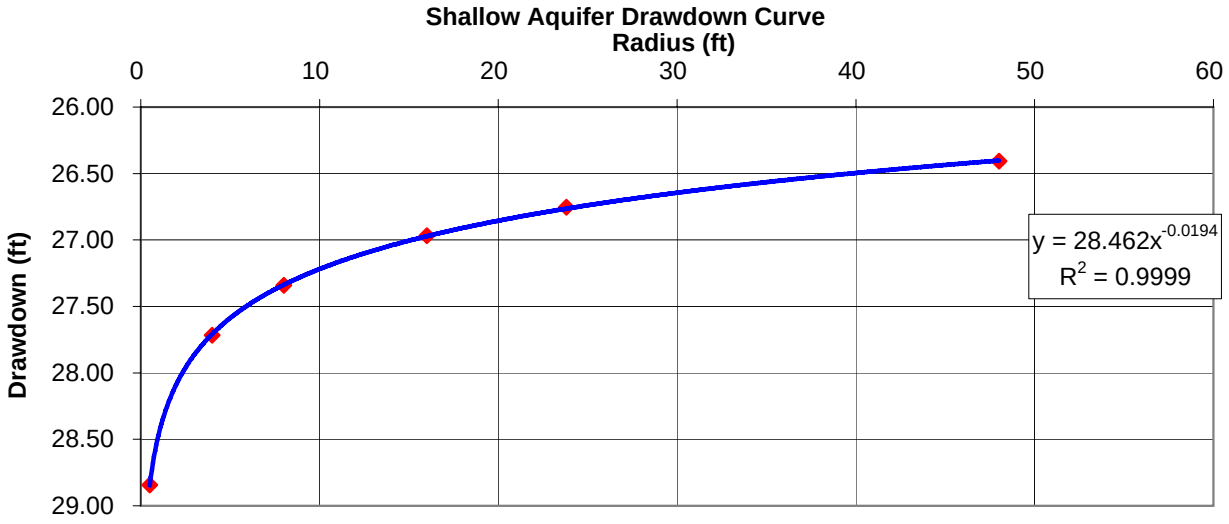
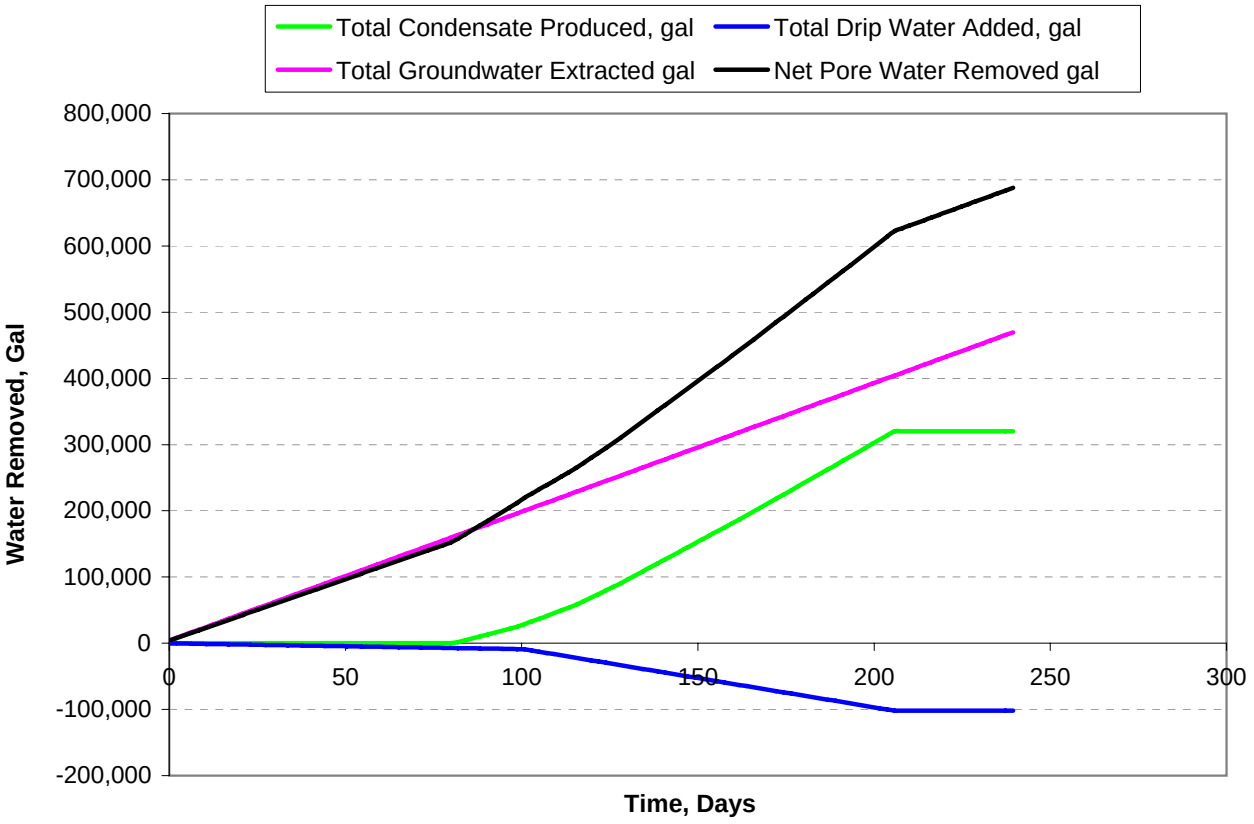
Groundwater Extraction & Overall Water Balance



Typical Depth to Groundwater: 26 ft bgs

Total Groundwater Extracted:	469,476	gallons
Total Condensate Produced:	320,300	gallons
Total Volume of Drip Water Added:	52,106	gallons
Total NAPL Extracted:	0	lb



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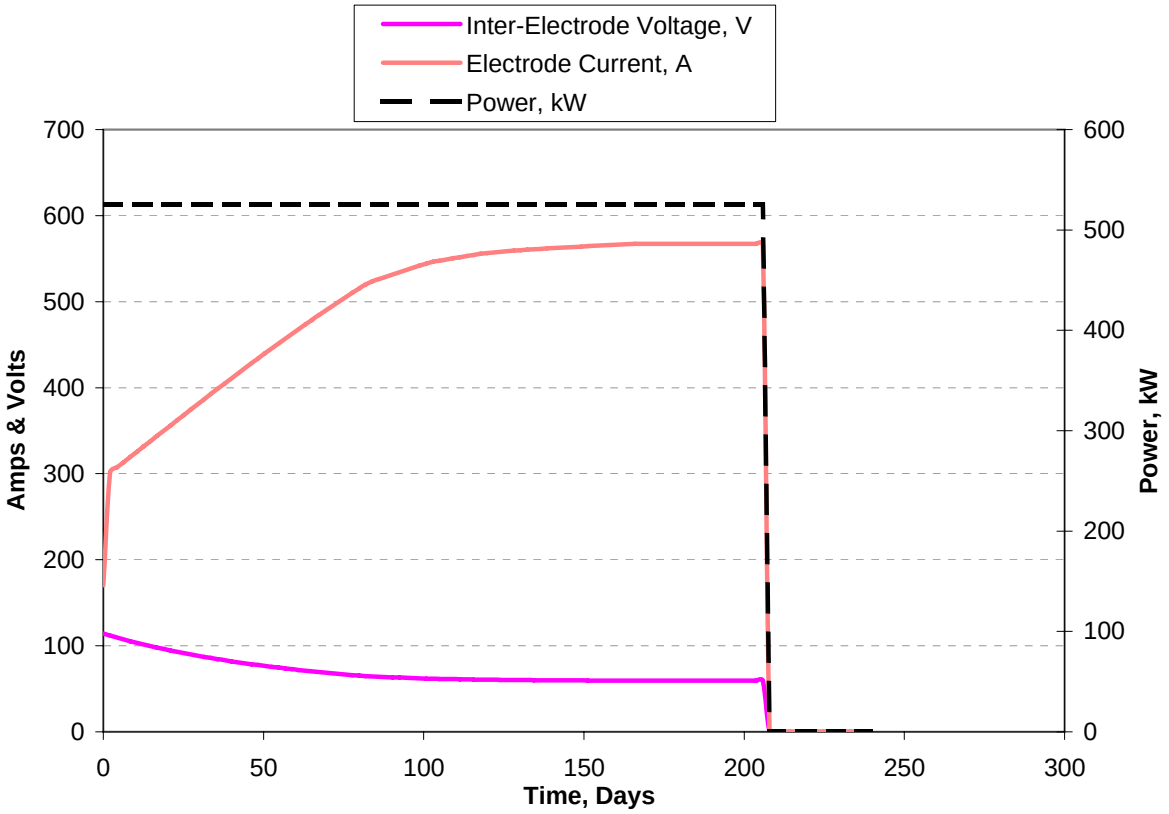
Estimated Treatment Time & Energy Requirements

Time to Pre-Heat/Dry Vadose Zone:	0	days
Time to Heat-up Site:	102	days
Time to Treat Site:	105	days
Extra Time for Multiphase Extraction:	0	days
Total Treatment Time:	208	days
Subsurface Energy Estimate:	2,619,600	kW-hr
Subsurface Energy Density:	236	kw hr/yd3
Total Energy Estimate:	2,813,537	kW-hr

Power Supply Specifications & Electrical Requirements



Site Electrical Power Requirement:	1,000	kW
Site Service Requirement at 480V, 3-Phase:	1,100	Amps
Power Supply Rating:	750	kW
Peak Electrode Voltage:	114	Volts
Peak Phase Current:	5,107	Amps
Number of Electrode Phases:	3	

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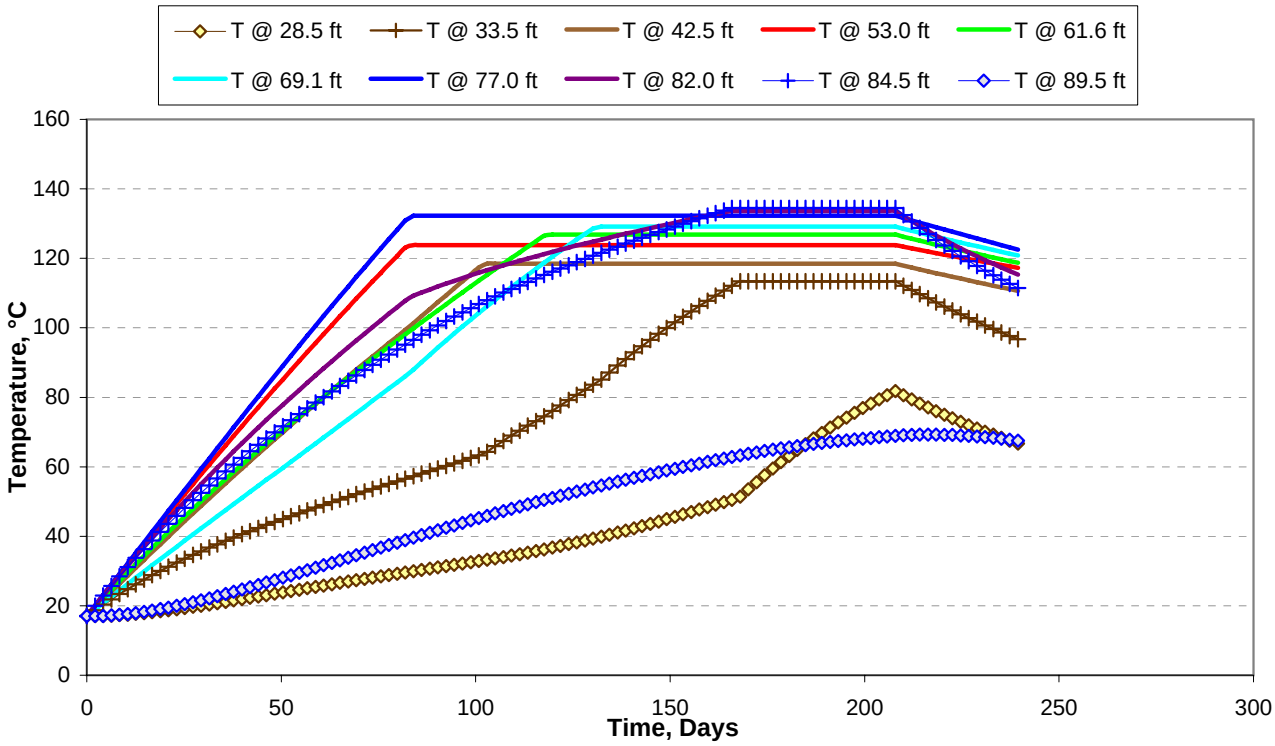
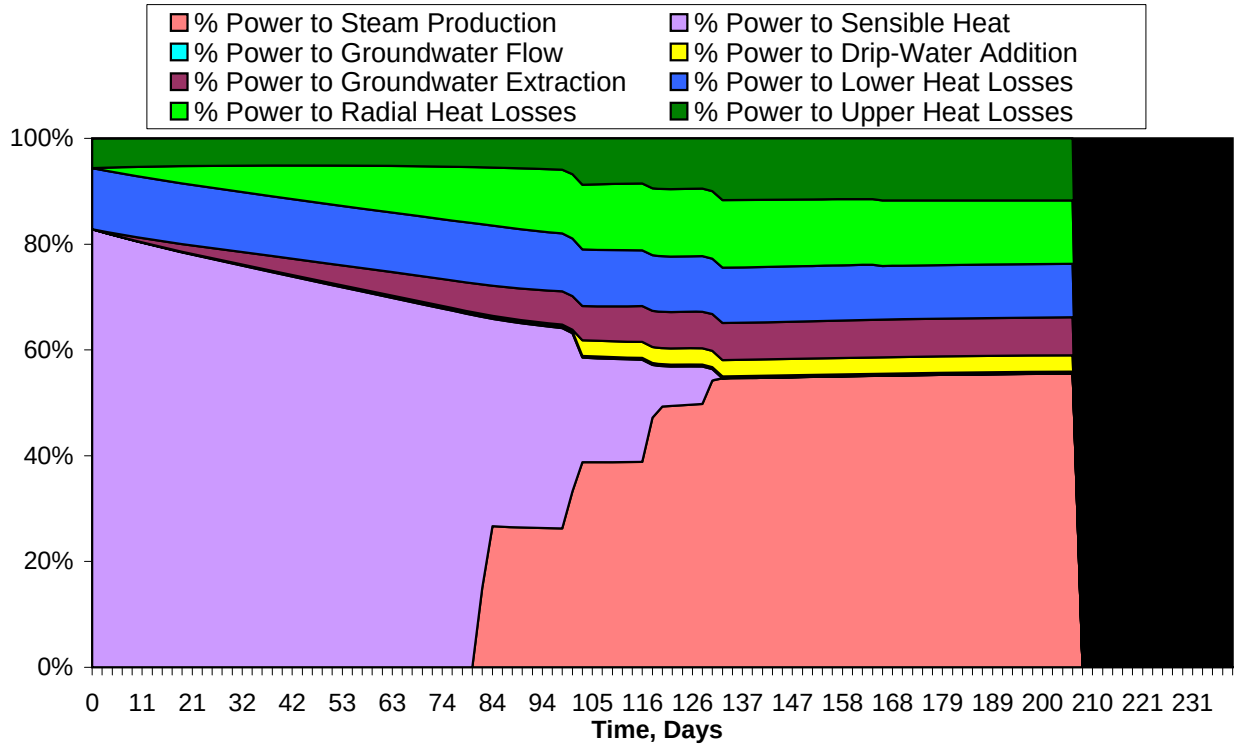
Predicted Subsurface Temperature Trends



Estimated Subsurface Energy Distribution



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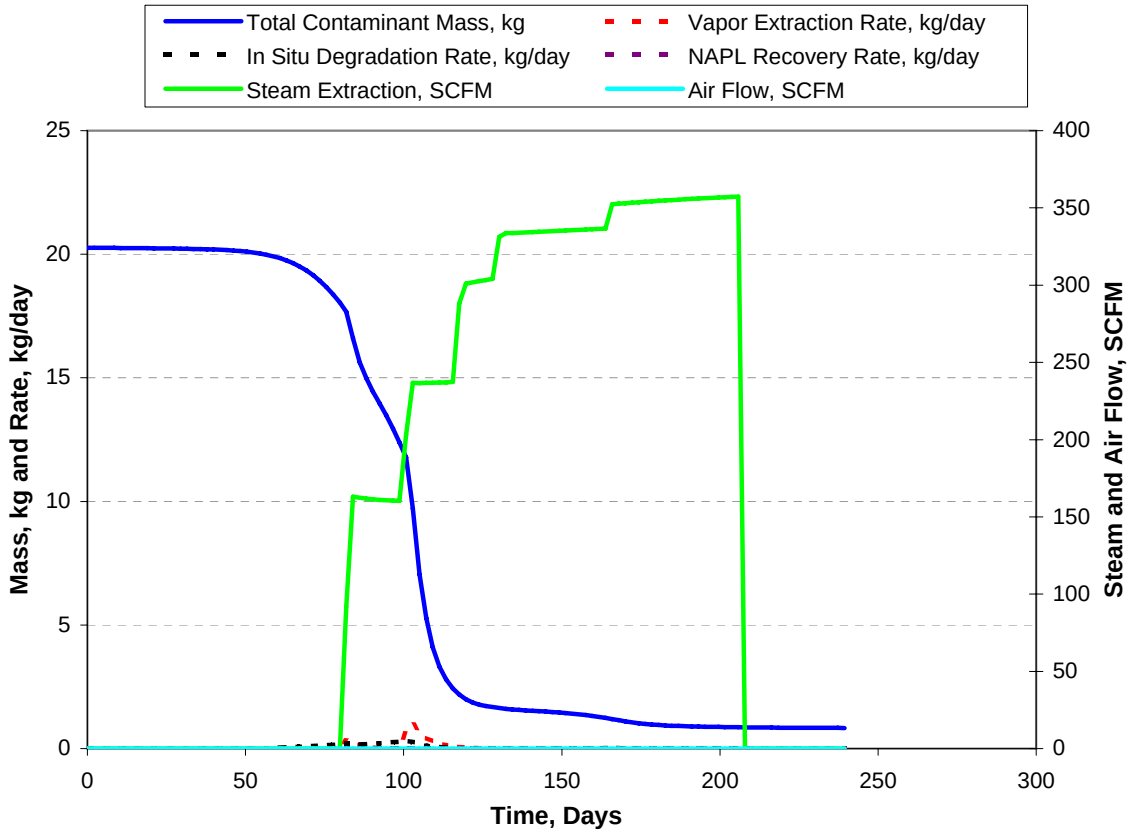
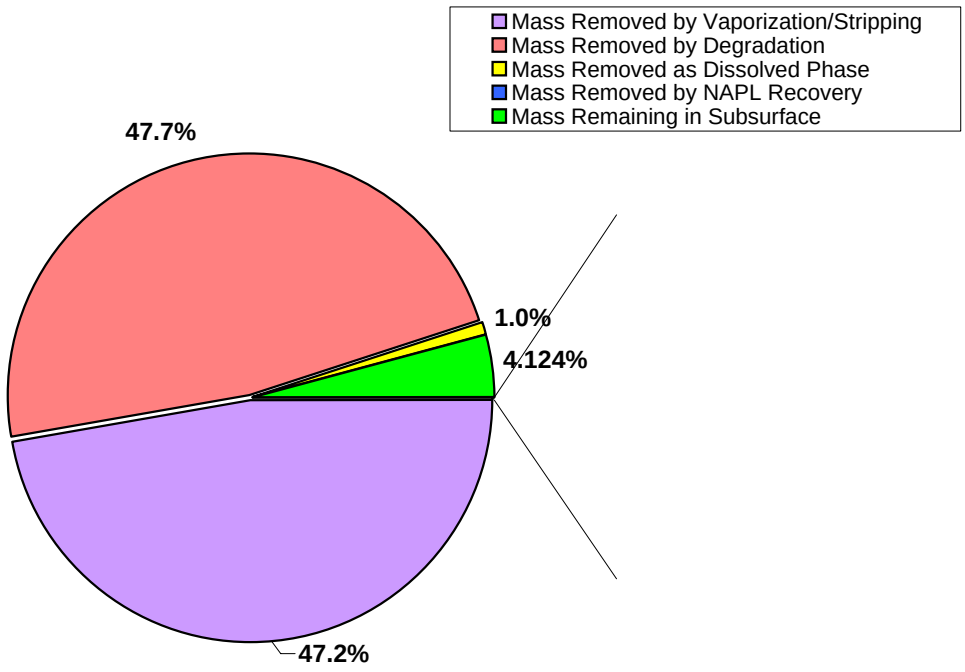
Projected Treatment Performance and Removal rates



Contaminant Fate Projection



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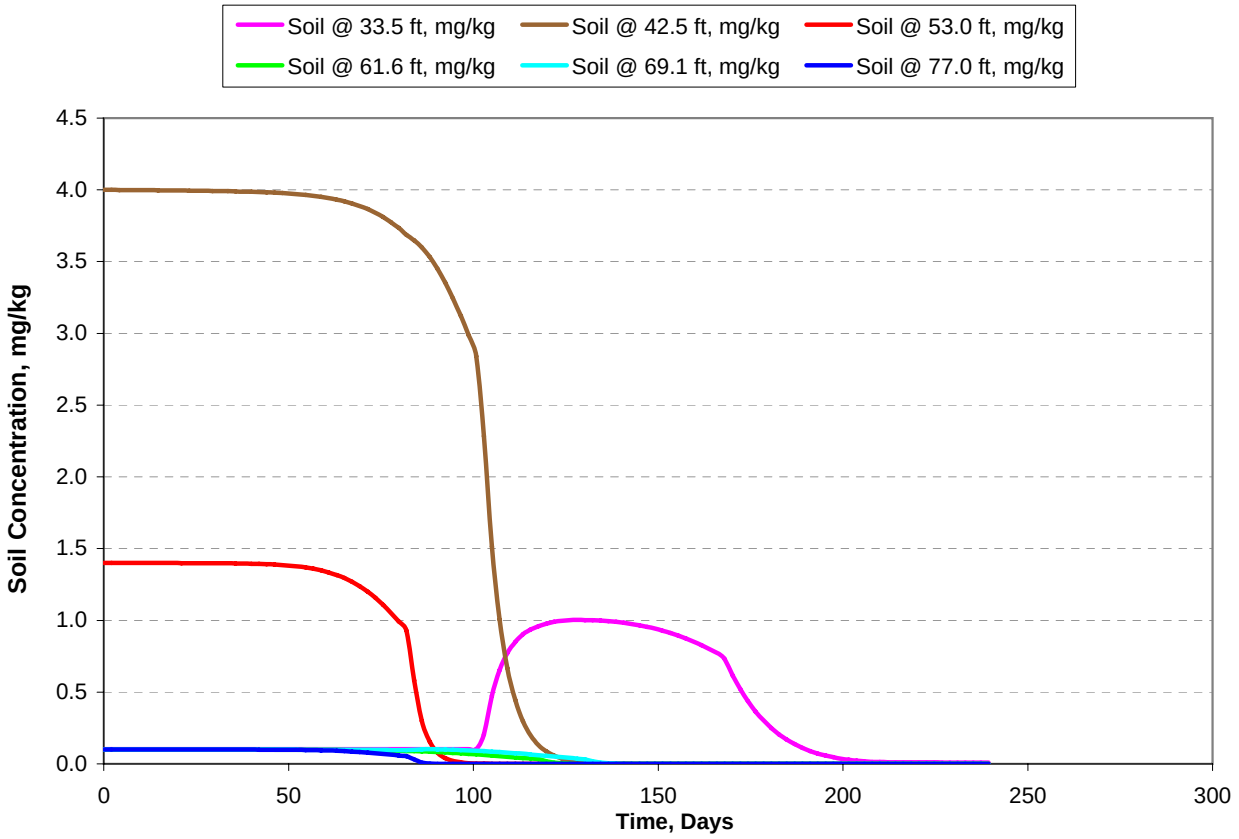
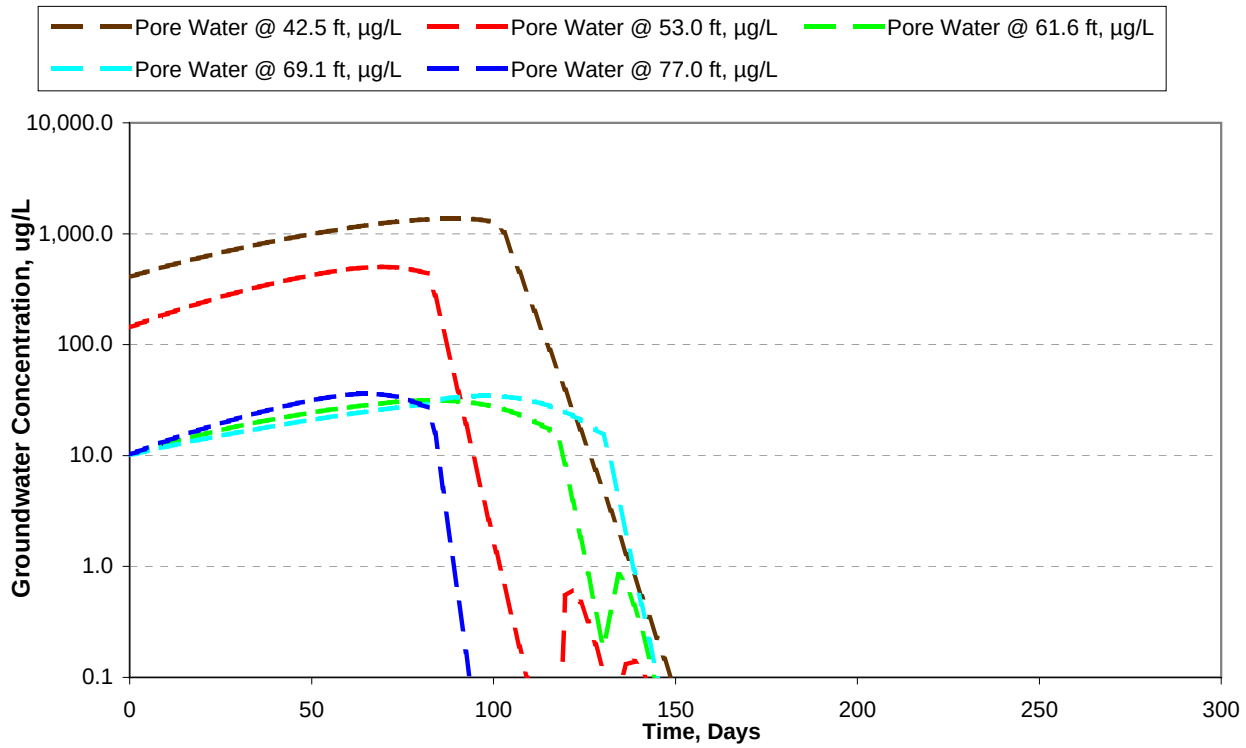
Predicted Soil and Groundwater Concentrations





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APPENDIX B

WELL ID	DATE START	DATE FINISH	Rig	TOTAL DEPTH	Casing Depth	Hole Diam	Screen Depth	Well Diameter	Sand	Bentonite	LF Abandoned	Water for cleanout	
EE-4	10/8/2008	10/10/2008	Sonic	90	85	7							core and sample, level E
EE-4	10/13/2008	10/13/2008					83	1	83-72	72-70		200	well install, level B
EE-4	10/13/2008	10/13/2008								90-83	7		
EE-3	10/14/2008	10/14/2008	Sonic	87	55	7							core and sample, level E
EE-3	10/15/2008	10/15/2008						1	55-35	35-32		220	well install, level B
EE-3	10/15/2008	10/15/2008					56			87-55	5		
AA-1	10/16/2008	10/17/2008	Sonic	90	48	10.5				90-48			core and sample, level C
AA-1	10/17/2008	10/17/2008						4	47-25	25-23			well install, level C
AA-1	10/17/2008	10/17/2008								90-47	90		
AA-1	10/27/2008	10/27/2008					48		7 to 5	5 to4			1.25" vent well
DD-5	10/20/2008	10/20/2008	Sonic	90	90	8.5							core and sample, level C
DD-5	10/22/2008	10/23/2008						4	86-59	59-57			well install, level C
DD-5	10/22/2008	10/23/2008								90-86	90		
DD-5	10/29/2008	10/29/2008					86		7 to 5	5 to4			1.25" vent well
BB-2	10/21/2008	10/21/2008	Sonic	90	90	7						200	core and sample, level C
BB-2	10/22/2008	10/22/2008					80	1	86-60	60-58			well install, level C
BB-2	10/22/2008	10/22/2008								90-86	10		
EE-1	10/23/2008	10/23/2008	Sonic	94	94	8.5						220	core and sample, level C
EE-1	10/27/2008	10/27/2008					91	4	90-77	77-75	1		well install, level C
EE-1	10/27/2008	10/27/2008							7 to 5	5 to4			1.25" vent well
EE-2	10/27/2008	10/27/2008	Sonic	90	90	7						165	core and sample, level C
EE-2	10/28/2008	10/28/2008					70	1	79-59	59-56			well install, level C
EE-2	10/28/2008	10/28/2008								90-79	20		
DD-4	10/28/2008	10/28/2008	Sonic	90	90	7						200	core and sample, level C
DD-4	10/29/2008	10/29/2008					83	1	84-65	65-63			well install, level C
DD-4	10/29/2008	10/29/2008								90-84	7		
DD-3	10/29/2008	10/30/2008	Sonic	90	90	7						165	
DD-3	10/30/2008	10/30/2008					*64	1	65-52	52-50			*blank 90-64
DD-3	10/30/2008	10/30/2008								90-65	35		
CC-4	10/30/2008	10/31/2008	Sonic	90	87	7						200	
CC-4	10/31/2008	10/31/2008						1	87-73	73-71			*blank 90-85
CC-4	10/31/2008	10/31/2008					86			90-87	0		
BB-1	10/31/2008	11/3/2008	Sonic	90	90	7		1				110	
BB-1	11/3/2008	11/3/2008					84		85-71	69-71			*blank 90-84
BB-1	11/3/2008	11/3/2008								90-85	0		
CC-3	11/4/2008	11/4/2008	Sonic	90	90	7		1				150	
CC-3	11/4/2008	11/4/2008							67-50	50-48			
CC-3	11/4/2008	11/4/2008					66			90-67			
EE-5	11/5/2008	11/5/2008	Sonic	91	91	7		1				160	
EE-5	11/5/2008	11/5/2008					85		86-72	72-70			*blank 90-85
EE-5	11/5/2008	11/5/2008								91-86			
GG-2	11/5/2008	11/5/2008	Water rotary	90	90	8		2					
GG-2	11/6/2008	11/6/2008					86		87-74	74-72			*blank 90-86
GG-2	11/6/2008	11/6/2008								90-87			
BB-3	11/6/2008	11/6/2008	Sonic	90	90	7		1				165	
BB-3	11/6/2008	11/6/2008							84-70	70-68			*blank 90-83
BB-3	11/6/2008	11/6/2008					84			90-84			
GG-1	11/6/2008	11/6/2008	Water rotary	90	90	8		2					
GG-1	11/7/2008	11/7/2008					88		90-75	75-73			*blank 90-88
FF-3	11/7/2008	11/7/2008	Sonic	90	80	7		1					
FF-3	11/7/2008	11/7/2008					53		57-41	41-39			
FF-3	11/7/2008	11/7/2008								90-57			*blank 57-53
DD-1	11/10/2008	11/10/2008	Water rotary	90	90	8		2					
DD-1	11/10/2008	11/10/2008					81		82-65	65-62.5			
DD-1	11/10/2008	11/10/2008								90-82			hole collapse, ream bacl
FF-2	11/10/2008	11/10/2008	Sonic	90	90	7		1				165	
FF-2	11/10/2008	11/10/2008					84		85-72	72-70			*blank 90-84
FF-2	11/10/2008	11/10/2008								90-85			
DD-2	11/11/2008	11/11/2008	Water rotary	90	90	8		2					
DD-2	11/11/2008	11/11/2008					45		47-30	30-28			
DD-2	11/11/2008	11/11/2008								90-47			
FF-1	11/11/2008	11/11/2008	Sonic	90	90	7		1					
FF-1	11/11/2008	11/11/2008							56-40	40-38			
FF-1	11/11/2008	11/11/2008					54			90-56			
GG-3	11/12/2008	11/12/2008	Water rotary	90	90	8		4					
GG-3	11/12/2008	11/12/2008					73			65-63			
GG-3	11/12/2008	11/13/2008							90-65				
CC-2	11/12/2008	11/12/2008	Sonic	90	90	7		1					
CC-2	11/12/2008	11/13/2008					49		51-35	35-33			
CC-2										90-51			
GG-4	11/13/2008	11/13/2008	Water rotary	90	90	8		4					
GG-4	11/14/2008	11/14/2008					90		90-66	66-63.5			

GG-4	11/14/2008	11/14/2008											
CC-6	11/13/2008	11/13/2008	Sonic	90	90	7		1					
	11/13/2008	11/13/2008					53		55-35	35-33			*sump 55-53
										90-55			
CC-1	11/17/2008	11/17/2008	Water rotary	90	90	9		4					
	11/17/2008	11/17/2008					85		87-72	72-70			
	11/17/2008	11/17/2008								90-87			
CC-5	11/17/2008	11/18/2008	Sonic	90	86	7		1					
	11/18/2008	11/18/2008							62-41	41-39			blank 60-55, then dropp
	11/18/2008	11/18/2008					57			90-62			
DD-6	11/18/2008	11/18/2008	Water rotary	90	90	8		2					
DD-6	11/18/2008	11/18/2008					50		52-38	38-36			blank 50-55
DD-6	11/18/2008	11/18/2008								90-52			

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: AA-1

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD83 X:6646613.063275 Y:1963252.533349

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500 BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: NESTED WELL: 4" MW AND 1.25" VMP

DRILLING START:FINISH DATE: 10/16/2008 : 10/17/08

COMPLETION START/FINISH DATE: 10/17/08 : 10/17/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 10"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
						(Hand auger to 5 ft)		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
1								
2				ML		SILT WITH SAND Dark grey brown moist blocky firm silt, reddish brown mottling, fine to medium sand (20%), low plasticity		
3								1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4								
5								Bentonite 4 - 5 ft.
6				CL		LEAN CLAY Dark brown soft sitly clay		1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP). Sand 5 -7 ft.
7								
8								
9				CL		LEAN CLAY Dark brown soft sitly clay, stiff		
10								Grout from 7 to 23 ft.
11								
12				CL		LEAN CLAY Dark brown soft sitly clay, stiff		4 in ID CPVC riser from surface to 37 ft. bgs
13								
14								
15				CL		LEAN CLAY Dark brown soft sitly clay, stiff		
16				ML		SILT Brown clayey silt, grey mottling		
17								
18				CL		LEAN CLAY Brown silty clay		
19								
20								
21								
22								
23				MH		ELASTIC SILT WITH SAND Brown soft SILT with fine sand (20%), high plasticity		
24								Bentonite from 23 - 25 ft.
25								

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033
BORING NUMBER: AA-1

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA
LOCATION: NAD83 X:6646613.063275 Y:1963252.533349
GROUND SURFACE ELEVATION:
DRILLING CONTRACTOR: CASCADE DRILLING
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500 BORING & COMPLETION PERFORMED IN LEVEL C PPE
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: NESTED WELL: 4" MW AND 1.25" VMP
DRILLING START:FINISH DATE: 10/16/2008 : 10/17/08
COMPLETION START/FINISH DATE: 10/17/08 : 10/17/08
LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 10"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
26				SM		SILTY SAND Brown soft fine to medium sand with silt and clay, meduim plasti		4 in ID CPVC riser from surface to 38 ft. bgs
27								
28				SM		SILTY SAND Brown silty fine to medium sand (70%)		
29								
30				ML		SANDY SILT Brown firm silt with 35% fine sand, meduim plasticity		Sand from 25 - 47 ft.
31								
32								
33						No Recovery 30 - 38 ft.		
34						Note: Where "no recovery" is reported, depths for subsequent samples to 10 ft below starting depth of "no recovery" zone may be off by thickness of reported "no recovery" zone (i.e. samples reported from 38 - 40 ft may actually be from 30 - 32 ft depth due to no recovery reported from 30-38 ft.)		
35								
36								
37								
38								
39				CL		LEAN CLAY inclusions, meduim plasticity		
40								
41								
42								
43				SM		SILTY SAND Very soft brown fine to coarse silt with plastic silt layers		4 in. ID SS304 0.010 slot well scree from 38 - 48 ft.
44								
45								
46						Calcarous nodules 3/4"		
47								
48				ML		SANDY SILT Brown and grey streaked fine to coarse sandy (40%) silt, medium plasticity		10 in. dia.hole abandoned 47 - 90 f Filled with Bentonite
49								
50				CL		LEAN CLAY WITH SAND Brown clay with fine to medium sand (20%), medium plasticity		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: AA-1	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646613.063275 Y:1963252.533349	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 10/16/2008 : 10/17/08	COMPLETION START/FINISH DATE: 10/17/08 : 10/17/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 10"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
51								
52								
53				CL		LEAN CLAY WITH SAND Dark brown-grey clay with fine sand (15%), calcarous inclusions		
54								
55								
56								
57								
				SM		SILTY SAND		10 in dia.hole abandoned 47 - 90 ft.
58				CL		LEAN CLAY WITH SAND Dark brown-grey clay with fine sand (15%), calcarous inclusions		Filled with Bentonite
59								
60								
61				CL		LEAN CLAY WITH SAND Dark brown-grey clay with fine sand (15%), calcarous inclusions		
62								
63						3/4" calcarious sand nodules		
64								
65						softer at 65-67 ft.		
66								
67								
68								
69								
70								
71				CL		LEAN CLAY WITH SAND Dark brown-grey clay with fine sand (15%), calcarous inclusions		
72								
73								
74								
75								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: AA-1	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646613.063275 Y:1963252.533349	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 10/16/2008 : 10/17/08	COMPLETION START/FINISH DATE: 10/17/08 : 10/17/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 10"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
76				CL		LEAN CLAY WITH SAND Dark brown-grey clay with fine sand (15%), calcarous inclusions		
77								
78								
79								
80						No Recovery, sandy slough		10 in dia.hole abandoned 47 - 90 ft. Filled with Bentonite
81								
82								
83								
84				CL		LEAN CLAY Light brown soft clay, 1/4" calcarous sand inclusions and silty sand lenses		
85								
86				CL		LEAN CLAY WITH SAND sand lenses		
87								
88								
89								
90								
						TOTAL DEPTH = 90 FT		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

CES CURRENT ENVIRONMENTAL SOLUTIONS	Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: BB-2	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646613.063275 Y:1963280.246122	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/21/2008 : 10/21/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/22/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
1						Hand auger to 5 ft		
2				SC		CLAYEY SAND Brown gravelly (20%) clayey fine to coarse sand (60%)		
3								
4								
5								
6								
7								1 in. ID FRP Riser from surface to 70 ft bgs.
8								Grout from surface to 58 ft. bgs.
9								
10				CL		LEAN CLAY Dark brown very stiff blocky clay with fine sand (10%), medium plasticity		
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21				CL		LEAN CLAY WITH SAND Brown firm clay with fine sand (20%)		
22								
23				CL		SANDY LEAN CLAY Brown soft clay with fine sand (35%)		
24								
25				CL		LEAN CLAY		

CONTINUED

CES CURRENT ENVIRONMENTAL SOLUTIONS	Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: BB-2	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646613.063275 Y:1963280.246122
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/21/2008 : 10/21/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/22/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	NOTES
						LEAN CLAY		
26				CL		Dark brown very stiff blocky clay with fine sand (10%)		
27				ML		SANDY SILT Soft silt with fine sand (45%), low plasticity		
28								
29						SILT		
30								
31				SM		SILTY SAND Light brown firm silty fine to coarse sand (70%); blocky with black staining		
32				SM		SILTY SAND Silty fine to coarse sand (80%); black and iron staining		
33								
34								
35								1 in. ID FRP Riser from surface to 70 ft bgs.
36				CL		Light brown stiff clay with fine sand (10%) medium plasticity		Grout from surface to 58 ft. bgs.
37								
38				CL		SANDY LEAN CLAY 35% fine to medium sand		
39								
40								
41				ML		SANDY SILT Brown silt with 40% fine to medium sand; grey mottling low plasticity		
42								
43								
44								
45				SM		SILTY SAND Brown firm silty fine to coarse sand; blocky, small roots, grey mottling, low plasticity		
46								
47								
48								
49								
				SP-SM		POORLY GRADED SAND WITH SILT		

50						Brown silty fine to medium sand (90%)		CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: BB-2	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646613.063275 Y:1963280.246122
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/21/2008 : 10/21/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/22/08 — LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
51								
52								
53								1 in. ID FRP Riser from surface to 70 ft bgs.
54				SC-CL		Mixed CLAYEY SAND and SANDY LEAN CLAY Brown clay and clayey fine sand (35 to 55%), medium plastici		Grout from surface to 58 ft bgs.
55								
56								
57								
58								
59								Bentonite 58 - 60 ft bgs
60								
61								
62								
63								Sand pack 60 - 86 ft.
64								
65								
66						No Recovery 60 - 75 ft very soft		
67						Where "no recovery" is reported,		
68						depths for subsequent samples to 10 ft below starting depth of "no recovery" zone		
69						may be off by thickness of reported "no recovery" zone		
70								
71								1 " ID SS304 0.010 SLOT well screen from 70 - 80 ft
72								
73								
74								
75								CONTINUED

CES CURRENT ENVIRONMENTAL SOLUTIONS

P.O. Box 531139
Grand Prairie, TX 75053

78-0033 | BB-2 | SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA | LOCATION: NAD83 X:6646613.063275 Y:1963280.246122

GROUND SURFACE ELEVATION: | DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500 | BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES	DRILLING START:FINISH DATE:	COMPLETION START/FINISH DATE:	LOGGER:
1" MW	10/21/2008 : 10/21/08	10/22/08 : 10/22/08	JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: NOTES
76								
77								1 " ID SS304 0.010 SLOT well screen from 70 - 80 ft
78								
79								Sand pack 60 - 86 ft.
80				SM		SILTY SAND Brown firm fine to medium sand wth clay and silt, medium plasticity		
81								
82								
83								
84								
85								
86								
87								
88				CL		LEAN CLAY		7" dia.hole abandoned from 86 to 90 ft bgs. Filled with bentonite
89								
90								
91						**TOTAL DEPTH = 90 FT**		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: BB-2

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD83 X:6646613.063275 Y:1963280.246122

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500 BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 10/21/2008 : 10/21/08

COMPLETION START/FINISH DATE: 10/22/08 : 10/22/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: NOTES
1						Hand auger to 5 ft		
2				SC		CLAYEY SAND Brown gravelly (20%) clayey fine to coarse sand (60%)		
3								
4								
5								
6								
7								1 in. ID FRP Riser from surface to 70 ft bgs.
8								Grout from surface to 58 ft. bgs.
9								
10				CL		LEAN CLAY Dark brown very stiff blocky clay with fine sand (10%), medium plasticity		
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21				CL		LEAN CLAY WITH SAND Brown firm clay with fine sand (20%)		
22								
23				CL		SANDY LEAN CLAY Brown soft clay with fine sand (35%)		
24								
25				CL		LEAN CLAY		

CONTINUED

CES CURRENT ENVIRONMENTAL SOLUTIONS	Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: BB-2	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646613.063275 Y:1963280.246122
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/21/2008 : 10/21/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/22/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	NOTES
						LEAN CLAY		
26				CL		Dark brown very stiff blocky clay with fine sand (10%)		
27				ML		SANDY SILT Soft silt with fine sand (45%), low plasticity		
28								
29						SILT		
30				SM		SILTY SAND Light brown firm silty fine to coarse sand (70%); blocky with black staining		
31								
32				SM		SILTY SAND Silty fine to coarse sand (80%); black and iron staining		
33								
34								
35								1 in. ID FRP Riser from surface to 70 ft bgs.
36				CL		Light brown stiff clay with fine sand (10%) medium plasticity		Grout from surface to 58 ft. bgs.
37								
38				CL		SANDY LEAN CLAY 35% fine to medium sand		
39								
40								
41				ML		SANDY SILT Brown silt with 40% fine to medium sand; grey mottling low plasticity		
42								
43								
44								
45				SM		SILTY SAND Brown firm silty fine to coarse sand; blocky, small roots, grey mottling, low plasticity		
46								
47								
48								
49								
50				SP-SM		POORLY GRADED SAND WITH SILT Brown silty fine to medium sand (90%)		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: BB-2	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646613.063275 Y:1963280.246122
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/21/2008 : 10/21/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/22/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
51								
52								
53								1 in. ID FRP Riser from surface to 70 ft bgs.
54				SC-CL		Mixed CLAYEY SAND and SANDY LEAN CLAY Brown clay and clayey fine sand (35 to 55%), medium plastici		Grout from surface to 58 ft bgs.
55								
56								
57								
58								
59								Bentonite 58 - 60 ft bgs
60								
61								
62								
63								Sand pack 60 - 86 ft.
64								
65								
66						No Recovery 60 - 75 ft very soft		
67						Where "no recovery" is reported,		
68						depths for subsequent samples to 10 ft below starting depth of "no recovery" zone		
69						may be off by thickness of reported "no recovery" zone		
70								
71								1 " ID SS304 0.010 SLOT well screen from 70 - 80 ft
72								
73								
74								
75								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: BB-2	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646613.063275 Y:1963280.246122
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/21/2008 : 10/21/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/22/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
76								
77								1 " ID SS304 0.010 SLOT well screen from 70 - 80 ft
78								
79								Sand pack 60 - 86 ft.
80				SM		SILTY SAND Brown firm fine to medium sand wth clay and silt, medium plasticity		
81								
82								
83								
84								
85								
86								
87								
88				CL		LEAN CLAY		7" dia.hole abandoned from 86 to 90 ft bgs. Filled with bentonite
89								
90								
91						**TOTAL DEPTH = 90 FT**		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: BB-3	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085326.834775 Y:322895.653053
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/6/2008 : 11/6/08	COMPLETION START/FINISH DATE: 11/6/08 : 11/6/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
						CLAYEY SAND		
1				SC		Firm dark brown moist clayey fine sand (65%) with roots, Medium plasticity		
2								
3								
4								
				CL		LEAN CLAY WITH SAND		
5						Dark brown stiff moist clay with fine sand (20%), iron staining, Medium plasticity		
6								
								1 in. ID FRP Riser from surface to
7						Iron and black staining		73 ft bgs.
8								Grout from surface to 68 ft bgs.
				CH		FAT CLAY		
9						nodule 1/8"		
						High plasticity		
10								
						SANDY FAT CLAY		
11						40% fine sand		
12								
				SC		CLAYEY SAND		
13						Stiff dark brown clayey fine sand (60%), medium plasticity iron and black staining, calcareous nodules 1/8"		
14								
15								
				CH		SANDY FAT CLAY		
16						Brown, soft sticky clay with fine sand (40%), high plasticity Iron and black staining, calcareous nodules 1/8"		
17								
18								
19						no iron and black staining		
20								
21								
22								
23								
24								
				SM		SILTY SAND		
25						Brown frim silty fine sand (70%), iron and black staining, low plasticity		

CONTINUED

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA | LOCATION: NAD27 X:2085326.834775 Y:322895.653053

GROUND SURFACE ELEVATION: | DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC | BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW | DRILLING START:FINISH DATE: 11/6/2008 : 11/6/08 | COMPLETION START/FINISH DATE: 11/6/08 : 11/6/08 | LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: NOTES
				SM		SILTY SAND		
26								
				CL		SANDY LEAN CLAY		
27						Brown firm wormy textured clay with fine sand (40%)		
						Low plasticity		
28								
				SM		SILTY SAND		
29						Brown firm fine to coarse sand (70%), occassional gravel 1/2"		
						Iron and black staining		
30								
31						80% fine sand; grey mottling, black and iron staining		
32								
33						Calcareous nodules		
34								
				CL		LEAN CLAY WITH SAND		
35						Brown grey stiff clay with fine sand (20%), low plasticity		1 in. ID FRP Riser from surface to
						Iron and black staining, calcareous nodules 1/2"		73 ft bgs.
36								
								Grout from surface to 68 ft bgs.
37						SANDY LEAN CLAY		
						40% fine to medium sand, firm		
38								
				SM		SILTY SAND		
39						Brown soft clayey fine sand (80%), low plasticity		
						Calcareous nodules 1/4"		
40								
41						[illegible] plasticity		
42								
43								
44								
45						60% fine sand, grey mottling		
						No recovery 45-48 ft.		
46								
47								
48								
				SC		CLAYEY SAND		
49						Very soft clayey sand (60%), high plasticity		
50								CONTINUED

CURRENT ENVIRONMENTAL SOLUTIONS

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA	LOCATION: NAD27 X:2085326.834775 Y:322895.653053
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW	DRILLING START:FINISH DATE: 11/6/2008 : 11/6/08 / COMPLETION START/FINISH DATE: 11/6/08 : 11/6/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: NOTES
				SC		CLAYEY SAND Very soft clayey sand (60%), high plasticity		
51								
52								
				CL		LEAN CLAY WITH SAND Brown stiff clay with fine sand (20%), medium plasticity Iron and black staining, calcareous nodules, grey mottling		
53								
54								
55								
						No recovery 55-57 ft.		
56								
57								
				SC		CLAYEY SAND Soft brown clayey fine SAND (60%), high plasticity calcareous nodules 1/2"		
58								
59								1 in. ID FRP Riser from surface to 73 ft bgs.
60								
				CH		FAT CLAY WITH SAND Brown clay with fine sand (20%), high plasticity Iron and black staining, grey mottling		Grout from surface to 68 ft bgs.
61								
62								
63						Calcareous nodules 1/16"		
64								
65								
66								
				SC		CLAYEY SAND Very soft brown clayey sand (60%), high plasticity Calcareous nodules 1/2"		
67								
68								
				CH		SANDY FAT CLAY Brown clay with fine sand (35%), high plasticity Iron and black staining, calcareous nodules 1/16"		Bentonite 68-70 ft bgs
69								
70								
				SM		SILTY SAND Firm brown silty sand (75%), low plasticity Iron staining, grey mottling		
71								
72								
				SM		SILTY SAND Firm brown silty sand (75%), medium plasticity Iron and black staining, calcareous nodules 1/16"		1 " ID SS304 0.010 SLOT WELL SCREEN FROM 74 - 84 FT Sand pack 70-84 ft bgs
73								
74								
75						85% sand		CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: BB-3	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085326.834775 Y:322895.653053
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/6/2008 : 11/6/08	COMPLETION START/FINISH DATE: 11/6/08 : 11/6/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	NOTES
				SM				
76								
				SP		POORLY GRADED SAND		
77						Brown soft fine sand (95%)		
78								
				SC		CLAYEY SAND		
79						Soft brown clayey sand (60%), high plasticity		1 " ID SS304 0.010 SLOT
								WELL SCREEN FROM 74 - 84 FT
80								Sand pack 70-84 ft bgs
81						80% sand		
82								
				CL		SANDY LEAN CLAY		
83						Brown firm blocky clay with fine sand (30%), medium plasticity		
84								
						LEAN CLAY		
85						Stiff, sand 10%		
								Well sealed with Bentonite from
86								84-90 ft. bgs
87								
88								
89								
90								
						TOTAL DEPTH = 90 FT		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-1	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.654106 Y:322905.484332
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/13/2008 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
1								NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
2								
3								1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4						LEAN CLAY		Bentonite 4 - 5 ft.
5				CL		Soft dark brownish dark grey clay with 10% fine sand Medium plasticity, moist		1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP). Sand 5 -7 ft.
6								
7						No recovery 5.5 to 10 ft.		
8								
9								Grout from 7 to 70 ft.
10								
11				CH		FAT CLAY WITH SAND Firm dark brownish dark grey clay with 20% fine sand		4 in ID CPVC riser from surface to 75 ft.
12						High plasticity, black staining, 1/8" calcareous nodules		
13				CH		FAT CLAY WITH SAND Firm dark brownish grey clay with 20% fine sand		
14						High plasticity, black and iron staining		
15				CH		SANDY FAT CLAY Stiff brown clay with 30% fine sand, high plasticity		
16						Black and iron staining, grey mottling, 1/8" calcareous nodules		
17				CH		FAT CLAY WITH SAND Stiff brown clay with 20% fine sand, high plasticity		
18						Black and iron staining, grey mottling, 1/8" calcareous nodules		
19				CH		FAT CLAY WITH SAND Soft dark brown clay with 20% fine sand, high plasticity		
20								
21						NO RECOVERY 20 to 22.5 FT		
22								
23				CH		FAT CLAY WITH SAND Soft dark brown clay with 20% fine sand, high plasticity		
24				SC		CLAYEY SAND		
25						Soft brown cleyey sand (65% fine), high plasticity		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-1	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.654106 Y:322905.484332
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/13/2008 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
26						NO RECOVERY 25 to 29 FT		Grout from 7 to 70 ft.
27								4 in ID CPVC riser from surface to 75 ft.
28								
29								
30				SC		CLAYEY SAND Soft brown cleyey sand (50% fine), high plasticity Pockets of dark brown clay		
31								
32								
33				CH		FAT CLAY WITH SAND Soft brown clay with 15% fine sand, high plasticity		
34								
35				SM		SILTY SAND Soft brown silty sand (85% fine) Black and iron staining, grey mottling, 1/8" calcareous nodules		
36								
37				SP		POORLY GRADED SAND Soft brown sand (95% fine)		
38								
39								
40								
41				CH		SANDY FAT CLAY Soft brown clay with 35% fine sand, high plasticity 1/2" calcareous nodules		
42								
43				SM		SILTY SAND Soft brown silty sand (75% fine) Iron staining, grey mottling		
44								
45				SP		POORLY GRADED SAND Soft brown sand (95% fine)		
46						No recovery 45-48 ft.		
47								
48								
49				SC		CLAYEY SAND Soft brown cleyey sand (60% fine), high plasticity		
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-1	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.654106 Y:322905.484332
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/13/2008 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
51				CH		FAT CLAY Stiff brown clay with 10% fine sand, high plasticity		Grout from 7 to 70 ft.
52						Black and iron staining, grey mottling		4 in ID CPVC riser from surface to 75 ft.
53				CH		FAT CLAY WITH SAND Stiff brown clay with 20% fine sand, high plasticity		
54						Black and iron staining, grey mottling, 1/8" calcareous nodules		
55				SM		SILTY SAND Firm brown silty sand (80% fine)		
56						Iron staining		
57				CH		SANDY FAT CLAY Firm brown clay with 35% fine sand, high plasticity		
58						Black staining		
59				SM		SILTY SAND Soft brown silty sand (80% fine)		
60						Black staining, calcareous specks		
61				CH		SANDY FAT CLAY Soft brown clay with 40% fine sand, high plasticity		
62								
63				CH		SANDY FAT CLAY Soft brown clay with 40% fine sand, high plasticity		
64						Black and iron staining		
65				CH		FAT CLAY Stiff brown clay with 10% fine sand, high plasticity		
66						Black and iron staining, calcareous specks		
67				CH		FAT CLAY Soft brown clay with 10% fine sand, high plasticity		
68								
69				CH		FAT CLAY WITH SAND Stiff brown clay with 25% fine sand, high plasticity		
70						Black and iron staining, grey mottling, 1/8" calcareous nodules		
71						SLOUGH		Bentonite from 70 - 72 ft.
72								
73						SLOUGH		Sand from 72 - 87 ft.
74								
75				CH		FAT CLAY WITH SAND Firm brown, 20% fine sand, black and iron staining, grey mottling		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-2	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085134.681405 Y:322922.636773
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/12/2008 : 11/12/08	COMPLETION START/FINISH DATE: 11/12/08 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1								
2								
3				CH		FAT CLAY WITH SAND Stiff dark brownish dark grey clay with 20% fine sand		
4						Moist, high plasticity		1 in. ID FRP Riser from surface to 39 ft.
5				CL		LEAN CLAY Soft dark brownish dark grey clay, 10% fine sand, medium plasticity		Grout from surface to 33 ft bgs.
6						Black and iron staining, grey mottling		
7				CL		LEAN CLAY Firm dark brown clay with 10% fine sand, medium plasticity		
8								
9				CH		FAT CLAY Firm dark brown clay with 10% fine sand, high plasticity		
10						Black and iron staining, grey mottling, 1/8" calcareous nodules		
11				CH		FAT CLAY WITH SAND Stiff dark brown clay with 20% fine sand, high plasticity		
12						Black and iron staining, grey mottling, 1/8" calcareous nodules		
13				CH		SANDY FAT CLAY Firm brown clay with 30% fine sand, high plasticity		
14						Black and iron staining, grey mottling, calcareous specks		
15				CH		SANDY FAT CLAY Stiff dark brown clay with 30% fine sand		
16						Black and iron staining, grey mottling, 1/4" calcareous nodules		
17				CH		SANDY FAT CLAY Soft brown clay with 30% fine sand, high plasticity		
18						Calcareous specks		
19				CH		SANDY FAT CLAY Soft brown clay with 40% fine sand		
20						Calcareous specks		
21				CH		SANDY FAT CLAY Firm brown clay with 35% fine sand		
22						Black staining, calcareous specks		
23				CH		FAT CLAY WITH SAND Firm brown clay with 25% fine sand, high plasticity		
24						Black staining, 1/4" calcareous nodules		
25				CH		SANDY FAT CLAY		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-2	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085134.681405 Y:322922.636773	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/12/2008 : 11/12/08	COMPLETION START/FINISH DATE: 11/12/08 : 11/13/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
26								
27						SLOUGH 25- 27.5 FT.		
28								
29				CH		SANDY FAT CLAY Firm brown clay with 35% fine sand Black and iron staining, calcareous specks		
30								
31				SC		CLAYEY SAND Stiff brown clayey sand (65% fine) Black and iron staining, grey mottling, 1/8" calcareous specks		
32								
33				SM		SILTY SAND Firm brown clayey silty sand (70% fine) Black and iron staining, grey mottling		Bentonite 33 - 35 ft bgs
34								
35				CH		SANDY FAT CLAY Stiff brown clay with 45% fine sand, high plasticity Black and iron staining, grey mottling		
36								Sand pack 35 - 51 ft bgs
37				SM		SILTY SAND Soft brown clayey silty sand (65% fine), medium plasticity Black staining, calcareous specks		
38								
39				SC		CLAYEY SAND Soft brown clayey sand (60% fine), medium plasticity 1" Calcareous nodules		
40								1 in. ID SS304 0.010" Slot well screen from 39 - 49 ft
41				SP		POORLY GRADED SAND Soft brown silty sand (95% fine)		
42								
43				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty sand (90% fine) 2" Calcareous nodules		
44								
45				SP-SM		POORLY GRADED SAND WITH SILT Soft brownish grey silty sand (90% fine) 1" Calcareous nodules		
46								
47				CH		FAT CLAY WITH SAND Soft brown clay with 20% fine sand, high plasticity Grey mottling		
48								
49				CH		FAT CLAY WITH SAND Soft brown clay with 20% fine sand, high plasticity Grey mottling		
50								

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: CC-2

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA

LOCATION: NAD27 X:2085134.681405 Y:322922.636773

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME: 1" MW

DRILLING START:FINISH DATE: 11/12/2008 : 11/12/08

COMPLETION START/FINISH DATE: 11/12/08 : 11/13/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
								Sand pack 35 - 51 ft bgs
51				CH		SANDY FAT CLAY Soft brown clay with 45% fine sand, high plasticity		
52						Grey mottling		
								Hole abandoned from
53				CH		FAT CLAY Stiff brown clay with 10% fine sand, high plasticity		51 to 90 ft bgs. Filled with Bentonite
54						Black and iron staining, grey mottling, calcareous specks		
55				CH		SANDY FAT CLAY Stiff brown clay with 40% fine sand, high plasticity		
56						Black and iron staining, grey mottling		
57						NO RECOVERY 56 to 58 Ft		
58								
59						SLOUGH 58-61.5 FT.		
60								
61								
62								
63				SP		POORLY GRADED SAND Soft brown fine sand		
64								
65				SP		POORLY GRADED SAND Soft brown fine sand		
66								
67				SC		CLAYEY SAND Soft brown clayey sand (60% fine), high plasticity		
68						Calcareous specks		
69				CH		SANDY FAT CLAY Firm brown clay with 40% fine sand, high plasticity		
70								
71				CH		FAT CLAY WITH SAND Firm brown clay with 25% fine sand, high plasticity		
72						Grey mottling		
73				CH		FAT CLAY WITH SAND Firm brown clay with 25% fine sand, high plasticity		
74						Black staining, grey mottling, calcareous specks		
				CH		SANDY FAT CLAY		
75						Stiff brown clay with 45% fine sand, hgh plasticity		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-2	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085134.681405 Y:322922.636773
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/12/2008 : 11/12/08	COMPLETION START/FINISH DATE: 11/12/08 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
76								Hole abandoned from 51 to 90 ft bgs. Filled with Bentonite
77				CL		LEAN CLAY Stiff brown clay with 10% fine sand, medium plasticity Black staining, 1/8" calcareous nodules		
78								
79				CH		SANDY FAT CLAY Soft brown clay with 45% fine sand, high plasticity		
80								
81				CH		SANDY FAT CLAY Soft brown clay with 45% fine sand		
82								
83								
84								
85				CH		FAT CLAY WITH SAND Stiff brown clay with 20% fine sand, high plasticity Black staining, 1/4" calcareous nodules		
86								
87				CH		FAT CLAY WITH SAND Stiff brown clay with 20% fine sand, high plasticity		
88								
89				CH		FAT CLAY WITH SAND Stiff brown CLAY with 20% fine sand, High plasticity Black staining, 1/4" calcareous nodules		
90								
91						TOTAL DEPTH = 90 FT.		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-3	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085174.862420 Y:322919.520639
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/4/2008 : 11/4/08	COMPLETION START/FINISH DATE: 11/4/2008 : 11/4/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
				CL		LEAN CLAY Dark brown clay		
1								
2								
3				SW		WELL GRADED SAND Dark brown silty fine to coarse sand (90%) with little gravel		
4								
5				ML		SANDY SILT Dark brown silt with fine to medium sand (30%) Iron stained, grey mottling		
6								1 in. ID FRP Riser from surface to 55 ft. bgs
7						Slough		
8								Grout from surface to 48 ft bgs.
9				CL		LEAN CLAY Very stiff dark brown clay with fine sand (10%), iron and black st calcareous lineations, low plasticity		
10								
11						Slough		
12				CL				
13								
14								
15				SC		CLAYEY SAND Very stiff brown clayey fine sand (60%), calcareous lineations, low plasticity		
16								
17				ML		SANDY SILT Soft crumbly silt with fine sand (35%) and roots		
18								
19						SILT WITH SAND Very stiff brown silt with fine sand (25%), calcareous lineations		
20								
21				CL		SANDY LEAN CLAY Soft crumbly fine sandy (40%) clay, medium plasticity		
22								
23						LEAN CLAY WITH SAND 20% fine sand		
24								
25						SANDY LEAN CLAY Stiff clay, fine sand (40%), iron and black staining, medium plasticity		CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-3	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085174.862420 Y:322919.520639
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/4/2008 : 11/4/08	COMPLETION START/FINISH DATE: 11/4/2008 : 11/4/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
26						CLAYEY SAND		
27				SC		Soft brown clayey fine sand (60%), high plasticity		
28						SILTY SAND		
29				SM		Stiff brown silty fine to medium sand (80%), iron and black staini Low plasticity, calcareous nodules 1/2"		
30								
31						Firm		
32								
33								
34						LEAN CLAY		
35				CL		Stiff brown clay with fine sand (10%), low plasticity, Calcareous nodules 1/2"		1 in. ID FRP Riser from surface to 55 ft bgs.
36						SANDY LEAN CLAY		Grout from surface to 48 ft bgs.
37						40% fine sand, grey mottling		
38						CLAYEY SAND		
39				SC		Soft brown clayey fine sand (60%)		
40								
41								
42						SILTY SAND		
43				SM		Soft brown silty fine sand (85%)		
44								
45								
46						No recovery 45-50 ft.		
47								
48								
49								Bentonite 48-50 ft bgs
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-3	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085174.862420 Y:322919.520639
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/4/2008 : 11/4/08	COMPLETION START/FINISH DATE: 11/4/2008 : 11/4/08 — LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
						CLAYEY SAND		
51				SC		Soft brown, grey mottled clayey fine sand (70%), high plasticity		1 in. ID FRP Riser from surface to 55 ft bgs.
52						FAT CLAY		Sand pack 50-67 ft bgs
53				CH		Firm brown, grey mottled clay with fine sand (45%), high plasticity		
54						FAT CLAY WITH SAND		
55						Very stiff, 20% fine sand		1 " ID SS304 0.010 SLOT
56						No Recovery 55-60.5 ft		WELL SCREEN FROM 56-66 FT
57								
58								
59								
60								
61				SC		CLAYEY SAND Brown firm clayey fine sand (75%), high plasticity		
62						FAT CLAY		
63				CL		Brown silty clay with fine sand (10%), low plasticity		
64								
65						medium plasticity		
66						CLAYEY SAND		
67				SC		Brown soft clayey fine sand (60%), high plasticity		
68						SANDY FAT CLAY		Well sealed with Bentonite from 90-67ft. bgs
69				CH		Firm brown, grey mottled clay with fine sand (40%), high plasticity		
70								
71						soft		
72								
73						firm, 45% fine sand		
74								
75						30% fine sand		

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: CC-3

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD27 X:2085174.862420 Y:322919.520639

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 11/4/2008 : 11/4/08

COMPLETION START/FINISH DATE: 11/4/2008 : 11/4/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
76				CH		SANDY FAT CLAY Firm brown clay with fine sand (45%)		
77								
78						CLAYEY SAND		Well sealed with Bentonite from
79				SC		Firm brown clayey fine sand (65%), calcareous nodules (3/4"), high plasticity		90-67ft. bgs
80						SILTY SAND		
81				SM		Sitly fine sand (80%), medium plasticity		
82						CLAYEY SAND		
83				SC		Firm brown clayey fine sand (70%), high plasticity		
84								
85						Firm, blocky texture, 60% fine sand		
86								
87						50% fine sand		
88						SANDY FAT CLAY		
89				CH		Brown firm clay with fine sand (40%), high plasticity		
90						TOTAL DEPTH = 90 FT.		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-4	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085238.862260 Y:322919.521586
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 10/30/2008 : 10/31/08	COMPLETION START/FINISH DATE: 10/31/08 : 10/31/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1								
2						SANDY LEAN CLAY		
3				CL		Stiff dark grey clay with 30% fine sand, low plasticity Damp		
4						LEAN CLAY WITH SAND		1 in. ID FRP Riser from surface to 75 ft. bgs
5				CL		Stiff dark brown dark grey clay, 20% fine sand Medium plasticity		Grout from surface to 71 ft bgs.
6						LEAN CLAY		
7				CL		Stiff dark brownish dark grey clay with 10% fine sand, medium plasticity		
8								
9				CH		FAT CLAY Stiff dark brownish dark grey clay, 10% fine sand, high plastic		
10						Black staining, 1/4" calcareous nodules		
11				CH		FAT CLAY Stiff dark brown clay with 10% fine sand, high plasticity		
12						Black staining, 1/4" calcareous nodules		
13				SC		CLAYEY SAND Stiff dark brown clayey sand (55% fine), medium plasticity		
14						Black staining, 1/8" calcareous nodules		
15				CH		SANDY FAT CLAY Stiff dark brown clay with 20% fine & 10% coarse sand,		
16						Black staining, 1/4" calcareous nodules, high plasticity		
17				CH		SANDY FAT CLAY Stiff dark brown clay with 20% fine & 10% coarse sand,		
18						Black staining		
19				CH		FAT CLAY Firm brown clay with 10% fine sand, black staining,		
20						High plasticity		
21				CH		FAT CLAY Stiff brown clay with 10% fine sand, high plasticity		
22						Black and iron staining, calcareous specks		
23				CH		SANDY FAT CLAY Stiff brown clay with 35% fine sand, high plasticity		
24						Black and iron staining, calcareous specks SILTY SAND		
25				SM		Firm brown clayey sand (65% fine), low plasticity, black and iron staining		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-4	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085238.862260 Y:322919.521586
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 10/30/2008 : 10/31/08	COMPLETION START/FINISH DATE: 10/31/08 : 10/31/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
26								
27				CH		FAT CLAY Firm dark brown clay with 10% fine sand, high plasticity Black staining, 1/8" calcareous nodules		
28								
29				CH		FAT CLAY Firm brown clay with 10% fine sand, high plasticity Black staining		1 in. ID FRP Riser from surface to 75 ft. bgs
30								Grout from surface to 71 ft bgs.
31				SC		CLAYEY SAND Firm brown clayey sand (60% fine), high plasticity Much black and iron staining		
32								
33				CH		FAT CLAY Stiff brown clay with 10% sand, high plasticity Black and iron staining, grey mottling, calcareous lineation		
34								
35				CH		SANDY FAT CLAY Stiff brown clay with 45% fine sand, high plasticity Black and iron staining, grey mottling, 1/8" calcareous nodules		
36								
37				CH		SANDY FAT CLAY Soft brown clay with 45% fine sand, high plasticity Black and iron staining		
38								
39				CH		SANDY FAT CLAY Soft brown clay with 45% fine sand Black and iron staining		
40								
41				CH		SANDY FAT CLAY Soft brown clay with 45% fine sand, high plasticity Black and iron staining		
42								
43				SM		SILTY SAND Soft brown silty sand (80% fine sand), low plasticity Black and iron staining, grey mottling		
44								
45				CH		FAT CLAY WITH SAND Soft brown clay with 20% fine sand, high plasticity Grey mottling		
46								
47								
48								
49				SM		SILTY SAND Soft brown silty sand (65% fine), medium plasticity		
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-4	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085238.862260 Y:322919.521586
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 10/30/2008 : 10/31/08	COMPLETION START/FINISH DATE: 10/31/08 : 10/31/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
51				SC		CLAYEY SAND Soft brown clayey sand (50% fine), high plasticity		
52								
53				CH		FAT CLAY WITH SAND Firm brown clay with 20% fine sand, high plasticity		Grout from surface to 71 ft bgs.
54								
55				SM		SILTY SAND Soft brown silty sand (65% fine), medium plasticity Black and iron staining, 1/8" Calcareous nodules		
56								
57				CH		FAT CLAY WITH SAND Soft brown clay with 25% fine sand, high plasticity		
58								
59				CH		SANDY FAT CLAY Firm brown clay with 40% fine sand, high plasticity		
60								
61				CL		LEAN CLAY WITH SAND Stiff brown clay with 25% fine sand, medium plasticity Black and iron staining		
62								
63				CL		LEAN CLAY WITH SAND Stiff brown clay with 15% fine sand, medium plasticity Black and iron staining, 1/8" calcareous nodules		
64								
65				CH		SANDY FAT CLAY Firm brown clay with 20% fine & 10% coarse sand, high plasticity Calcareous specks		
66								
67				CH		SANDY FAT CLAY Firm brown clay with 40% fine sand, high plasticity		
68								
69				SC		CLAYEY SAND Soft brown clayey sand (80% fine), high plasticity		
70								
71				SM		SILTY SAND Soft brown silty sand (70% fine), mediium plasticity Calcareous lineations		Bentonite from 71 - 73 ft. bgs
72								
73				SC		CLAYEY SAND Brown clayey sand (50% fine), high plasticity		Sand from 73 - 87 ft. bgs
74								
75				SC		CLAYEY SAND 60% fine sand, calcareous lineations		

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: CC-4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA

LOCATION: NAD27 X:2085238.862260 Y:322919.521586

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME: 1" MW

DRILLING START:FINISH DATE: 10/30/2008 : 10/31/08

COMPLETION START/FINISH DATE: 10/31/08 : 10/31/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
76								
77				SC		CLAYEY SAND Brown sand (75% fine), high plasticity 1/2" Calcareous nodules		
78								
79				SP		POORLY GRADED SAND Soft brown silty sand (95% fine)		Sand pack 73-87 ft bgs
80								
81				SM		SILTY SAND Soft brown clayey silty sand (85% fine), medium plasticity		
82								
83				SC		CLAYEY SAND Firm brown sand (60% fine), high plasticity		1 in. ID SS304 0.010 Slot well screen from 75 - 85 ft bgs
84								
85				CL		LEAN CLAY WITH SAND Firm brown clay with 20% fine sand, medium plasticity		
86								Blank riser sump from 85-90 ft. bg
87				CL		LEAN CLAY WITH SAND Stiff brown clay with 20% fine sand, medium plasticity 1/2" Calcareous nodules		
88								Bentonite from 87 - 90 ft. bgs
89				CL		LEAN CLAY WITH SAND Stiff brown clay with 20% fine sand, medium plasticity		
90								
91						TOTAL DEPTH = 90FT.		
92								
93								
94								
95								
96								
97								
98								
99								

100_								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-5	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085294.472534 Y:322933.884004	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/17/2008 : 11/18/08	COMPLETION START/FINISH DATE: 11/18/2008 : 11/18/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1								
2								
3				CL		SANDY LEAN CLAY Firm dark grey clay with 20% fine, 10% medium, 10% coarse sa		
4						Medium plasticity, black and iron staining, trace gravel		1 in. ID FRP Riser from surface to 47 ft. bgs
5				CL		LEAN CLAY Firm dark brown clay with 10% fine sand		Grout from surface to 39 ft bgs.
6						Black and iron staining		
7				CL		LEAN CLAY Firm dark brown clay with 10% fine sand, medium plasticity		
8						Black and iron staining		
9				CL		LEAN CLAY Firm dark brown clay with 10% fine sand		
10						Black and iron staining, calcareous specks, roots		
11				CL		SANDY LEAN CLAY Stiff dark brown clay with 40% fine sand		
12						Black and iron staining, calcareous specks, roots		
13				SM		SILTY SAND Stiff brown silty sand (70% fine)		
14						Black and iron staining, grey mottling		
15				CH		FAT CLAY WITH SAND Stiff brown clay with 25% fine sand, high plasticity		
16						Black and iron staining, calcareous specks		
17						No Recovery 16-20 ft.		
18								
19								
20								
21				CH		SANDY FAT CLAY Soft brown clay with 30% fine sand, high plasticity		
22								
23				CH		FAT CLAY Firm brown clay with 10% fine sand, high plasticity		
24						Black and iron staining		
25				CH		FAT CLAY Black and iron staining, grey mottling, calcareous lineations		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-5	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085294.472534 Y:322933.884004
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/17/2008 : 11/18/08	COMPLETION START/FINISH DATE: 11/18/2008 : 11/18/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
26								
27				CH		FAT CLAY Firm brown clay with 10 % fine sand, high plasticity Black staining		
28								
29				SM		SILTY SAND Firm brown silty sand (65% fine), low plasticity Black and iron staining, grey mottling		
30								
31				CH		FAT CLAY Firm brown clay with 10 % fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		
32								
33				CH		FAT CLAY Stiff brown clay with 10 % fine sand, high plasticity Black and iron staining, grey mottling, 1/4" calcareous nodules		
34								
35				CH		FAT CLAY Stiff brown clay with 10 % fine sand, high plasticity Black and iron staining, grey mottling, 1/4" calcareous nodules		
36								1 in. ID FRP Riser from surface to 47 ft. bgs
37				CH		SANDY FAT CLAY Firm dark grey clay with 20% fine, 10% med. sand, high plasticit		
38								Grout from surface to 39 ft bgs.
39				CH		SANDY FAT CLAY Firm brown clay with 30 % fine sand, high plasticity		
40						Black and iron staining, grey mottling, calcareous specks		Bentonite from 39-41 ft. bgs
41				CH		SANDY FAT CLAY Firm brown clay with 30 % fine sand, high plasticity		
42						Black and iron staining, grey mottling, calcareous specks		
43				SM		SILTY SAND concretions		
44								
45				SP		POORLY GRADED SAND Soft brown fine sand		
46								1 in. ID SS304 0.010 Slot well screen from 47 - 57 ft bgs
47				CH		SANDY FAT CLAY Soft brown clay with 35 % fine sand, high plasticity		
48						Iron staining, grey mottling, calcareous specks		
49				SC		CLAYEY SAND Soft brown clayey sand (80% fine), medium plasticity		Sand pack 62 - 41 ft bgs
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-5	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085294.472534 Y:322933.884004
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/17/2008 : 11/18/08	COMPLETION START/FINISH DATE: 11/18/2008 : 11/18/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
51				CH		SANDY FAT CLAY Soft brown sandy clay (40% fine sand), high plasticity		1 in. ID SS304 0.010 Slot well screen from 47 - 57 ft bgs
52						SLOUGH		
53				CH		FAT CLAY WITH SAND Soft brown clay with fine sand (20%), high plasticity Iron and black staining		Sand pack 62 - 41 ft bgs
54								
55				SC		CLAYEY SAND Stiff brown clayey (60%) fine sand Black and iron staining		
56								
57								
58						Slough 57-61 ft.		Riser sump from 57-62 ft. bgs
59								
60								
61				SM		SILTY SAND Soft brown sitly fine (80%) sand		
62								Hole abandoned filled with Bentonite 62 - 90 ft bgs
63				CH		FAT CLAY WITH SAND Stiff brown clay with fine sand (20%), high plasticity Black and iron staining, grey mottling, calcareous specks		
64								
65				CH		FAT CLAY WITH SAND Stiff brown clay with fine sand (20%), high plasticity Black and iron staining, grey mottling, calcareous specks		
66								
67				CH		SANDY FAT CLAY Firm brown sandy clay (fine sand 35%), high plasticity		
68								
69				CH		SANDY FAT CLAY Firm brown sandy clay (fine sand 45%), high plasticity Black and iron staining, grey mottling, calcareous specks		
70								
71				CH		FAT CLAY WITH SAND Stiff brown clay with fine sand (20%), high plasticity Black and iron staining, grey mottling		
72								
73				SM		SILTY SAND Firm brown silty sand (80% fine), low plasticity		
74								
75				SM		SILTY SAND Firm brown silty sand (75% fine), low plasticity, calcareous specks		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-5	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085294.472534 Y:322933.884004
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/17/2008 : 11/18/08	COMPLETION START/FINISH DATE: 11/18/2008 : 11/18/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
76								Hole abandoned filled with Bentonite 62 - 90 ft bgs
77				SM		SILTY SAND Soft brown silty fine sand (75%)		
78						Slough 77 - 80 ft.		
79								
80								
81				SM		SILTY SAND Soft brown silty fine sand (75%)		
82								
83				SM		SILTY SAND Soft brown silty fine sand (75%)		
84								
85				SM		SILTY SAND Soft brown silty fine sand (70%)		
86								
87				SC		CLAYEY SAND Firm brown clayey fine sand (50%)		
88								
89				SM		SILTY SAND Firm brown silty fine sand (75%)		
90								
91						TOTAL DEPTH = 90 FT.		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-6	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085342.445079 Y:322922.197199	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/14/2008 : 11/14/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1								
2								
3				GM		SILTY GRAVEL WITH SAND Firm dark grey silty gravel with sand (10% fine, 10% med, 10% coarse); Crumbly, dry; gravel angular to rounded		
4								1 in. ID FRP Riser from surface to 43 ft. bgs
5				CH		FAT CLAY Stiff dark brownish dark grey clay, high plasticity Calcareous specks		Grout from surface to 33 ft bgs.
6								
7				CH		FAT CLAY WITH SAND Stiff dark brownish grey clay with 20% fine sand, high plasticity Black and iron staining, moist		
8								
9				CH		FAT CLAY Stiff dark grey clay, high plasticity Black and iron staining		
10								
11				CH		SANDY FAT CLAY Stiff dark brown sandy (35% fine sand) clay, high plasticity Black and iron staining, grey mottling, 1/8"calcareous nodules		
12								
13				CL		SANDY LEAN CLAY Firm brown sandy (45% fine sand) clay, low plasticity Black and iron staining, grey mottling, calcareous specks		
14								
15				CL		LEAN CLAY WITH SAND Firm brown clay with 20% fine sand, medium plasticity Black and iron staining, grey mottling, 1/8"calcareous nodules		
16								
17				CL		SANDY LEAN CLAY Firm dark brownish grey clay with sand (20% fine, 10% med, 10% coarse) Medium plasticity		
18								
19				CH		SANDY FAT CLAY Firm brown sandy clay (40% fine sand), high plasticity Black and iron staining, calcareous specks		
20								
21				CH		FAT CLAY Soft brown silty clay (10% fine sand), high plasticity		
22								
23				CH		FAT CLAY Stiff brown silty clay (10% fine sand), high plasticity Black and iron staining, calcareous lineations		
24								
25				CH		FAT CLAY WITH SAND		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-6	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085342.445079 Y:322922.197199
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/14/2008 : 11/14/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
						Stiff brown silty clay with 25% fine sand, high plasticity Black and iron staining, grey mottling, 1/4" calcareous nodules		
26								
27				SC		CLAYEY SAND Firm brown clayey sand with 65 % fine sand, medium plasticity Black and iron staining, grey mottling, calcareous specks		
28								
29				SC		CLAYEY SAND Firm brown clayey sand with 70 % fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		1 in. ID FRP Riser from surface to 43 ft. bgs
30								
31				SC		CLAYEY SAND Firm brown clayey sand with 75 % fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		Grout from surface to 33 ft bgs.
32								
33				CH		FAT CLAY WITH SAND Stiff brown clay with 15% fine sand, high plasticity Black and iron staining, grey mottling, 1/8" calcareous nodules		Bentonite 33 -35 ft bgs
34								
35				CH		FAT CLAY WITH SAND Stiff brown clay with 15% fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		Sand pack 55 - 35 ft bgs
36								
37				CH		FAT CLAY WITH SAND Stiff brown clay with 15% fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		
38								
39				SC		CLAYEY SAND Soft brown clayey fine (50%) sand, high plasticity		
40								
41				CH		SANDY FAT CLAY Firm brown clay with 40% fine sand, high plasticity Black and iron staining, grey mottling, 1/4" calcareous nodules		
42								
43				SC		CLAYEY SAND Firm brown clayey sand (60% fine), high plasticity Black and iron staining, grey mottling, 1/2" calcareous nodules		
44				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty fine sand (90%)		
45								
46						NO RECOVERY 45-53 ft.		1 in. ID SS304 0.010 Slot well screen from 43 - 53 ft bgs
47								
48								
49								
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-6	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085342.445079 Y:322922.197199
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/14/2008 : 11/14/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
51						NO RECOVERY 50-52.5 ft.		1 in. ID SS304 0.010 Slot well screen from 43 - 53 ft bgs
52								
53				CH		FAT CLAY Stiff brown clay with fine sand (10%), high plasticity Black and iron staining, grey mottling, calcareous specks		Sump 53 -55 ft. bgs Sand pack 55 - 35 ft bgs
54								
55				CH		FAT CLAY Stiff brown clay with fine sand (10%), high plasticity Black and iron staining, grey mottling, calcareous specks		
56								Hole abandoned filled with Bentonite 55 - 90 ft bgs
57						NO RECOVERY 56-63 ft.		
58								
59								
60								
61						SLOUGH		
62								
63				SC		CLAYEY SAND Soft brown clayey sand (60% fine), high plasticity Black and iron staining, grey mottling, 1" calcareous nodules		
64								
65				CH		FAT CLAY Stiff brown clay with fine sand (10%), high plasticity Black and iron staining, grey mottling		
66								
67				CL		LEAN CLAY Firm brown silty clay with fine sand (10%), low plasticity Black and iron staining, grey mottling, calcareous specks		
68								
69				SC		CLAYEY SAND Firm brown clayey sand (55% fine), high plasticity Black and iron staining, grey mottling, calcareous specks		
70								
71				SC		CLAYEY SAND Firm brown clayey sand (65% fine), high plasticity Black and iron staining, grey mottling		
72								
73				SC		CLAYEY SAND Firm brown clayey sand (65% fine), high plasticity Black and iron staining, grey mottling, calcareous specks		
74								
75				SM		SILTY SAND Firm brown silty sand (80% fine), low plasticity, calcareous specks		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: CC-6	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085342.445079 Y:322922.197199
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: 1" MW	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/14/2008 : 11/14/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
76						No Recovery 75-78 ft.		Hole abandoned filled with Bentonite 55 - 90 ft bgs
77								
78								
79				SP-SM		POORLY GRADED SAND WITH SILT 90% fine sand with silt		
80								
81				SM		SILTY SAND Firm brown silty fine sand (80%)		
82								
83				CL		LEAN CLAY Stiff, brown, black staining, low plasticity		
84								
85				CL		LEAN CLAY Stiff, brown clay, low plasticity		
86								
87				CH		FAT CLAY Firm brown clay with 10% fine sand, high plasticity		
88								
89				CH		FAT CLAY Firm brown clay with 10% fine sand, high plasticity		
90								
91						TOTAL DEPTH = 90 FT.		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-1	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.862510 Y:322933.376127
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/7/2008 : 11/10/08	COMPLETION START/FINISH DATE: 11/10/08 : 11/10/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 2" MW and 1.25" VMP
						Hand auger 0 to 5 ft. No samples		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
1								
2								
3								1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4								Bentonite 4 - 5 ft.
5								1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP). Sand 5 -7 ft.
6				GC		CLAYEY GRAVEL WITH SAND Soft dark brown, sand: 10% fine, 10% med., 20% coarse 30% Gravel: 1/4" to 1" subangler and subrounded, high plasticit		
7								
8								
9				CH		FAT CLAY Firm dark brown clay with 10% fine sand, high plasticity Black staining, grey mottling, calcareous specks		Grout from 7 to 62.5 ft. bgs
10								
11				CH		FAT CLAY Firm dark brown clay with 10% fine sand, high plasticity Black staining, calcareous specks		2 in ID CPVC riser from surface to 71 ft.
12								
13				CH		FAT CLAY WITH SAND Firm dark brown clay with 20% fine sand, high plasticity Black staining, calcareous specks		
14								
15				CH		FAT CLAY WITH SAND Firm dark brown clay with 20% fine sand, high plasticity Black staining, calcareous specks		
16								
17				CH		SANDY FAT CLAY Firm dark brown clay with 30% fine sand, high plasticity Black staining, calcareous lineations		
18								
19				CH		SANDY FAT CLAY Firm brown clay with 30% fine sand, high plasticity Black and iron staining, calcareous lineations		
20								
21				CH		SANDY FAT CLAY Firm brown clay with 30% fine sand, high plasticity Black and iron staining, calcareous lineations		
22								
23				CH		SANDY FAT CLAY Firm brown clay with 35% fine sand, high plasticity Black staining, 1/2" calcareous specks		
24								
25						Soft		CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: DD-1

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA

LOCATION: NAD27 X:2085118.862510 Y:322933.376127

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: ROTARY-WATER

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP

DRILLING START:FINISH DATE: 11/7/2008 : 11/10/08

COMPLETION START/FINISH DATE: 11/10/08 : 11/10/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
26								Grout from 7 to 62.5 ft. bgs
27				CH		SANDY FAT CLAY Stiff brown clay with 45% fine sand, high plasticity Black and iron staining, grey mottling		
28								
29				SC		CLAYEY SAND Stiff brown clayey sand (60% fine), high plasticity Black and iron staining, grey mottling, 1/8" calcareous nodules		
30								
31				CH		SANDY FAT CLAY Stiff brown clay with 40% fine sand, high plasticity Black and iron staining, grey mottling, 1/2" calcareous nodules		
32								
33				CH		SANDY FAT CLAY Stiff brown clay with 40% fine sand, high plasticity Black and iron staining, grey mottling, 1/4" calcareous nodules		
34								
35				CH		FAT CLAY WITH SAND Stiff brown clay with 15% fine sand, high plasticity Black and iron staining, grey mottling, 1/4" calcareous nodules		
36								
37				CH		FAT CLAY WITH SAND Stiff brown clay with 15% fine sand, high plasticity Black and iron staining, grey mottling, 1/4" calcareous nodules		
38								
39				CH		FAT CLAY WITH SAND Stiff brown clay with 15% fine sand, high plasticity Black and iron staining, grey mottling, 1/4" calcareous nodules		
40								
41				MH		SANDY ELASTIC SILT Soft brown clayey silt with 45% fine sand, high plasticity Calcareous specks		
42								
43				SM		SILTY SAND Soft brown silty sand (85% fine), low plasticity Grey mottling		
44								
45						3/4" calcareous nodules		
46						NO RECOVERY 45 to 48 ft		
47								
48								
49				SM		SILTY SAND Soft brown silty sand (80% fine), low plasticity		
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-1	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.862510 Y:322933.376127
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/7/2008 : 11/10/08	COMPLETION START/FINISH DATE: 11/10/08 : 11/10/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
51				CH		FAT CLAY Stiff brown silty clay with 10% fine sand, high plasticity		Grout from 7 to 62.5 ft. bgs
52						Iron staining, grey mottling, 1/8" calcareous nodules		
53				CH		FAT CLAY Stiff brown silty clay with 10% fine sand, high plasticity		
54						Black and iron staining, grey mottling, calcareous lineation		
55				SC		CLAYEY SAND Stiff brown clayey silty sand (75% fine), high plasticity		
56								
57				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty sand (90% fine), low plasticity		
58								
59				SP		POORLY GRADED SAND Soft brown sand (95% fine), low plasticity		
60				CH		FAT CLAY Stiff brown clay with 10% fine sand, high plasticity		
61						Little black staining, calcareous specks		
62								
63				CH		FAT CLAY Stiff brown clay with 10% fine sand, high plasticity		Bentonite from 62.5 - 65 ft. bgs
64						Little black staining, calcareous specks		
65				CH		FAT CLAY WITH SAND		
66						NO RECOVERY 65 to 68 Ft		Sand from 65 - 82 ft. bgs
67								
68								
69				CH		SANDY FAT CLAY Firm brown clay with 35% fine sand, high plasticity, calcareous specks		
70								
71						NO RECOVERY 70 to 72 Ft		
72								2 in ID SS304 0.010 slot well screen from 71 - 81 ft. bgs
73				CH		SANDY FAT CLAY Firm brown clay with 35% fine sand, high plasticity		
74						Grey mottling, calcareous specks		
75								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-1	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.862510 Y:322933.376127
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/7/2008 : 11/10/08	COMPLETION START/FINISH DATE: 11/10/08 : 11/10/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL DRILLING RATE, DRILLING FLUID LOST CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
				CH				
76								Sand from 65 - 82 ft. bgs
77				SC		CLAYEY SAND Soft brown clayey sand (60% fine), high plasticity		
78								2 in ID SS304 0.010 slot well screen from 71 - 81 ft. bgs
79				SP		POORLY SORTED SAND Soft brown sand (95% fine)		
80								
81				CH		FAT CLAY WITH SAND Soft brown clay with 25% fine sand, high plasticity		
82								
83				ML		SILT WITH SAND Firm brown clayey silt with 20% fine sand, low plasticity Grey mottling, calcareous lineation		Bentonite from 82 - 90 ft. bgs
84								
85				MH		ELASTIC SILT WITH SAND Firm brown silt with 20% fine sand, high plasticity 1/4" calcareous nodules, crumbly		Hole collapsed, Reamed back out to 86 ft
86								
87				MH		SANDY ELASTIC SILT Firm brown clayey silt with 30% fine sand, high plasticity 1/8" calcareous nodules		
88								
89				MH		ELASTIC SILT Firm brown clayey silt with 10% fine sand, high plasticity 1/8" calcareous nodules		
90								
91						TOTAL DEPTH =		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-2	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION:'LOCATION:NAD27 X:2085134.862410 Y:322951.854871
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/10/2008 : 11/11/08	COMPLETION START/FINISH DATE: 11/11/08 : 11/11/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
1				SM		SILTY SAND Soft dark gray silty sand (50 % fine 10 % med.), low plasticity Calcareous specks		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
2								
3				ML		SANDY SILT Soft dark gray silt (20% fine 20% med. sand), low plasticity Calcareous specks		1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4								Bentonite 4 - 5 ft.
5				MH		SANDY ELASTIC SILT Soft brownish gray silt (20% fine 10% med. sand), high plasticity		1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP). Sand 5 -7 ft.
6						Grey mottling		
7				MH		SANDY ELASTIC SILT Soft brownish grey clayey silt with sand (30% fine 10 % med.),		
8						High plasticity, grey mottling, 1/8" calcareous nodules		
9				MH		SANDY ELASTIC SILT Firm brownish grey silt with 30% fine sand, high plasticity		Grout from 7 to 28 ft. bgs
10						Little black and iron staining, grey mottling		
11				CH		FAT CLAY WITH SAND Stiff dark brown clay with 25% fine sand, high plasticity		2 in ID CPVC riser from surface to 35 ft. bgs
12						Black and iron staining, grey mottling		
13				CH		FAT CLAY WITH SAND Stiff brownish dark grey clay with 15% fine sand, high plasticity		
14						Calcareous specks		
15				SM		SILTY SAND Firm brown silty sand (50% fine 10% med.), medium plasticity		
16						Black and iron staining, grey mottling, 1/8" calcareous nodules		
17				CH		SANDY FAT CLAY Soft brownish grey clay with 30% fine sand, high plasticity		
18								
19				CH		FAT CLAY WITH SAND Soft brown clay with 25% fine sand, high plasticity		
20						Grey mottling, iron staining		
21				CH		FAT CLAY WITH SAND Very soft brown clay with 15% fine sand, high plasticity		
22						Black staining, ¼" calcareous nodules		
23				CH		SANDY FAT CLAY Very soft brown clay with 30% fine sand, high plasticity		
24						Much black staining		
25								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-2	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION:NAD27 X:2085134.862410 Y:322951.854871	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER		BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/10/2008 : 11/11/08	COMPLETION START/FINISH DATE: 11/11/08 : 11/11/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
26				SM		SILTY SAND Firm light brown silty sand (70% fine), low plasticity, Much black, some iron staining, ¾" calcareous nodules		
27								
28								
29				SM		SILTY SAND Soft light brown silty sand (80% fine), low plasticity Much black, some iron staining		Bentonite from 28 - 30 ft. bgs
30								
31				CL		SANDY LEAN CLAY Firm light brown grey clay with 30% fine sand, Low plasticity, Much black, some iron staining, ¾ calcareous nodules		Sand from 30 - 47 ft. bgs
32								
33				CL		LEAN CLAY Firm light brown grey clay, low plasticity, Much black, some iron staining, calcareous lineations		
34								
35				CL		LEAN CLAY WITH SAND Stiff brown clay with 15% fine sand, medium plasticity Black and iron staining, grey mottling, 1/8" calcareous nodules		
36								
37						SLOUGH		
38								
39				SM		SILTY SAND Stiff brown silty fine sand (55%), low plasticity Black and iron staining, grey mottling, 1/8" calcareous nodules		
40								
41				SC		CLAYEY SAND Soft brown clayeyfine sand (50%), high plasticity, grey mottling Calcareous specks		
42								
43				SP		POORLY GRADED SAND Soft brown fine sand		2 in ID SS304 0.010 slot well scree from 35 - 45 ft. bgs
44								
45								
46								
47				CL		SANDY LEAN CLAY Firm clay with 40% fine sand, Black & iron staining, grey mottling, 1/8" calcareous nodules		Hole abandoned 47 - 90 ft. bgs Filled with bentonite
48								
49				CL		LEAN CLAY WITH SAND Firm brown clay with 20% fine sand Black and iron staining, grey mottling, 1/8" calcareous nodules		
50								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-2	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION:NAD27 X:2085134.862410 Y:322951.854871	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER		BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/10/2008 : 11/11/08	COMPLETION START/FINISH DATE: 11/11/08 : 11/11/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
51						SLOUGH		
52				CL		LEAN CLAY WITH SAND Firm brown clay with 20% fine sand		
53						Black and iron staining, grey mottling, 1/8" calcareous nodules		
54								
55				SC		CLAYEY SAND Stiff brown sand (75% fine), low plasticity		
56						Black and iron staining, grey mottling, 1/8" calcareous nodules		
57						SLOUGH		Hole abandoned 47 - 90 ft. Filled with bentonite
58								
59				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty fine sand (90%)		
60								
61				CH		FAT CLAY WITH SAND Firm brown clay with 20% fine sand, high plasticity		
62						1/8" calcareous nodules		
63				CH		FAT CLAY WITH SAND Stiff brown clay with 20% fine sand, high plasticity		
64						Black and iron staining, grey mottling, 1/8" calcareous nodules		
65				CH		FAT CLAY WITH SAND Stiff brown clay with 20% fine sand, high plasticity		
66						1/8" calcareous nodules		
67				CH		SANDY FAT CLAY Firm brown clay with 30% fine sand, high plasticity		
68						Iron staining, grey mottling, 1/8" calcareous nodules		
69				SC		CLAYEY SAND Firm brown clayey fine (70%) sand		
70						Iron staining, grey mottling		
71				SC		CLAYEY SAND Soft brown clayey sand (55% fine)		
72						1/8" calcareous nodules		
73				CH		FAT CLAY WITH SAND Soft brown clay with 25% fine sand, high plasticity		
74						Black staining		
75						1/8" calcareous nodules		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-2	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION:NAD27 X:2085134.862410 Y:322951.854871	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/10/2008 : 11/11/08	COMPLETION START/FINISH DATE: 11/11/08 : 11/11/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
76								
77				CH		SANDY FAT CLAY Firm brown clay with 35% fine sand, grey mottling		
78								
79				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty sand (90% fine)		Hole abandoned 47 - 90 ft. Filled with Bentonite
80								
81				SC		CLAYEY SAND Soft dark brown sand (75% fine), high plasticity		
82								
83				SC		CLAYEY SAND Firm dark brown sand (60% fine), high plasticity		
84						Black staining, 1/8" calcareous nodules		
85				CH		FAT CLAY Soft dark brown clay (10% fine), high plasticity		
86						1/8" calcareous nodules		
87								
88								
89								
90								
91						TOTAL DEPTH = 90 FT.		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-3	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085206.862280 Y:322937.999620
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/29/2008 : 10/30/08	COMPLETION START/FINISH DATE: 10/30/08 : 10/30/08 — LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
1						No recovery 0-5 ft		
2								
3								
4								
5								
6				CL		SANDY LEAN CLAY Dark grey dry clay with coarse sand 20%, angular gravel 10%		
7				SM		SILTY SAND Dark grey dry silty sand (coarse sand 40%, angular gravel 10		1 in. ID FRP Riser from surface to 54 ft bgs.
8								Grout from surface to 50 ft bgs.
9								
10				CL		LEAN CLAY WITH SAND Dark grey dry silty clay with fine to coarse sand (20%); low plasticity		
11								
12								
13				SM		SILTY SAND Dark grey silty sand (fine to coarse 60%) with calcareous incl		
14								
15				ML		SILT WITH SAND Dark brown silt with fine to coarse sand (20%)		
16						No Recovery 15 - 20 ft. Where "no recovery" is reported, depths for subsequent samples to		
17						10 ft. below starting depth of "no recovery" zone may be off by thickness of reported "no recovery" zone		
18								
19								
20								
21						LEAN CLAY		
22				CL		Dark brown silty clay; calcareous inclusions at 22 ft.; low plasticity		
23								
24				CL		SANDY LEAN CLAY Brown sandy clay (20% fine sand, 10% gravel);		
25						Calcareous inclusions and black staining		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-3	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085206.862280 Y:322937.999620
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/29/2008 : 10/30/08	COMPLETION START/FINISH DATE: 10/30/08 : 10/30/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
26						No recovery 25 - 29 ft. Where no recovery is reported, depths for subsequent samples to 29 ft. below starting depth of no recovery zone may be off by thickness of reported "no recovery" zone		
27								
28								
29								
30				CL		LEAN CLAY Brown silty clay, low plasticity		
31								
32								
33				SM		SILTY SAND Brown stiff silty fine to medium sand (60%); black specks; Medium plasticity		
34								
35				SC		CLAYEY SAND Brown firm clayey fine to coarse sand (60%), medium plasticity		1 in. ID FRP Riser from surface to 54 ft bgs.
36								Grout from surface to 50 ft bgs.
37						Soft at 37 ft.		
38								
39				CH		SANDY FAT CLAY Brown soft sandy silty clay (fine sand 30%); high plasticity		
40								
41				CH		FAT CLAY Brown soft,clay, high plasticity		
42								
43				MH		SANDY ELASTIC SILT Brown soft sandy silt (fine sand 30%), increasing sand content with depth; high plasticity		
44								
45								
46						No recovery 45 - 47 ft. Where no recovery is reported, depths for subsequent samples 47 ft. below starting depth of no recovery zone may be off by thickness of reported "no recovery" zone		
47								
48				CH		FAT CLAY WITH SAND Brown soft silty clay with fine to coarse sand (20%); high plas Grey mottling		
49								
50						Decreasing sand content with depth;		CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-3	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085206.862280 Y:322937.999620
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/29/2008 : 10/30/08	COMPLETION START/FINISH DATE: 10/30/08 : 10/30/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
51				CH		FAT CLAY WITH SAND Brown soft silty clay with fine to coarse sand (20%); high plas decreasing sand content with depth		Bentonite 50 - 52
52								
53								Sand pack 52 - 65 ft bgs
54				ML		SILT Brown very stiff silt; low plasticity		
55								1 in. ID SS304 0.010 slot
56						No recovery 55 - 57 ft.		well screen from 54 - 64 FT
57								
58				SM/ SC		Mixed SILTY SAND and CLAYEY SAND Brown very soft silty fine to medium sand (70%) with clay; Highly plastic clay seams (2" thick) at 58 ft.; Low to high plasticity		
59								
60								
61				SW		WELL GRADED SAND		
				SP- SC		POORLY GRADED SAND WITH CLAY Brown clayey fine sand (90%), high plasticity Decreasing sand content below 61 ft.;		
62								
63								
64								
65								Blank riser 90-64 ft. bgs
66								
67								
68				CL		LEAN CLAY WITH SAND Brown stiff silty clay with fine sand (20%); calcareous inclusio low plasticity		Hole abandoned from
69								65 to 90 ft bgs. Filled with Bentonite
70								
71								
72								
73								
74								

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: DD-3

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD27 X:2085206.862280 Y:322937.999620

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 10/29/2008 : 10/30/08

COMPLETION START/FINISH DATE: 10/30/08 : 10/30/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
75								CONTINUED
76				CL		LEAN CLAY Brown stiff silty clay with fine sand (20%); Low plasticity, calcareous inclusions 1/2"		
77								
78				CH		FAT CLAY Brown soft silty clay; high plasticity		Blank riser 90-64 ft. bgs
79								
80								
81								Hole abandoned from 65 to 90 ft bgs. Filled with Bentonite
82				ML		SANDY SILT Brown firm sandy silt (fine sand 30%); low plasticity		
83								
84								
85				CL		LEAN CLAY Brown stiff silty clay, low plasticity		
86								
87				CH		FAT CLAY Brown stiff silty clay; high plasticity		
88								
89				CL		LEAN CLAY Brown stiff silty clay, low plasticity		
90								
91						**TOTAL DEPTH = 90 FT**		
92								
93								
94								
95								
96								
97								
98								
99								

100_								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-4	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646629.063252 Y:1963335.671667	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/28/2008 : 10/28/08	COMPLETION START/FINISH DATE: 10/29/08 : 10/29/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	NOTES
						(Hand auger to 5 ft)		
1				SC		CLAYEY SAND WITH GRAVEL Dark grey dry clayey sand (70%) with some gravel		
2								
3								
4				CL		SANDY LEAN CLAY Dark grey clay with fine to coarse sand (30%), little gravel (10%) Low plasticity		
5								
6				SM		SILTY SAND Dark grey dry silty fine to coarse sand (70%)		1 in. ID FRP Riser from surface to 73 ft.
7								
8								Grout from surface to 63 ft.
9								
10								
11								
12								
13								
14				CL		SANDY LEAN CLAY Dark grey clay with fine to coarse sand (30%); Low plasticity		
15								
16								
17								
18								
19								
20				CL		SANDY LEAN CLAY Calcareous lineations, small roots		
21								
22								
23								
24				CL		SANDY LEAN CLAY Brown, moist very stiff clay with fine to medium sand (40%); Black and iron staining		
25								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-4	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646629.063252 Y:1963335.671667
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/28/2008 : 10/28/08	COMPLETION START/FINISH DATE: 10/29/08 : 10/29/08 — LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
26				CL		LEAN CLAY		
27				CL		SANDY LEAN CLAY Dark grey clay with fine to coarse sand (30%), low plasticity		
28								
29								
30								
31				SM		SILTY SAND Brown with grey mottling, clayey silty fine sand		
32								
33								
34								
35				ML		SILT Brown stiff clayey silt with fine sand (10%)		1 in. ID FRP Riser from surface to 73 ft.
36								Grout from surface to 63 ft.
37								
38								
39								
40								
41				SC		CLAYEY SAND Brown soft clayey fine to coarse sand (60%); high plasticity		
42						Calcarous inclusions 1/2" from 41 - 43 ft.;		
43								
44				SP		POORLY GRADED SAND		
45						CLAYEY SAND		
46						Poor recovery 45 - 47 ft. Clay and sand slough		
47								
48				SM/SP		SILTY SAND with POORLY GRADED SAND Brown silty fine to coarse sand with lenses of clean sand		
49				SC		CLAYEY SAND Brown clayey fine to medium sand (70%)		
50								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-4	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646629.063252 Y:1963335.671667
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/28/2008 : 10/28/08	COMPLETION START/FINISH DATE: 10/29/08 : 10/29/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
51								
52				CL		LEAN CLAY Brown silty clay, low plasticity		
53								1 in. ID FRP Riser from surface to 73 ft.
54								
55								Grout from surface to 63 ft.
56						No recovery 55 - 57 ft Note: Where no recovery is reported, depths for subsequent samples to 10 ft below starting depth of no recovery zone may be off by the thickness of reported "no recovery" zone.		
57								
58						Poor recovery: Clay with silty sand: slough		
59								
				SM		SILTY SAND		
60				SP		POORLY GRADED SAND		
				SC		CLAYEY SAND Brown clayey fine to coarse sand (60%);		
61								
62								
63				CL		LEAN CLAY Brown silty clay; low plasticity		
64								
				ML		SILT Brown clayey silt		Bentonite 63 - 65 ft.
65								
66								
67								Sand pack 65 - 84 ft.
68				SC		CLAYEY SAND Brown clayey fine sand (65%)		
69								
70								
71								
72								
73								1 " ID SS304 0.010 slot well screen from 73 - 83 ft.
74				SM		SILTY SAND Brown silty fine sand (65%)		
75								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-4	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646629.063252 Y:1963335.671667
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/28/2008 : 10/28/08	COMPLETION START/FINISH DATE: 10/29/08 : 10/29/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
76				CH		FAT CLAY Brown silty clay; high plasticity		
77								
				SC		CLAYEY SAND Brown clayey fine sand (65%); medium plasticity		
78								
79								1 in. ID SS304 0.010 slot well screen from 73 - 83 ft.
80				SM		SILTY SAND Brown silty fine sand (70%)		
81								Sand pack 65 - 84 ft.
82								
83								
				SC		CLAYEY SAND Brown clayey fine sand (65%); medium plasticity		
84								
85								7 in. dia. hole abandoned from 84 to 90 ft bgs. Filled with Bentonite
				CL		LEAN CLAY Brown silty clay; low plasticity		
86								
87								
				SM		SILTY SAND Brown clayey silty fine sand; medium plasticity		
88								
89				ML		SILT Brown clayey silt; low plasticity		
90								
						TOTAL DEPTH = 90 FT		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-5	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085350.861930 Y:322938.001752
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 10/20/2008 : 10/20/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/23/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
1						(Hand auger to 5 ft)		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
2								
3								1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4								
5				ML		SILT WITH SAND Dark brown silt with fine sand (15%), low plasticity		Bentonite 4 - 5 ft.
6								1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP). Sand 5 - 7 ft
7								
8								
9								Grout from 7 - 57 ft.
10								
11								
12				ML		SILT WITH SAND Dark brown silt with fine to coarse sand (25%), low plasticity		4 in ID CPVC riser from surface to 76 ft
13				ML		SANDY SILT Dark brown silt with fine to coarse sand (35%), low plasticity		
14								
15								
16								
17								
18				CL		LEAN CLAY WITH SAND Brown firm clay, fine to medium sand (20%); 1/2 " calcareous sand nodules, medium plasticity		
19								
20								
21								
22								
23				ML		SANDY SILT Brown soft blocky silt, fine to medium sand (30%), low plasticity		
24								
25								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-5	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085350.861930 Y:322938.001752
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 10/20/2008 : 10/20/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/23/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
26				SM		SILTY SAND Wet, brown fine to coarse sand (65%) with silt, low plasticity		
27								
28				SM		SILTY SAND Brown soft silty fine to medium sand (75%), 3/4" calcareous nodules		
29						60% Sand		
30				ML		SANDY SILT Brown firm fine to medium sandy (35%) silt, low plasticity		
31								
32								
33				CL		LEAN CLAY WITH SAND Light brown stiff clay with fine sand (15%), meduim plasticity		
34								
35				CL		SANDY LEAN CLAY 35% fine to meduim sandy clay		
36								Grout from 7 - 57 ft.
37								
38								4 in ID CPVC riser from surface to 76 ft
39				ML		SANDY SILT Light brown soft silt with fine to medium sand (35%) Low plasticity		
40								
41								
42								
43								
44				SM		SILTY SAND Fine to coarse sand (65%) with silt; 1/4" calcareous sand nodule		
45								
46						Siltier below 46 ft.		
47								
48								
49								
50				CH		SANDY FAT CLAY Brown soft clay with fine to medium sand (40%), high plasticity		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-5	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085350.861930 Y:322938.001752
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 10/20/2008 : 10/20/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/23/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
51				CH		SANDY FAT CLAY Brown soft clay with fine to medium sand (40%), high plasticity		
52								
53				CH		FAT CLAY WITH SAND Same, 20% sand at 53 ft.		Grout 7 - 57 ft.
54								4 in ID CPVC riser from surface to 76 ft
55								
56								
57								
58								Bentonite 57 - 59 ft
59								
60				SM		SILTY SAND Brown fine to coarse sand (60%) with silt; grey and Rreddish brown iron accretions		
61								
62				SM		SILTY SAND Light brown stiff fine to medium sand (60%) with silt at 62 ft.		
63								Sand from 59 - 86 ft
64								
65								
66								
67								
68								
69								
70								
71								
72				CL		LEAN CLAY WITH SAND Brown clay with fine to medium sand (20%) meduim plasticity		
73								
74								
75				SM		SILTY SAND		CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-5	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085350.861930 Y:322938.001752
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 10/20/2008 : 10/20/08	COMPLETION START/FINISH DATE: 10/22/08 : 10/23/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
76				SM		SILTY SAND Brown silty fine to medium sand (75%) with some clay lenses		
77								
78				SP		POORLY GRADED SAND WITH SILT Brown soft fine to medium sand (90%)		4 in ID SS304 0.010 slot well screen
79								from 76 - 86 ft.
80								Sand from 59 - 86 ft
81				SM		SILTY SAND Brown silty fine to medium sand (65%) with some clay lenses		
82								
83				CH		FAT CLAY Brown clay with fine sand (10%), high plasticity		
84								
85				ML		SANDY SILT nodules		
86								
87								Hole abandoned 86 - 90 ft
88				CL		LEAN CLAY WITH SAND Brown clay with fine to medium sand (20%), low plasticity		Filled with Bentonite
89								
90								
						TOTAL DEPTH = 90 FT		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-6	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085382.861860 Y:322938.002226
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/18/2008 : 11/18/08	COMPLETION START/FINISH DATE: 11/18/08 : 11/18/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
1								NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
2								
3				SW-SM		WELL-GRADED SAND WITH SILT AND GRAVEL Soft dark grey silty gravelly sand		1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4								Bentonite 4 - 5 ft.
5				ML		SANDY SILT Soft dark brown sandy (20% fine, 10% medium) silt,		1.25" ID CPVC slotted well screen
6						Crumbly, moist, medium plasticity		from 5 - 7 ft. (VMP). Sand 5 -7 ft.
7				CL		LEAN CLAY WITH SAND Firm dark brown fine sandy (15%) clay, medium plasticity		
8						Calcareous nodules 1/4"		
9				CL		LEAN CLAY WITH SAND Firm dark brown fine sandy (15%) clay, medium plasticity		Grout from 7 to 36 ft. bgs
10						Iron and black staining, grey mottling		
11								
12								2 in ID CPVC riser from surface to 40 ft. bgs
13								
14								
15				SM		SILTY SAND Brown soft silty fine sand (60%)		
16								
17				MH		SILT WITH SAND Brown soft clayey silt with 20% fine sand, high plasticity		
18								
19				CH		FAT CLAY WITH SAND Brown soft clay with fine sand (15%), high plasticity		
20						Black staining, calcareous specks		
21				CH		FAT CLAY Brown soft clay with fine sand (10%), high plasticity		
22						Iron and black staining, calcareous specks		
23				ML		SANDY SILT Brown soft fine sandy (35%) silt, low plasticity		
24						Iron and black staining, 1/8"calcareous nodules		
25				ML		SILT WITH SAND		CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: DD-6

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA

LOCATION: NAD27 X:2085382.861860 Y:322938.002226

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: ROTARY -WATER

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP

DRILLING START:FINISH DATE: 11/18/2008 : 11/18/08

COMPLETION START/FINISH DATE: 11/18/08 : 11/18/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
				ML		SILT WITH SAND Brown soft fine sandy (25%) silt, medium plasticity Iron and black staining, grey mottling, calcareous specks		
26								
27				CH		SANDY FAT CLAY Brownish dark grey soft clay with fine sand (30%), high plasticity Iron and black staining		
28								Grout from 7 to 36 ft. bgs
29				SM		SILTY SAND Brown firm silty fine sand (65%), low plasticity Iron and black staining, grey mottling		
30								2 in ID CPVC riser from surface to 40 ft. bgs
31				SC		CLAYEY SAND Soft brown clayey sand (50%), high plasticity Iron and black staining		
32								
33				CH		SANDY FAT CLAY Brown soft clay with fine sand (45%), high plasticity Iron and black staining		
34								
35				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity Iron and black staining, grey mottling		
36								
37				CH		SANDY FAT CLAY Brown soft clay with fine sand (40%), high plasticity 1/4"calcareous nodules		Bentonite from 36 - 38 ft. bgs
38								
39				SM		SILTY SAND Brown firm clayey silty fine sand (60%), low plasticity Iron and black staining, grey mottling, calcareous lineations		Sand from 38 - 52 ft. bgs
40								
41								
42								
43				MH		SANDY SILT Brown soft clayey silt with 30% fine sand, high plasticity		2 in ID SS304 0.010 slot well screen from 40 - 50 ft. bgs
44								
45				SM		SILTY SAND Brown firm clayey silty fine sand (65%) Iron and black staining, grey mottling		
46								
47								
48								
49				CL		LEAN CLAY WITH SAND Firm brown fine sandy (15%) clay, medium plasticity Iron and black staining, grey mottling		
50								

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: DD-6

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA

LOCATION: NAD27 X:2085382.861860 Y:322938.002226

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: ROTARY -WATER

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP

DRILLING START:FINISH DATE: 11/18/2008 : 11/18/08

COMPLETION START/FINISH DATE: 11/18/08 : 11/18/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
51				ML		SILT WITH SAND Brown firm fine sandy (25%) silt, low plasticity Iron and black staining, grey mottling, 1/8"calcareous nodules		Sand from 38 - 52 ft. bgs
52								
53				ML		SANDY SILT Brown firm fine sandy (35%) silt, low plasticity Iron and black staining, grey mottling, calcareous specks		
54								
55				ML		SANDY SILT Brown firm fine sandy (40%) silt, low plasticity Iron staining, grey mottling		
56								
57								
58								Hole abandoned 52 - 90 ft. Filled with bentonite
59				CL		LEAN CLAY WITH SAND Stiff brown fine sandy (20%) clay Iron staining, grey mottling		
60								
61				CL		LEAN CLAY WITH SAND Firm brown fine sandy (20%) clay, low plasticity Iron staining, grey mottling		
62								
63				CL		SANDY LEAN CLAY Firm brown fine sandy (30%) clay, low plasticity Iron staining, grey mottling, 1/4"calcareous nodules		
64								
65				CL		SANDY LEAN CLAY Firm brown fine sandy (30%) clay, medium plasticity		
66								
67				CL		SANDY LEAN CLAY Firm brown fine sandy (40%) clay Iron staining, grey mottling, 1/4"calcareous nodules		
68								
69				CL		SANDY LEAN CLAY Firm brown fine sandy (30%) clay, low plasticity		
70								
71				CH		SANDY FAT CLAY Brown soft clay with fine sand (30%), high plasticity		
72								
73				SM		SILTY SAND Brown soft clayey silty fine sand (65%), low plasticity		
74								
75				SM		SILTY SAND		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: DD-6	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085382.861860 Y:322938.002226	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER		BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/18/2008 : 11/18/08	COMPLETION START/FINISH DATE: 11/18/08 : 11/18/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
				SM		Brown soft clayey silty fine sand (65%), low plasticity		
76						Iron and black staining, calcareous specks		
77				SP		POORLY GRADED SAND		
						Soft brown fine sand		
78								
79				SP		POORLY GRADED SAND		
						Soft dark brown fine sand		Hole abandoned 52 - 90 ft.
80								Filled with bentonite
81								
82								
83								
84								
85				SP		POORLY GRADED SAND		
						Soft brown fine sand		
86								
87				SC		CLAYEY SAND		
						Soft brown clayey sand (60%), high plasticity		
88						Grey mottling, 1/2" calcareous nodules		
89				CH		FAT CLAY WITH SAND		
						Brown firm clay with fine sand (20%), high plasticity		
90						Grey mottling, calcareous specks		
						TOTAL DEPTH = 90 FT.		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-1	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646493.06345 Y:1963368.006651	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500		BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES	DRILLING START:FINISH DATE:	COMPLETION START/FINISH DATE	LOGGER:
NESTED WELL: 4" MW AND 1.25" VMP	10/23/2008 : 10/23/08	10/27/08 : 10/27/08	JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 8"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
						(Hand auger to 5 ft)		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
1								
2								
3								1.25 in ID CPVC riser from surface to 5 ft
4								Bentonite 4 - 5 ft.
5				CL		LEAN CLAY WITH SAND dry to moist, low plasticity		
6								1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP).
7								Sand 5 - 7 ft.
8								
9								
10								Grout from 7 - 75 ft.
11								
12								4 in ID CPVC riser from surface to 81 ft.
13								
14				ML		SILT WITH SAND Brown silt with fine to medium sand, low plasticity		
15								
16				SM		SILTY SAND Dark brown stiff silty fine sand (55%), moist, low plasticity		
17								
18								
19								
20								
21				CL		LEAN CLAY WITH SAND Brown silty clay with fine to medium sand (20%)		
22								
23								
24						LEAN CLAY WITH SAND		
25				CL		Light brown firm blocky clay with fine to medium sand (25%); iron and black staining		

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: EE-1

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD83 X:6646493.06345 Y:1963368.006651

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500 BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: NESTED WELL: 4" MW AND 1.25" VMP

DRILLING START:FINISH DATE: 10/23/2008 : 10/23/08

COMPLETION START/FINISH DATE: 10/27/08 : 10/27/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 8"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: NOTES Nested Completion 4" MW and 1.25" VMP
				CL		LEAN CLAY WITH SAND		
26								
27								
28				SM		SILTY SAND		
29						Light brown firm silty fine to medium sand (75%);		
						Grey mottling; 1/2" calcareous sand concretions, meduim plasticity		
30						Iron and black staining		
31								Grout from 7 - 75 ft.
32								
33								4 in ID CPVC riser from surface to 81 ft.
34								
35								
36								
37				CL		LEAN CLAY		
						Light brown clay with fine sand (10%), calcareous concretions 1/8"		
38						Meduim plasticity		
39								
40								
41								
42								
43				CL		LEAN CLAY WITH SAND		
						Increase fine to medium sand content to 25%		
44						CLAYEY SAND		
				SC		Brown soft silty clayey fine to medium sand (55%)		
45						High plasticity		
46						No recovery 45 - 48 ft		
						Note: Where no recovery is reported, depths for subsequent		
47						samples to 10 ft below starting depth of no recovery zone		
						may be off by the thickness of reported "no recovery" zone.		
48								
49				SM		SILTY SAND		
						Very soft, silty fine to medium sand (70%)		
50								

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: EE-1

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD83 X:6646493.06345 Y:1963368.006651

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500 BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: NESTED WELL: 4" MW AND 1.25" VMP

DRILLING START:FINISH DATE: 10/23/2008 : 10/23/08

COMPLETION START/FINISH DATE: 10/27/08 : 10/27/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 8"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: NOTES Nested Completion 4" MW and 1.25" VMP
51				SM		SILTY SAND Very soft, silty fine to medium sand, low plasticity		
52								
53				CH		FAT CLAY WITH SAND Very stiff clay with fine to medium sand (20%) High plasticity		
54								
55								
56				SC		CLAYEY SAND Brown soft to very soft clayey fine to medium sand (70%);		
57								
58				SP-SC		POORLY GRADED SAND WITH CLAY		
59				SC		CLAYEY SAND		Grout from 7 - 75 ft.
60								
61				CH		SANDY FAT CLAY Brown stiff clay with fine sand (35%), high plasticity		4 in ID CPVC riser from surface to 81 ft.
62								
63						Crumbly		
64				CH		Calcareous inclusions 1/8", grey mottling, iron staining		
65								
66								
67								
68								
69								
70				SC		CLAYEY SAND Brown firm sticky clayey fine to medium sand (60%)		
71								
72								
73								
74								
75								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-1	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646493.06345 Y:1963368.006651
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 10/23/2008 : 10/23/08	COMPLETION START/FINISH DATE: 10/27/08 : 10/27/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 8"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
76								Bentonite 75-77 ft.
77								
78								
79								Sand from 77-91 ft.
80								
81				SC - CH		CLAYEY SAND and SANDY FAT CLAY Brown clayey sand with sandy clay lenses, high plasticity		
82								4 in ID SS304 0.010 slot well scre from 81-91 ft.
83								
84				CH		FAT CLAY WITH SAND Brown very stiff clay with fine sand (15%) high plasticity		
85								
86								
87				SM		SILTY SAND Brown firm silty fine to medium sand (70%)		
88								
89								
90				CL		LEAN CLAY		
91								
92						Redrilled and cleaned out to 94ft.		Bentonite 91-94 ft.
93								
94								
95						**TOTAL DEPTH - 94 FT**		
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-2	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646533.063392 Y:1963354.150265
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/27/2008 : 10/27/08	COMPLETION START/FINISH DATE: 10/28/08 : 10/28/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
1						(Hand auger to 5 ft)		
2								
3				SM		SILTY SAND Dark brown soft silty fine to course sand (60-80%); Calcareous specks		
4								
5								
6				ML		SANDY SILT Dark brown soft blocky silt with fine to course sand (40%); Calcareous specks		1 in. ID FRP Riser from surface to 60 ft.
7								
8				ML		SANDY SILT 40% fine to course sand; calcareous specks, iron staining; Low plasticity		Grout from surface to 56 ft.
9								
10				ML		SANDY SILT 30% fine to course sand; calcareous specks, iron staining		
11								
12								
13				SM		SILTY SAND Brown stiff silty fine to coarse sand (60%)		
14				SM		SILTY SAND Soft silty fine to medium sand (70%)		
15								
16				ML		SANDY SILT Brown stiff silt with fine to medium sand (45%)		
17								
18				ML		SANDY SILT Calcareous striations, iron staining, low plasticity		
19								
20								
21								
22								
23				SM		SILTY SAND Light brown crumbly silty fine to medium sand (60%)		
24								
25								

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: EE-2

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD83 X:6646533.063392 Y:1963354.150265

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500 BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 10/27/2008 : 10/27/08

COMPLETION START/FINISH DATE: 10/28/08 : 10/28/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
26				ML		SANDY SILT Dark brown crumbly silt with fine to medium sand (25%) and Subangular to subrounded gravel (10%) 1/4" to 1" at 27ft.		
27								
28				SM		SILTY SAND Brown silty fine to coarse sand (70%)		
29								
30								
31								
32						No recovery 30 - 35 ft Note: Where no recovery is reported, depths for subsequent samples		
33						to 10 ft below starting depth of no recovery zone may be off by the thickness of reported "no recovery" zone.		
34								
35								1 in. ID FRP Riser from surface to 60 ft.
36								Grout from surface to 56 ft.
37				ML		SANDY SILT Light brown silt with fine sand (30%), iron and black staining; Low plasticity		
38								
39								
40								
41				CL		LEAN CLAY WITH SAND Brown stiff silty clay with fine sand (20%);		
42								
43						Calcarous concretions 1/2" at 43 ft.		
44								
45								
46								
47				SM		SILTY SAND Brown silty fine to medium sand (80%);		
48				SP-SM		POORLY GRADED SAND WITH SILT Fine to medium sand		
49				CH		FAT CLAY Brown soft silty clay with fine sand (10%), high plasticity		
50								

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: EE-2

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD83 X:6646533.063392 Y:1963354.150265

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500 BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 10/27/2008 : 10/27/08

COMPLETION START/FINISH DATE: 10/28/08 : 10/28/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
51								
52				CL		LEAN CLAY Brown stiff silty clay with fine sand (10%), high plasticity		1 in. ID FRP Riser from surface to 60 ft.
53								
54								Grout from surface to 56 ft.
55								
56						No recovery 55 - 59 ft samples by the thickness of reported "no recovery" zone.		Bentonite 56 - 59 ft bgs
57								
58								
59								
60				CH - SM		FAT CLAY and SILTY SAND Slough: highly plastic clay blocks in wet sandy slurry		
61								1 " ID SS304 0.010 slot well screen from 60 - 70 ft
62				CH - SM		FAT CLAY and SILTY SAND Mixed clay and silty medium sand		
63								
64				CL		LEAN CLAY Brown stiff silty clay, low plasticity		
65								
66						No recovery 65 - 66 ft.		Sand 59 - 79 ft bgs
67				SM		SILTY SAND		
68				SP-SM		POORLY GRADED SAND WITH SILT Very soft fine to medium sand (90%)		
69				SP		POORLY GRADED SAND		
70								
71								
72				CL		LEAN CLAY Brown firm silty clay, medium plasticity		
73								
74								
75								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-2	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646533.063392 Y:1963354.150265
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/27/2008 : 10/27/08	COMPLETION START/FINISH DATE: 10/28/08 : 10/28/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	NOTES
76						No recovery 75 - 79 ft		Sand 59 - 79 ft.
77						samples		
78						by the thickness of reported "no recovery" zone.		
79								
80				CL		LEAN CLAY Brown firm silty clay, low plasticity		7 in dia. hole abandoned from 79 to 90 ft bgs. Filled with Bentonite
81								
82				SC		CLAYEY SAND Brown firm clayey sand (60%), meduim plasticity		
83								
84				ML		SILT Brown clayey silt, low plasticity		
85				CL		LEAN CLAY Brown firm silty clay, low plasticity		
86								
87								
88				CH		FAT CLAY Brown stiff silty clay, high plasticity		
89								
90								
91						**TOTAL DEPTH = 90 FT**		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-3	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646597.063298 Y:1963354.150265	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL B PPE		
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/14/2008 : 10/14/08	COMPLETION START/FINISH DATE: 10/15/08 : 10/15/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL Note: Specific Soil samples were designated by CH2M Hill Geologist for CES logging purposes.
1						(Hand auger to 5 ft)		
2								
3				SM-ML		SILTY SAND and SANDY SILT Dark brown soft damp fine to coarse sand with silt; low plasticity		
4								
5								
6								1 in. ID FRP Riser from surface to 46 ft.
7								
8				CL		LEAN CLAY Dark brown soft damp clay with 10% fine to medium sand; meduim plasticity		Grout from surface to 32 ft.
9								
10				CL		LEAN CLAY Dark brown stiff silty clay, blocky; meduim plasticity		
11								
12								
13								
14				SM		SILTY SAND Dark brown soft silty find to medium sand; low plasticity		
15								
16								
17								
18								
19								
20				MH		SILT WITH SAND Dark brown, firm silt with fine sand (25%), medium plasticity		
21								
22								
23								
24								
25								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-3	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646597.063298 Y:1963354.150265
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL B PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/14/2008 : 10/14/08	COMPLETION START/FINISH DATE: 10/15/08 : 10/15/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	Completion Log	WELL Note: Specific Soil samples were designated by CH2M Hill Geologist for CES logging purposes.
						SILT WITH SAND		
26				ML		Light brown, stiff, blocky silt with fine to medium sand (20%)		
						Medium plasticity		
27								
28								1 in. ID FRP Riser from surface to 46 ft.
				SM		SILTY SAND		
29						Light brown, soft fine to medium sand with some silt, low plastici		
								Grout from surface to 32 ft.
30								
31								
32								
				ML		SILT WITH SAND		
33						Brown soft silt with fine to medium sand, low plasticity		
34								Bentonite 32 - 35 ft.
35								
						Slough from 33-37		
36								
37								
				MH		ELASTIC SILT WITH SAND		
38						Brown crumbly silt with some fine to medium sand (20%),		
						High plasticity		Sand pack 35 - 55 ft.
39								
40								
						ELASTIC SILT WITH SAND		
41				MH		(20%),		
						High plasticity		
42								
43								
44								
				CH		FAT CLAY WITH SAND		
45						(15%),		
						High plasticity		
46								1 in. ID SS304 0.010 slot well screen from 46 - 56 FT
47								
48								
				SM		SILTY SAND		
49								
50								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-3	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646597.063298 Y:1963354.150265
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL B PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/14/2008 : 10/14/08	COMPLETION START/FINISH DATE: 10/15/08 : 10/15/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL Note: Specific Soil samples were designated by CH2M Hill Geologist for CES logging purposes.
51								
52				SM		SILTY SAND Brown silty fine to medium sand		1 in. ID SS304 0.010 slot well screen from 46 - 56 ft.
53								
54								
55								Sand pack 35 - 55 ft.
56								
57								
58								
59								
60				CH		FAT CLAY WITH SAND Brown soft clay with little fine to course sand (15%); high plasticity		
61								
62								7 in dia. hole abandoned from 55 to 87 ft. Filled with bentonite
63								
64								
65				ML		SANDY SILT Brown soft silt with fine to medium sand (35%); medium plasticity		
66								
67				ML		SILT WITH SAND Brown stiff blocky clayey silt with little fine to coarse sand		
68								
69				CH		SANDY FAT CLAY Light brown soft blocky silty clay with fine to medium sand (35%; high plasticity		
70								
71								
72								
73								
74								
75								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-3	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646597.063298 Y:1963354.150265
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL B PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/14/2008 : 10/14/08	COMPLETION START/FINISH DATE: 10/15/08 : 10/15/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	Note: Specific Soil samples were designated by CH2M Hill Geologist for CES logging purposes.
76								
				SM		SILTY SAND Brown silty fine to medium sand		
77								
78								
79								7 in dia. hole abandoned from 55 to 87 ft. Filled with bentonite
80						SANDY SILT Brown firm silt with fine sand (35%), meduim plasticity		
				ML				
81								
82								
83								
84								
85								
86								
						FAT CLAY		
87				CH		Brown stiff blocky silty clay, high plasticity		
						TOTAL DEPTH = 87 FT		
88								
89								
90								
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-4	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646661.063205 Y:1963354.150265	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL B PPE		
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/8/2008 : 10/10/08	COMPLETION START/FINISH DATE: 10/13/08 : 10/13/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL Note: Specific Soil samples were designated by CH2M Hill Geologist for CES logging purposes.
1						(Hand auger to 5 ft)		
2								
3				ML		SILT WITH SAND Dry, hard, grey brown silt with clay, sand and gravel, low plasticity		
4								
5								
6								1 in. ID FRP Riser from surface to 73 ft.
7				ML		SILT WITH SAND Same as above with some clay; subangular gravel, low plasticity		
8				ML		SILT WITH GRAVEL Dark brown silt with gravel (1.5" subrounded) and little sand, low plasticity		Grout from surface to 70 ft bgs.
9								
10						No Recovery 9 - 17 ft. Core barrel pushed through formation by cobble in core barrell.		
11								
12								
13								
14								
15								
16								
17								
18				ML		SILT WITH SAND Brown silt, some clay and coarse sand and angular gravel		
19								
20				ML		SILT Light brown clayey silt, trace coarse sand, low plasticity		
21								
22								
23				ML		SILT Light brown clayey silt, trace coarse sand, low plasticity		
24								
25								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-4	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646661.063205 Y:1963354.150265
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL B PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/8/2008 : 10/10/08	COMPLETION START/FINISH DATE: 10/13/08 : 10/13/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL Note: Specific Soil samples were designated by CH2M Hill Geologist for CES logging purposes.
						SILT WITH SAND		
26				ML		Stiff brown silt with clay and fine sand, trace medium sand		
27								
				ML/CL		SANDY SILT and LEAN CLAY		
28						Light brown sandy silt with holes filled with black clay with low plasticity (CL)		
29								
30								
31								
				ML		GRAVELLY SILT WITH SAND		
32						Dark grey and brown silt with fine angular gravel (30%) and coarse angular sand		
33				CL		LEAN CLAY WITH SAND		
34						Light yellowish brown clay with silt and some fine sand, meduim plasticity		
35								1 in. ID FRP Riser from surface to 73 ft.
36								
				CL		LEAN CLAY		Grout from surface to 70 ft bgs.
37						Brown clay, trace angular coarse sand and fine sand		
38								
39								
40								
41								
				ML		SILT WITH SAND		
42						Brown silt, some fine sand and clay		
43								
44								
45								
				ML		SILT		
46						Brown clayey silt, trace fine sand and coarse angular gravel		
47								
48								
49								
50								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-4	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646661.063205 Y:1963354.150265
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL B PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/8/2008 : 10/10/08	COMPLETION START/FINISH DATE: 10/13/08 : 10/13/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	Completion Log	WELL Note: Specific Soil samples were designated by CH2M Hill Geologist for CES logging purposes.
51								
52				ML		SANDY SILT Brown, soft sandy silt		
53								
54								
55				ML		SILT WITH SAND Brown, very stiff silt with fine sand (25%) and clay		
56								
57								
58								
59								1 in. ID FRP Riser from surface to 73 ft.
60								Grout from surface to 70 ft bgs.
61								
62				CL		LEAN CLAY Soft brown clay, trace fine to coarse sand, meduim plasticity		
63								
64				CL		LEAN CLAY Stiff brown clay, trace fine sand, meduim plasticity		
65								
66								
67								
68				CL		LEAN CLAY Stiff brown clay, trace fine sand		
69								
70				CL		LEAN CLAY Brown sitly clay to clayey silt, trace fine sand, low plasticity		Bentonite 70 - 72 ft bgs
71								
72				CL		LEAN CLAY Brown sitly clay to clayey silt, trace fine sand, low plasticity		Sand pack 72 - 84 ft bgs
73								
74				SM		SILTY SAND Silty fine silty sand (50%)		1 " ID SS304 0.010 SLOT WELL SCREEN FROM 73 - 83 FT
75								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: EE-4	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD83 X:6646661.063205 Y:1963354.150265
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC GUS PECH 500	BORING & COMPLETION PERFORMED IN LEVEL B PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 10/8/2008 : 10/10/08	COMPLETION START/FINISH DATE: 10/13/08 : 10/13/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE 6.5"	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL Note: Specific Soil samples were designated by CH2M Hill Geologist for CES logging purposes.
76				SM		SILTY SAND Brown silty fine sand (75%)		
77								
78								
79								1 in. ID SS304 0.010 Slot well screen from 73 - 83 ft
80								
81				SM		SILTY SAND Brown silty fine sand (75%)		Sand pack 72 - 83 ft bgs
82								
83				SM		SILTY SAND Brown silty fine sand (75%)		
84								7 in.dia. hole abandoned from. 83 to 90 ft bgs. Filled with Bentonite
85								
86				ML		SILT WITH SAND Very stiff, clayey silt with fine sand (20%)		
87								
88								
89				CL		LEAN CLAY		
90								
						TOTAL DEPTH = 90 FT		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: FF-1	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085158.862190 Y:323002.658310	
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING		
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE		
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/10/2008 : 11/11/08	COMPLETION START/FINISH DATE: 11/11/08 : 11/12/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
1								
2								
3				CH		FAT CLAY Dark brown firm clay with fine sand (10%), high plasticity Iron and black staining		
4								
5				ML		SILT WITH SAND Dark b rown firm fine sandy (15%) silt, medium plasticity Iron and black staining, grey mottling		
6								1 in. ID FRP Riser from surface to 44 ft. bgs
7								
8								Grout from surface to 38 ft bgs.
9				CH		FAT CLAY WITH SAND Dark brown soft clay with fine sand (15%), high plasticity		
10								
11				CL		LEAN CLAY WITH SAND Brown firm clay with fine sand (15%), medium plasticity Iron and black staining, calcareous specks		
12								
13				SC		CLAYEY SAND Soft brown clayey sand (50%), medium plasticity Iron and black staining, calcareous specks		
14								
15				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (25%), high plasticity		
16								
17								
18								
19				CL		LEAN CLAY WITH SAND Brown firm clay with fine sand (15%), medium plasticity		
20								
21				CL		LEAN CLAY Brown stiff clay with fine sand (10%), medium plasticity Iron and black staining		
22								
23				CL		LEAN CLAY WITH SAND Brown firm clay with fine sand (15%), medium plasticity Black and iron staining, 1/4" calcareous nodules		
24								
25				CL		SANDY LEAN CLAY		CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: FF-1	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085158.862190 Y:323002.658310
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/10/2008 : 11/11/08	COMPLETION START/FINISH DATE: 11/11/08 : 11/12/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
				CL		SANDY LEAN CLAY		
26						Brown soft clay with fine sand (35%), medium plasticity		
								1 in. ID FRP Riser from surface to
27				CH		FAT CLAY WITH SAND		44 ft. bgs
						Brownish dark grey soft clay with fine sand (15%), high plasticity		
28						Grey mottling		Grout from surface to 38 ft bgs.
29				CH		FAT CLAY		
						Brownish dark grey soft clay with fine sand (10%), high plasticity		
30						Black and iron staining		
31				CH		SANDY FAT CLAY		
						Brownish dark grey soft clay with fine sand (40%), high plasticity		
32						Iron and black staining		
33				SC		CLAYEY SAND		
						Stiff brown clayey sand (55%), medium plasticity		
34						Iron and black staining, grey mottling		
35				CH		FAT CLAY WITH SAND		
						Brown stiff clay with fine sand (20%), high plasticity		
36						Iron and black staining, grey mottling, 1/2" calcareous nodules		
37				CH		FAT CLAY WITH SAND		
						Brown soft clay with fine sand (25%), high plasticity		
38						Iron and black staining		
39				CH		FAT CLAY WITH SAND		Bentonite 38-40 ft. bgs
						Dark brown firm clay with fine sand (25%), high plasticity		
40								
41				SC		CLAYEY SAND		
						Brown firm clayey sand (55%), medium plasticity		Sand pack 40 - 56 ft bgs
42								
43				SC		CLAYEY SAND		
						Brown firm clayey sand (60%), medium plasticity		
44								1 " ID SS304 0.010 SLOT
								WELL SCREEN FROM 44- 54 FT
45				SM		SILTY SAND		
						Brown firm silty fine sand (80%), 2" clacareous nodule		
46								
47				CH		FAT CLAY		
						Brown soft clay with fine sand (10%), high plasticity		
48						Grey mottling, 1/2" calcareous nodules		
49				SC		CLAYEY SAND		
						Soft brown clayey sand (80%), medium plasticity		
50								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: FF-1	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085158.862190 Y:323002.658310
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/10/2008 : 11/11/08	COMPLETION START/FINISH DATE: 11/11/08 : 11/12/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
51				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (20%), high plasticity Iron and black staining, grey mottling		1 " ID SS304 0.010 SLOT WELL SCREEN FROM 44- 54 FT
52								
53				SC		CLAYEY SAND Brown soft clayey sand (50%), medium plasticity		
54								
55				CH		FAT CLAY Brown stiff clay with fine sand (10%), high plasticity Iron and black staining, grey mottling		Sand pack 40 - 56 ft bgs
56								
57				CH		FAT CLAY WITH SAND Brown soft clay with fine sand (25%), high plasticity Iron and black staining, grey mottling		Well sealed with Bentonite from 56 - 90 ft. bgs
58								
59				CH		FAT CLAY WITH SAND Brown soft clay with fine sand (15%), high plasticity Iron and black staining, grey mottling		
60								
61				CH		FAT CLAY WITH SAND Brown soft clay with fine sand (20%), high plasticity Iron and black staining, grey mottling		
62								
63				SC		CLAYEY SAND Brown firm clayey sand (70% fine, 10% medium), medium plasti		
64								
65				CH		FAT CLAY WITH SAND Brown stiff clay with fine sand (20%), high plasticity Iron and black staining, grey mottling, 1/4" calcareous nodules		
66								
67				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity Iron and black staining, grey mottling		
68								
69				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity Iron and black staining, grey mottling		
70								
71				CH		FAT CLAY WITH SAND Brown stiff clay with fine sand (20%), high plasticity Iron and black staining		
72								
73				CH		SANDY FAT CLAY Brown firm clay with fine sand (35%), high plasticity		
74								
75				CH		SANDY LEAN CLAY		CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: FF-1	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085158.862190 Y:323002.658310
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/10/2008 : 11/11/08	COMPLETION START/FINISH DATE: 11/11/08 : 11/12/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
76								Well sealed with Bentonite from 56 - 90 ft. bgs
77				SC		CLAYEY SAND Brown soft clayey sand (60%), high plasticity		
78								
79				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (20%), high plasticity 1/8" calcareous nodules		
80								
81				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity Iron and black staining, 1/2" calcareous nodules		
82								
83				SC		CLAYEY SAND Dark brown firm clayey sand (60% fine), low plasticity		
84								
85				SC		CLAYEY SAND Dark brown firm clayey sand (65% fine), low plasticity		
86								
87				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity		
88								
89				CH		FAT CLAY Brown firm clay with fine sand (10%), high plasticity Iron and black staining, calcareous specks		
90								
91						**TOTAL DEPTH = 90 FT.**		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: FF-2	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X: 2085206.86208 Y:323002.659021
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/7/2008 : 11/10/08	COMPLETION START/FINISH DATE: 11/10/08 : 11/10/08 — LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
1						(Hand auger to 5 ft, no samples)		
2								
3								
4								
5								
6								1 in. ID FRP Riser from surface to 74 ft. bgs
7				CL		LEAN CLAY Dark grey stiff clay with fine sand (10%), medium plasticity Iron and black staining		
8								Grout from surface to 70 ft bgs.
9				CL		LEAN CLAY Dark brownish grey stiff clay with fine sand (10%), medium plasticity Iron and black staining, calcareous specks		
10								
11								
12								
13				CL		LEAN CLAY Dark brownish grey stiff clay with fine sand (10%), medium plasticity Iron and black staining, calcareous lineations		
14								
15				ML		SANDY SILT Dark brown stiff fine sandy (45%) silt, low plasticity Iron and black staining, calcareous specks		
16								
17								
18								
19								
20								
21				CL		LEAN CLAY Dark brownish grey stiff clay with fine sand (10%), medium plasticity Iron and black staining, calcareous lineations		
22								
23				ML		SILT WITH SAND Brown firm fine sandy (20%) silt, low plasticity Iron and black staining, grey mottling, calcareous specks		
24								
25				CL		LEAN CLAY		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: FF-2	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X: 2085206.86208 Y:323002.659021
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/7/2008 : 11/10/08	COMPLETION START/FINISH DATE: 11/10/08 : 11/10/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	NOTES
26				CL		LEAN CLAY Dark brown stiff clay with fine sand (10%), medium plasticity Iron and black staining, grey mottling		
27								
28				CH		FAT CLAY Brown stiff clay with fine sand (10%), high plasticity Iron and black staining, calcareous lineations		
29								
30								
31				CH		SANDY FAT CLAY Brown stiff clay with fine sand (35%), high plasticity Iron and black staining, calcareous specks		
32								
33				SM		SILTY SAND Brown firm silty fine sand (85%), iron and black staining		
34				CH		SANDY FAT CLAY Brown stiff clay with fine sand (45%), high plasticity Iron and black staining, calcareous specks		1 in. ID FRP Riser from surface to 74 ft. bgs
35								
36				CH		SANDY FAT CLAY Brown stiff clay with fine sand (45%), high plasticity Black staining, 1/8" calcareous nodules		Grout from surface to 70 ft bgs.
37								
38				CH		SANDY FAT CLAY Brown stiff clay with fine sand (35%), high plasticity Black staining, 1/4" calcareous nodules		
39								
40				SC		CLAYEY SAND Soft brown clayey sand (70%), high plasticity Calcareous lineations		
41								
42				SC		CLAYEY SAND Soft brown clayey sand (70%), high plasticity Black and iron staining, 1/4" calcareous nodules		
43								
44								
45				SM		SILTY SAND Brown soft silty fine sand (80%) 3" calcareous nodules		
46								
47								
48								
49				SP-SM		POORLY GRADED SAND WITH SILT Soft brown fine sand (90%) with silt		
50								

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: FF-2

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD27 X: 2085206.86208 Y:323002.659021

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 11/7/2008 : 11/10/08

COMPLETION START/FINISH DATE: 11/10/08 : 11/10/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
51				CH		SANDY FAT CLAY Brown stiff clay with fine sand (30%), high plasticity Iron staining, grey mottling		1 in. ID FRP Riser from surface to 74 ft. bgs
52								Grout from surface to 70 ft bgs.
53				CH		FAT CLAY WITH SAND Brown soft clay with fine sand (25%), high plasticity Grey mottling		
54								
55				CL		LEAN CLAY Brown stiff clay with fine sand (10%), medium plasticity Iron and black staining, grey mottling		
56								
57								
58								
59				MH		SILT WITH SAND Brown firm clayey silt with 25% fine sand, high plasticity Iron staining, grey mottling		
60								
61				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity Iron and black staining, grey mottling		
62								
63				CL		LEAN CLAY WITH SAND Brown stiff clay with fine sand (15%), medium plasticity Iron and black staining		
64								
65				CL		LEAN CLAY WITH SAND Brown stiff clay with fine sand (20%), medium plasticity 1/4" calcareous nodules		
66								
67				SC		CLAYEY SAND Soft brown clayey sand (60%), high plasticity Iron staining		
68								
69				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity Iron staining, grey mottling		
70								
71				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (20%), high plasticity Iron staining, grey mottling		Bentonite 70-72 ft bgs
72								Sand pack 72-85 ft bgs
73				CH		SANDY FAT CLAY Brown firm clay with fine sand (40%), high plasticity Iron staining, grey mottling		
74								1 in. ID SS304 0.010 SLOT WELL SCREEN FROM 84-74 FT
75				CH		SANDY FAT CLAY		

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: FF-2

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD27 X: 2085206.86208 Y:323002.659021

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 11/7/2008 : 11/10/08

COMPLETION START/FINISH DATE: 11/10/08 : 11/10/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
				CH		SANDY FAT CLAY		
76						Brown firm clay with fine sand (30%), high plasticity		1 in. ID SS304 0.010 SLOT WELL SCREEN FROM 74-84 FT
77				SM		SILTY SAND Brown soft silty fine sand (85%)		Sand pack 72-85 ft bgs
78								
79				SM		SILTY SAND Brown soft silty fine sand (80%)		
80								
81				SC		CLAYEY SAND Soft brown clayey sand (65%), medium plasticity		
82								
83				CH		SANDY FAT CLAY Brown stiff clay with fine sand (45%), high plasticity		
84								
85				CL		LEAN CLAY Brown stiff clay with fine sand (10%), medium plasticity Iron and black staining, calcareous specks		Well sealed with Bentonite from 85-90 ft bgs
86								
87				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity		Blank riser 84-90 ft. bgs
88								
89				CH		FAT CLAY WITH SAND Brown firm clay with fine sand (15%), high plasticity		
90								
						TOTAL DEPTH = 90 FT.		
91								
92								
93								
94								
95								
96								
97								
98								
99								

100_								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: FF-3	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085270.861920 Y:323002.659969
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/7/2008 : 11/7/08	COMPLETION START/FINISH DATE: 11/7/08 : 11/7/08	LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
1						(Hand auger to 5 ft, no samples)		
2								
3								
4								
5						No recovery 5-13 ft.		
6								
7								1 in. ID FRP Riser from surface to 43 ft. bgs
8								Grout from surface to 39 ft bgs.
9								
10								
11								
12								
13								
14				CH		FAT CLAY Dark grey stiff moist clay with fine sand (10%), high plasticity Iron staining		
15								
16				SC/CH		CLAYEY SAND and FAT CLAY Dark brown calyey sand (60% fine) with pockets of fat clay		
17								
18				CH		FAT CLAY WITH SAND Brown clay with fine sand (15%), high plasticity Iron and black staining, calcareous specks		
19								
20								
21								
22								
23								
24								
25								

CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: FF-3

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD27 X:2085270.861920 Y:323002.659969

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 11/7/2008 : 11/7/08

COMPLETION START/FINISH DATE: 11/7/08 : 11/7/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: NOTES
				CH		FAT CLAY WITH SAND Brown clay with fine sand (15%), high plasticity Iron and black staining, calcareous specks		
26								
27								
28								
29								
30								
31				SC		CLAYEY SAND Brown clayey fine sand (60%), medium plasticity Iron and black staining, calcareous specks		
32								
33								
34								
35								1 in. ID FRP Riser from surface to 43 ft. bgs
36				SC		CLAYEY SAND Brown clayey fine sand (70%), medium plasticity 1/2" calcareous nodules		Grout from surface to 39 ft bgs.
37								
38								
39								
40								Bentonite 39-41 ft bgs
41								
42								Sand pack 41-57 ft bgs
43				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty fine sand (90%)		1 " ID SS304 0.010 SLOT WELL SCREEN FROM 43-53 FT
44								
45						No recovery 45-49 ft.		
46								
47								
48								
49								
50				SP		POORLY GRADED SAND Soft brown fine sand (95%)		CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: FF-3	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085270.861920 Y:323002.659969
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: SONIC	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/7/2008 : 11/7/08	COMPLETION START/FINISH DATE: 11/7/08 : 11/7/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
				SP		POORLY GRADED SAND		
51				SC		CLAYEY SAND Soft brown clayey fine sand (70%)		1 " ID SS304 0.010 SLOT WELL SCREEN FROM 43-53 FT
52				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty fine sand (90%)		
53				CL		LEAN CLAY		
54						Brown very stiff clay with fine sand (10%), medium plasticity Iron and black staining, grey mottling		Riser sump from 53-57 ft. bgs
55						No recovery 55-57 ft		Sand pack 41-57 ft bgs
56								
57						Slough 57-60		Well sealed with Bentonite from 57-90 ft bgs
58								
59								
60								
				SP		POORLY GRADED SAND		
61						Soft brown fine sand		
				SC		CLAYEY SAND		
62						Firm brown clayey fine sand (70%)		
				CL		LEAN CLAY		
63						Brown very stiff clay with fine sand (10%), medium plasticity Iron and black staining, 1" calcareous nodules		
64								
65				SC		CLAYEY SAND		
66						Stiff brown clayey fine sand (70%)		
67								
68								
69								
70								
				CL		LEAN CLAY WITH SAND Stiff, brown, 20% fine sand, iron and black staining, grey mottling		
71				SC		CLAYEY SAND		
72						Stiff brown clayey fine sand (70%)		
73								
74								
75								CONTINUED

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: FF-3

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA

LOCATION: NAD27 X:2085270.861920 Y:323002.659969

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: SONIC

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES: 1" MW

DRILLING START:FINISH DATE: 11/7/2008 : 11/7/08

COMPLETION START/FINISH DATE: 11/7/08 : 11/7/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES
						Slough 75-77 ft.		
76								Well sealed with Bentonite from 57-90 ft bgs
77				SM		SILTY SAND Brown soft silty fine sand (80%)		
78								
79								
80								
81								
82								
83								
84								
85				CL		SANDY LEAN CLAY Brown stiff clay with fine sand (30%), low plasticity Iron and black staining, calcareous nodules 1/2"		
86								
87				CL		LEAN CLAY		
88								
89								
90								
						TOTAL DEPTH = 90 FT.		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-1	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.862250 Y:323016.514035
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/06/2008 : 11/06/08	COMPLETION START/FINISH DATE: 11/07/08 : 11/07/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 2" MW and 1.25" VMP
						Hand Auger 0 to 5 Ft		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
1								
2				ML		SILT WITH SAND Soft brown clayey silt with 20% fine sand, medium plasticity		1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
3								
4								Bentonite 4 - 5 ft.
5				MH		SILT WITH SAND Soft brown clayey silt with 20% fine sand, high plasticity		1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP). Sand 5 -7 ft.
6								
7						SLOUGH		
8								
9				MH		ELASTIC SILT WITH SAND Soft brown silt with 25% fine sand, high plasticity Iron staining		Grout from 7 to 73 ft.
10								
11				SC		CLAYEY SAND Firm brown clayey sand (60% fine, 10% med.), med. plasticity Black and iron staining		2 in ID CPVC riser from surface to 78 ft.
12								
13				SC		CLAYEY SAND Stiff brown clayey sand (70% fine), med. plasticity Black and iron staining, calcareous specks		
14								
15				CH		FAT CLAY WITH SAND Firm brown clay with 20% fine sand, high plasticity Black and iron staining, grey mottling		
16								
17				CH		FAT CLAY Firm brown clay with 10% fine sand, high plasticity Black staining, calcareous specks		
18								
19				CH		SANDY FAT CLAY Stiff brown clay with 30% fine sand, high plasticity Black staining, calcareous specks		
20								
21								
22				CH		FAT CLAY Firm brown clay with 10% fine sand, high plasticity Black and iron staining, 1/8" calcareous nodules		
23								
24				CH		FAT CLAY Black staining		
25								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-1	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.862250 Y:323016.514035
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/06/2008 : 11/06/08	COMPLETION START/FINISH DATE: 11/07/08 : 11/07/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 2" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
26				SC		CLAYEY SAND Stiff brown clayey sand (70% fine), med. plasticity Black and iron staining, 1/8" calcareous nodules		
27								
28								Grout from 7 to 73 ft.
29				SM		SILTY SAND Firm brown silty sand (80% fine), low plasticity Black staining, calcareous specks		
30								2 in ID CPVC riser from surface to 78 ft. bgs
31						NO RECOVERY 30' to 32'		
32								
33						Slough		
34								
35				SM		SILTY SAND Firm brown silty sand (80% fine), low plasticity Black staining		
36								
37				SM		SILTY SAND Firm brown silty sand (75% fine), low plasticity Black and iron staining		
38								
39				SC		CLAYEY SAND Firm brown clayey sand (65% fine), high plasticity Black staining, grey mottling, calcareous lineations		
40								
41				CH		FAT CLAY WITH SAND Firm brown silty clay with 20% fine sand, high plasticity Black and iron staining, grey mottling		
42								
43				CH		FAT CLAY WITH SAND Firm brown silty clay with 20% fine sand, high plasticity Black and iron staining, grey mottling		
44								
45								
46						Slough		
47				SC		CLAYEY SAND Firm brown clayey silty sand (75% fine), high plasticity		
48								
49				SC		CLAYEY SAND Firm brown clayey silty sand (80% fine), high plasticity Grey mottling, calcareous specks		
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-1	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.862250 Y:323016.514035
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/06/2008 : 11/06/08	COMPLETION START/FINISH DATE: 11/07/08 : 11/07/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 2" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
51				SP-SM		POORLY GRADED SAND WITH SILT Soft brownish grey silty sand (90% fine), low plasticity		
52								Grout from 7 to 73 ft.
53				CH		SANDY FAT CLAY Firm brown silty clay with 40% fine sand, high plasticity		
54						Black and iron staining, grey mottling, 1/2" calcareous nodules		2 in ID CPVC riser from surface to 78 ft. bgs
55				SM		SILTY SAND Firm brown clayey silty sand (80% fine), low plasticity		
56						Grey mottling		
57				ML		SANDY SILT Stiff brown clayey silt with 40% fine sand, low plasticity		
58						Black and iron staining, grey mottling, calcareous lineations		
59				SM		SILTY SAND Firm brownish grey silty sand (65% fine), low plasticity		
60						Calcareous lineations		
61				SM		SILTY SAND Firm brown silty sand (75% fine), low plasticity		
62						Calcareous lineations		
63				SM		SILTY SAND Soft light brownish light grey silty sand (80% fine), low plasticity		
64								
65				SC		CLAYEY SAND Firm light brownish light grey clayey sand (60% fine), high plasti		
66						Calcareous cementation		
67				CH		SANDY FAT CLAY Stiff light brown clay with 30% fine sand, high plasticity		
68								
69				CH		FAT CLAY WITH SAND Firm brown clay with 20% fine sand, high plasticity		
70						1/8" calcareous cementation		
71				CH		FAT CLAY WITH SAND Firm brown clay with 20% fine sand, high plasticity		
72						Black and iron staining, grey mottling, 1/2" calcareous nodules		
73				CH		FAT CLAY WITH SAND Firm brown clay with 20% fine sand, high plasticity		Bentonite from 73 - 75 ft.
74						Black and iron staining, grey mottling, 1/2" calcareous nodules		
75				MH		SANDY ELASTIC SILT		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-1	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085118.862250 Y:323016.514035
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 2" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/06/2008 : 11/06/08	COMPLETION START/FINISH DATE: 11/07/08 : 11/07/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 2" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
76				MH		Firm brown clayey silt with 35% fine sand, high plasticity Iron staining, calcareous lineation		Sand from 75 - 90 ft.
77				CH		SANDY FAT CLAY Firm brown clay with 30% fine sand, high plasticity		
78						Iron staining, grey mottling, 1/8" calcareous nodules		
79				SM		SILTY SAND Firm brown clayey silty sand (55% fine), medium plasticity		
80						Grey mottling, 1/2" calcareous specks		2 in ID SS304 0.010 slot well screen
81				SM		SILTY SAND Firm brown silty sand (75% fine), low plasticity		from 78 - 88 ft.
82								
83				SP		POORLY GRADED SAND Soft brown SAND (95% fine)		
84								
85				SM		SILTY SAND Firm brown silty sand (80% fine), low plasticity		
86								
87				CL		LEAN CLAY WITH SAND Firm brown clay with 20% fine sand, medium plasticity		
88						Grey mottling, Calcareous cementation		Blank casing 88 to 90 ft.
89				CH		SANDY FAT CLAY Firm olive brown clay with 30% fine sand, high plasticity		
90								
91						TOTAL DEPTH = 90 FT.		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-2	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085199.043125 Y:323016.736260
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/4/2008 : 11/5/08	COMPLETION START/FINISH DATE: 11/6/08 : 11/6/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
						Hand Auger 0 to 5 Ft		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
1				CL		LEAN CLAY Dry, dark grey brown silty clay, medium plasticity		
2								
3								1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4				SC		CLAYEY SAND Brown clayey fine to medium sand (60%), low plasticity Iron and black staining		Bentonite 4 - 5 ft.
5								1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP)
6				ML		SILT WITH SAND Brown clayey silt with 20% fine sand, calcareous inclusions		Sand 5 -7 ft.
7								
8								
9								Grout from 7 to 72 ft.
10								
11								2 in ID CPVC riser from surface to 76 ft.
12						No recovery 11-15 ft.		
13								
14								
15				ML		SANDY SILT Brown silt, 45% fine sand, iron and black staining, calcareous nodules, med. plasticity		
16				CL		LEAN CLAY WITH SAND Dark grey brown silty sand, fine sand (20%), medium plasticity Iron and black staining, calcareous inclusions		
17								
18								
19								
20								
21						No recovery 20-25 ft.		
22								
23								
24								
25								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-2	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085199.043125 Y:323016.736260
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/4/2008 : 11/5/08	COMPLETION START/FINISH DATE: 11/6/08 : 11/6/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
				CL		LEAN CLAY		
26						Firm brown silty clay, fine sand (10%), medium plasticity		
27						LEAN CLAY WITH SAND Firm brown silty clay, fine sand (15%), medium plasticity		
28						iron and black staining, calcareous inclusions		
				SM		SILTY SAND		
29						Firm brown clayey silty fine sand (70%), low plasticity iron and black staining, calcareous inclusions		
30								
				CH		FAT CLAY WITH SAND		
31						Soft brown, grey mottled, wormy textured clay with fine sand (15%), High plasticity		
32								
33						wet		
34								
				SM		SILTY SAND		
35						Firm brown clayey silty fine sand (70%), low plasticity iron and black staining, calcareous inclusions		2 in. ID CPVC Riser from surface to 76 ft bgs.
36								
				ML		SILT WITH SAND		Grout from surface to 72 ft bgs.
37						Firm brown clayey silt, fine sand (25%), low plasticity		
38						SANDY SILT		
39						Firm brown sandy silt (40% fine), calcareous inclusions 1"		
40								
41						30% fine sand, medium plasticity		
42								
				SM		SILTY SAND		
43						Firm brown clayey silty fine sand (60%), low plasticity Iron staining, calcareous inclusions		
44								
45								
46								
				SC		CLAYEY SAND		
47						Firm brown clayey fine sand (60%), medium plasticity		
48								
				SM		SILTY SAND		
49						Firm brown silty fine sand (60%), low plasticity Iron staining, calcareous inclusions		
50								CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-2	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085199.043125 Y:323016.736260
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/4/2008 : 11/5/08	COMPLETION START/FINISH DATE: 11/6/08 : 11/6/08 — LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
				SM		SILTY SAND		
51						Firm brown clayey silty fine sand (70%), low plasticity, grey mottling, iron staining, calcareous inclusions 3/4"		
52								
				ML		SILT WITH SAND		
53						Soft brown clayey silt, fine sand (25%), medium plasticity, grey mottling, iron staining, calcareous inclusions 1/2"		
54								
				CL		FAT CLAY WITH SAND		
55						Firm brown silty clay, fine sand (25%), medium plasticity		
56								
				CH		FAT CLAY WITH SAND		
57						Dark grey, wormy texture, silty clay, fine sand (20%), high plastic		
58								
				CL		LEAN CLAY WITH SAND		
59						Firm brown silty clay, fine sand (15%), medium plasticity		2 in. ID CPVC Riser from surface to 76 ft bgs.
60								
				SC		CLAYEY SAND		Grout from surface to 72 ft bgs.
61						Soft brown clayey fine sand (60%), high plasticity		
62								
63								
64								
65						Firm, fine sand (65%), iron and black staining, medium plasticity		
66								
67						Fine sand 55%, iron staining and calcareous nodules 1/4"		
68								
				ML		SANDY SILT		
69						Soft brown clayey silt with fine sand, iron staining and calcerous nodules 1/4", low plasticity		
70								
				SC		CLAYEY SAND		
71						Soft brown clayey fine sand (50%), high plasticity		
72								
				CL		SANDY LEAN CLAY		
73						Firm brown silty clay, fine sand (30%), medium plasticity iron staining and calcareous nodules 1/8"		Bentonite 72 - 74 ft bgs
74								
				CH		SANDY FAT CLAY		Sand pack 74 - 87 ft bgs
75								

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-2	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Superfund Site, Davis, CA		LOCATION: NAD27 X:2085199.043125 Y:323016.736260
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME or ADDITIONAL NOTES 1" MW	DRILLING START:FINISH DATE: 11/4/2008 : 11/5/08	COMPLETION START/FINISH DATE: 11/6/08 : 11/6/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
						SANDY FAT CLAY		
76						Firm brown silty clay, fine sand (40%), high plasticity		
						iron staining and calcareous nodules 1/8"		
77				CH		FAT CLAY WITH SAND		
						Firm brown silty clay, fine sand (20%), high plasticity		
78						iron staining and calcareous nodules 1/8"		
				SP-SM		POORLY GRADED SAND WITH SILT		
79						Soft brown silty fine sand (90%)		2 in. ID SS304 0.010 SLOT
								WELL SCREEN FROM 76 - 86 ft bgs
80								Sand pack 74 - 87 ft bgs
81						No recovery 80-85 ft.		
82								
83								
84								
85								
86						SANDY LEAN CLAY		
				CL		Stiff olive brown silty clay, fine sand (35%), low plasticity		Blank casing 86 to 90 ft.
87								
88								Well sealed with Bentonite from
						CLAYEY SAND		87 - 90 ft. bgs
89				SC		Soft brown clayey fine sand (65%), medium plasticity		
90								
						TOTAL DEPTH = 90 FT.		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-3	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085246.861890 Y:323033.500647
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/11/2008 : 11/12/08	COMPLETION START/FINISH DATE: 11/12/08 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
						Hand auger to 5 ft.		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
1								
2								
3				ML		SILT Soft brown clayey silt with 10% fine sand, low plasticity, dry		1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4								Bentonite 4 - 5 ft.
5				MH		ELASTIC SILT Soft brown clayey silt with 10% fine sand, high plasticity, moist		1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP). Sand 5 -7 ft.
6								
7				MH		SANDY ELASTIC SILT Soft brown clayey silt with 30% fine sand, high plasticity		
8								
9				MH		SANDY ELASTIC SILT Firm brownish dark grey silt with 30% fine sand, high plasticity		Grout from 7 to 63 ft. bgs
10								
11				CH		SANDY FAT CLAY Stiff dark grey silty clay with 30% fine sand, high plasticity Black and iron staining		4 in ID CPVC riser from surface to 63 ft. bgs
12								
13				CH		SANDY FAT CLAY Stiff brownish dark grey clay with 30% fine sand, high plasticity Black and iron staining, calcareuos specks		
14								
15				CH		FAT CLAY WITH SAND Firm brownish grey silty clay with 25% fine sand, high plasticity Black and iron staining, grey mottling, calcareuos specks		
16								
17				CH		FAT CLAY Firm brownish grey clay with 10% fine sand, high plasticity		
18								
19				CH		FAT CLAY Firm brown clay with 10% fine sand, high plasticity		
20								
21				CH		FAT CLAY Soft dark brown clay with 10% fine sand, high plasticity		
22								
23				CH		FAT CLAY WITH SAND Firm brown clay with 20% fine sand, high plasticity		
24								
25				ML		SANDY SILT Stiff brown silt, 40% fine sand, med. plasticity, black & iron staini		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-3	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085246.861890 Y:323033.500647
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/11/2008 : 11/12/08	COMPLETION START/FINISH DATE: 11/12/08 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
26								
27				CH		SANDY FAT CLAY Firm brown silty clay with 30% fine sand, high plasticity		
28						Black and iron staining, grey mottling		
29				CL		SANDY LEAN CLAY Stiff brown silty clay with 45% fine sand, medium plasticity		
30						Black and iron staining, grey mottling, 1/4" calcareous nodules		
31				CH		FAT CLAY Soft brownish dark grey clay with 10% sand, high plasticity		
32								
33				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty sand (90% fine)		
34								
35				CH		SANDY FAT CLAY Firm brown clay with 35% fine sand, high plasticity		
36						Black and iron staining, grey mottling		
37				SM		SILTY SAND Firm brown silty sand (60% fine), low plasticity		
38						Grey mottling		
39								Grout from 7 to 63 ft. bgs
40								
41				CH		FAT CLAY WITH SAND Firm brown clay with 20% fine sand, high plasticity		
42						1/8" calcareous nodules		
43				SM		SILTY SAND Soft brown silty sand (75% fine), low plasticity		
44						Iron staining, grey mottling		
45				ML		SANDY SILT Soft brown silt with 40% fine sand, low plasticity		
46						1/8" calcareous nodules		
47				MH		ELASTIC SILT WITH SAND Soft brown silt with 25% fine sand, high plasticity		
48						Grey mottling, 1/8" calcareous nodules		
49				SM		SILTY SAND Soft brownish grey silty sand (85% fine)		
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-3	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085246.861890 Y:323033.500647
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/11/2008 : 11/12/08	COMPLETION START/FINISH DATE: 11/12/08 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
51				CL		SANDY LEAN CLAY Stiff brownish grey clay with 35% fine sand, low plasticity		
52						1/4" calcareous nodules		
53				CL		SANDY LEAN CLAY Stiff brownish grey clay with 35% fine sand, low plasticity		
54						Black and iron staining, grey mottling, calcareous lineations		
55				SM		SILTY SAND Firm brown silty sand (55% fine), low plasticity		
56						Iron staining, grey mottling		
57				SP-SM		POORLY GRADED SAND WITH SILT Soft brown silty sand (80% fine, 10% med.)		
58								
59				CL		LEAN CLAY WITH SAND Stiff brown clay with 20% fine sand, medium plasticity		
60						Black and iron staining		
61						SLOUGH 60-62 ft.		
62								
63				SM/CL		Mixed SILTY SAND and LEAN CLAY Soft brown, 80% silty sand		
64								Bentonite from 63 - 65 ft.
65				CL		LEAN CLAY WITH SAND Firm brown clay with 20% fine sand,		
66						Grey mottling, 1/8" calcareous nodules		Sand from 65 - 90 ft.
67						NO RECOVERY 65' to 70'		
68								4 inch ID SS 304 screen, 0.010" slots from 63 -73 ft.
69								
70						SLOUGH 70-74 ft.		
71								
72								
73								
74				SM		SILTY SAND		
75						Firm brown silty sand (60% fine), low plasticity, black and iron staining		

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-3	SHEET 4 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085246.861890 Y:323033.500647
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY -WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/11/2008 : 11/12/08	COMPLETION START/FINISH DATE: 11/12/08 : 11/13/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
76								Sand from 65 - 90 ft.
77				SP-SM		POORLY GRADED SAND WITH SILT Firm brown silty sand (90% fine)		
78								
79								
80								
81						SLOUGH 80-82 FT.		
82								
83				SC		CLAYEY SAND Soft brown clayey sand (70% fine), medium plasticity		
84								
85								
86								
87						SLOUGH 85-88 FT.		
88								
89				SM		SILTY SAND Soft sand, numerous calcareous nodules to 1/2"		
90								
91						TOTAL DEPTH = 90 FT.		
92								
93								
94								
95								
96								
97								
98								
99								
100								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-4	SHEET 1 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085334.861680 Y:323030.373554
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/14/08 : 11/14/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP
						Hand Augered form 0 to 5 Ft		NOTE: Sand, Bentonite & Grout in shallow VMP only shown on one side of drawing for clarity of nested completion. Actually surrounds both VMP and MW.
1								
2								
3				MH		ELASTIC SILT Soft brown clayey silt with 10% fine sand, high plasticity, dry		1.25 in ID CPVC riser from surface to 5 ft. Grout from surface to 4 ft.
4								Bentonite 4 - 5 ft.
5								1.25" ID CPVC slotted well screen from 5 - 7 ft. (VMP). Sand 5 -7 ft.
6								
7				MH		ELASTIC SILT Soft dark brownish grey clayey silt with 10% fine sand, high plasticity Iron staining, moist		
8								
9				MH		ELASTIC SILT Soft dark brownish grey clayey silt with 10% fine sand, high plasticity Iron staining		Grout from 7 to 63.5 ft.
10								
11				SC		CLAYEY SAND Stiff dark brownish dark grey clayey sand (50% fine), high plasticity Black and iron staining, grey mottling, calcareous lineation		4 in ID CPVC riser from surface to 80 ft. bgs
12								
13				CH		SANDY FAT CLAY Firm dark brownish dark grey clay with 35% fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		
14								
15				SC		CLAYEY SAND Soft brown clayey sand (70% fine), high plasticity Black and iron staining, grey mottling		
16								
17				CH		FAT CLAY Stiff clay with 10% fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		
18								
19				CH		FAT CLAY WITH SAND Soft firm brown clay with 25% fine sand, high plasticity Grey mottling		
20								
21				CH		FAT CLAY Soft brown clay with 10% fine sand, high plasticity		
22								
23				CH		FAT CLAY WITH SAND Firm brown silty clay with 20% fine sand, high plasticity Black and iron staining		
24								
25				CH		SANDY FAT CLAY		

CONTINUED

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-4	SHEET 2 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085334.861680 Y:323030.373554
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/14/08 : 11/14/08
		LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
						Soft brown clay with 40% fine sand, high plasticity Iron staining, grey mottling		
26								
27				SC		CLAYEY SAND Firm brown clayey silty sand (65% fine), medium plasticity Iron staining, grey mottling		Grout from 7 to 63.5 ft.
28								
29				SC		CLAYEY SAND Firm brown clayey silty sand (60% fine), medium plasticity Black and iron staining, grey mottling		4 in ID CPVC riser from surface to 80 ft. bgs
30								
31				SC		CLAYEY SAND Stiff brown clayey silty sand (55% fine), medium plasticity Black and iron staining, grey mottling, calcareous specks		
32								
33				SP-SM		POORLY GRADED SAND WITH SILT Soft brown grey silty sand (90% fine) Black and iron staining, grey mottling		
34								
35				CH		FAT CLAY Stiff brown clay with 10% fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		
36								
37				CH		FAT CLAY WITH SAND Stiff brown clay with 25% fine sand, high plasticity Black and iron staining, grey mottling, 1/2" calcareous nodules		
38								
39				SM		SILTY SAND Soft brown silty sand (75% fine) Black iron staining		
40								
41				SM		SILTY SAND Firm brownish grey silty sand (70% fine)		
42								
43				SP		POORLY GRADED SAND Soft brown sand (95% fine)		
44								
45				SP-SM		POORLY GRADED SAND WITH SILT Soft brown sand (90% fine)		
46								
47				MH		SANDY ELASTIC SILT Firm brown clayey silt with 40% fine sand, high plasticity Iron staining, grey mottling		
48								
49				CH		FAT CLAY WITH SAND Stiff brown clay with 25% fine sand, high plasticity Iron staining, grey mottling		
50								

Current Environmental Solutions P.O. Box 531139 Grand Prairie, TX 75053	PROJECT NUMBER: 78-0033	BORING NUMBER: GG-4	SHEET 3 OF 4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA		LOCATION: NAD27 X:2085334.861680 Y:323030.373554
GROUND SURFACE ELEVATION:	DRILLING CONTRACTOR: CASCADE DRILLING	
DRILLING METHOD AND EQUIPMENT: ROTARY-WATER	BORING & COMPLETION PERFORMED IN LEVEL C PPE	
WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP	DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08	COMPLETION START/FINISH DATE: 11/14/08 : 11/14/08 / LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL Completion Log	WELL NOTES Nested Completion 4" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
51				CH		FAT CLAY WITH SAND Stiff brown clay with 20% fine sand, high plasticity Black and iron staining, grey mottling		
52								Grout from 7 to 63.5 ft.
53				CH		FAT CLAY WITH SAND Stiff brown clay with 20% fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		
54								4 in ID CPVC riser from surface to 80 ft. bgs
55				CH		SANDY FAT CLAY Stiff brown clay with 40% fine sand, high plasticity Black and iron staining, grey mottling		
56								
57				CH		SANDY FAT CLAY Stiff brown clay with 40% fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		
58								
59				SC		CLAYEY SAND Stiff brown clayey sand (55% fine) Iron staining, grey mottling		
60								
61				SM		SILTY SAND Soft brownish grey silty sand (75% fine) Iron staining, grey mottling		
62								
63				CH		SANDY FAT CLAY Firm brown silty clay with 40% fine sand, high plasticity Black and iron staining, grey mottling, calcareous specks		
64								Bentonite from 63.5 - 66 ft.
65				SC		CLAYEY SAND Firm brown clayey sand (75% fine) Black and iron staining, grey mottling, 1/8" calcareous nodules		
66								Sand from 66 - 90 ft.
67				SM		SILTY SAND Soft brown silty sand (80% fine)		
68								
69								
70								
71				SC		CLAYEY SAND Firm brown clayey sand (60% fine), high plasticity		
72								
73				CH		SANDY FAT CLAY Firm brownish grey clay with 45% fine sand, high plasticity Black and iron staining, grey mottling		
74								
75				SC		CLAYEY SAND		

Current Environmental Solutions
P.O. Box 531139
Grand Prairie, TX 75053

PROJECT NUMBER: 78-0033

BORING NUMBER: GG-4

SOIL BORING & COMPLETION LOG

PROJECT NAME: Frontier Fertilizer Site, Davis, CA

LOCATION: NAD27 X:2085334.861680 Y:323030.373554

GROUND SURFACE ELEVATION:

DRILLING CONTRACTOR: CASCADE DRILLING

DRILLING METHOD AND EQUIPMENT: ROTARY-WATER

BORING & COMPLETION PERFORMED IN LEVEL C PPE

WATER LEVELS, DATE, AND TIME: NESTED WELL: 4" MW AND 1.25" VMP

DRILLING START:FINISH DATE: 11/13/2008 : 11/13/08

COMPLETION START/FINISH DATE: 11/14/08 : 11/14/08

LOGGER: JAMES MALOT, PE

DEPTH BELOW SURFACE (FEET)	CASING SIZE	SAMPLE INTERVAL	RECOVERY	USCS SYMBOL	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: Completion Log	WELL: NOTES Nested Completion 4" MW and 1.25" VMP WATER LEVELS, WELL INSTRUMENTATION
						Firm brown clayey sand (65% fine) Iron staining, grey mottling		
76								
77				SP-SM		POORLY GRADED SAND WITH SILT Firm brownish grey fine sand		
78						Iron staining		
79				SP		POORLY GRADED SAND Soft brown fine sand		
80								
								4 in ID SS304 0.010 slot well scree
81				SP-SM		POORLY GRADED SAND WITH SILT Soft brown fine sand		from 80 - 90 ft.
82								
83				SP-SM		POORLY GRADED SAND WITH SILT Soft dark brown fine sand		
84								
85				SP-SM		POORLY GRADED SAND WITH SILT Soft dark brown fine sand		
86								
87				SP-SM		POORLY GRADED SAND WITH SILT Soft dark brown fine sand		
88								
89				SP-SM		POORLY GRADED SAND WITH SILT Soft dark brown fine sand		
90						Iron staining		
						TOTAL DEPTH = 90 FT.		
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								