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FINAL REPORT
VOLUME 1 OF 2

RESULTS OF ADDITIONAL SOIL AND GROUNDWATER INVESTIGATIONS AND GROUNDWATER MONITORING PLAN, UPLAND PORTION OF SUBUNIT 2A, RICHMOND FIELD STATION, RICHMOND, CALIFORNIA (TASKS 2A & 2B, RWQCB ORDER NO. 01-102)

Prepared for
University of California Berkeley
Environment, Health, and Safety
317 University Hall, #1150
Berkeley, California 94720

November 21, 2001

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VOLUME 1 OF 2

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Cecilio S. Felix
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612

Subject: **Results of Additional Soil and Groundwater Investigations and Groundwater Monitoring Plan, Upland Portion of Subunit 2A, Richmond Field Station, Richmond, California**

Dear Mr. Felix:

In compliance with the California Regional Water Quality Control Board, San Francisco Bay Region's (RWQCB) Order No. 01-102, Tasks 2a and 2b, URS Corporation is pleased to submit the enclosed document titled *Results of Additional Soil and Groundwater Investigations and Groundwater Monitoring Plan, Upland Portion of Subunit 2A, Richmond Field Station, Richmond, California* on the behalf of the University of California, Berkeley.

We appreciate the additional time granted us for completion of the report and discussions with Zeneca, Inc. If you have any questions or need further information, please call me at (510) 874-3284.

Sincerely,

URS CORPORATION

Diane K. Mims
Project Manager

George H. Muehleck, R.G.
Senior Hydrogeologist

REGISTERED GEOLOGIST
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Enclosure

Cc: Karl Hans, Environment, Health, & Safety, University of California Berkeley
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On the behalf of the University of California, Berkeley (UC Berkeley), URS Corporation (URS), UC Berkeley's environmental consultant, has prepared this report in compliance with the California Regional Water Quality Control Board, San Francisco Bay Region's (RWQCB) Order No. 01-102 Site Cleanup Requirements (SCR) of the Meade Street Operable Unit, Subunit 2A, Tasks 2a and 2b.

UC Berkeley's Richmond Field Station (RFS) is designated as Subunit 2 and is located at 1301 S. 46th Street in Richmond, California as shown on Figure 1. Subunit 2 was divided by the RWQCB into two subunits: Subunit 2A consists of the southeastern portion of the RFS for which UC Berkeley and Zeneca are named as joint responsible parties. Subunit 2B consists of the northern and western portion of the RFS for which UC Berkeley is named as the sole responsible party. The location of Subunit 2A and 2B and their respective boundaries are shown on Figure 2.

Subunit 2A is located in the southeastern portion of the upland area and the eastern portion of the Western Stege Marsh. A map showing the layout and features within Subunit 2A is shown on Figure 3.

The SCR Task 2a states: "The dischargers shall submit a technical report, acceptable to the Executive Officer, which provides the results of soil and groundwater investigations performed since the Field Sampling and Analysis results submitted in December 2000. If necessary, the report shall propose additional soil and/or groundwater sampling in order completely define the extent of pollution in Subunit 2A." The presented results are from investigations performed by URS and Levine Fricke (LFR), Zeneca's environmental consultant. This data is a follow up to the submittal of UC Berkeley's report titled "Field Sampling and Analysis Results, University of California, Berkeley, Richmond Field Station/Stege Marsh, Richmond, California", prepared by URS and dated December 2000.

The objectives of the investigation performed under Task 2a were to: 1) delineate the extent of metals, affected sediment, and pyrite cinders in the upland portion of Subunit 2A; 2) evaluate the impacts to the underlying groundwater; and 3) develop information necessary to complete a conceptual Remedial Action Plan (RAP) for Subunit 2A that will be submitted to the RWQCB in December 2001 as required under SCR Task 2c.

The SCR Task 2b states: "The dischargers shall submit a technical report, acceptable to the Executive Officer, which proposes installation of groundwater wells necessary to monitor the extent of groundwater contamination and evaluate the effectiveness of site cleanup in MSOU Subunit 2A. The workplan shall specify at a minimum..." That technical report is included here.

1.1 SUMMARY OF REPORT ORGANIZATION

This submittal consists of the two reports as required under SCR Tasks 2a and 2b of Order No. 01-102:

2a) The Results of Additional Soil and Groundwater Investigations in Subunit 2A; and

2b) Groundwater Monitoring Plan for Subunit 2A.

This document is organized as follows:

- Section 2 briefly summarizes the results from Subunit 2A that are presented in UC Berkeley's December 2000 report;
- Section 3 discusses field activities involving the collection of field data and soil and groundwater samples and the analysis of the samples since December 2000;
- Section 4 discusses the results of the analysis of the recent soil and groundwater samples;
- Section 5 discusses conclusions derived from data analysis and recommendations for additional characterization; and
- Section 6 presents the groundwater monitoring plan for the upland area of Subunit 2A as required by SCR Task 2b.

This section provides a summary of the results of the investigation of the upland portion of Subunit 2A presented in the previously referenced UC Berkeley December 2000 report to the RWQCB. Historically, this upland area was an intertidal mudflat bounded on the north by a wooden seawall for at least the last 100 years. A wooden plank pier placed on piles was built in the mid to late 1800's from the section of seawall at the current location of Building 100 to the existing portion of the pier south of the East Bay Regional Park District (EBRPD) Bay Trail. In the 1940's, a concrete rubble breakwater was constructed forming the southern boundary of the upland area and the current fence line was later placed along that boundary. The construction of the breakwater formed a marsh environment in this portion of Subunit 2A. During this period the RFS property was owned by the California Cap Company, a manufacturer of blasting caps until about 1948. Stauffer Chemical Company, a manufacturer of sulfuric acid, owned the adjacent property to the east. Pyrite cinders, a by-product of the acid manufacturing process, were deposited on the tidal mudflats that are now part of Subunit 2A. The cinders contain various metals, including arsenic, cadmium, copper, iron, lead, nickel, selenium and zinc

The Cap Company manufactured mercury fulminate, a constituent of the explosives, in a facility north of the seawall located in the southern portion of Subunit 2B (Mercury Fulminate Area). Prior to the UC Berkeley purchase of the property in October 1950, the Cap Company removed all production facilities and attempted to remove hazardous materials at the site. However, elevated concentrations of mercury in soil and groundwater have been detected in the Mercury Fulminate Area during UC Berkeley's previous and current investigations. This work will be reported to the RWQCB in December 2001 as required under the SCR Task 4a. To date, this work has shown migration of mercury into Subunit 2A, possibly from a drainpipe extending into the marsh between the breakwater and seawall shown in historical area photos from 1948.

By 1953, UC Berkeley had filled to grade and fenced the upland portion of Subunit 2A. Most of the Cap Company's facilities were removed and the area was developed for academic teaching and research. In the upland portion of Subunit 2A, UC Berkeley Sanitary Engineering constructed a round pond (Round Pond) on the east end of the area (later lined with plastic) and a concrete-lined rectangular pond (Rectangular Pond) in the central portion of the area for wastewater treatment research.

Due to the historical operations and disposition of cinders in the upland portion of Subunit 2A, the general stratigraphy in the area from the ground surface is clean fill, a zone of pyrite cinders and soil (cinder layer), and Bay sediments varying from sand to clay. Several sources appear to have contributed to the metals concentrations within Subunit 2A including:

- Deposition of pyrite cinders;
- Migration of mercury from the California Cap Company's mercury fulminate facility;
- Migration of dissolved metals in groundwater including copper, nickel, and zinc from the Zeneca site located to the east. The groundwater flow direction is south to southwest; and
- Surface flow of storm water from the California Cap Co./RFS site and the western portion of the Stauffer/Zeneca site into Western Stege Marsh.

The chemicals of concern (COCs) identified during previous investigations include metals in soil and groundwater, primarily arsenic, copper, mercury, lead, nickel, and zinc. Due to the identification of these COCs, additional characterization was performed to delineate the extent and evaluate the impacts to the underlying groundwater. The additional characterization and

results are discussed in the following sections. A summary of previous data collected in the upland portion of Subunit 2A is provided in Section 5.

The additional investigations, discussed below, consisted of the following events:

- Excavation of 34 test pits and the collection and analysis of 11 soil samples;
- Installation of seven Geoprobe borings and the collection and analysis of 24 soil samples and six groundwater samples. The soil samples consisted of fill material, pyrite cinders, and/or sediment samples; and
- Installation of 16 Geoprobe borings and the collection and analysis of 25 soil samples and 25 groundwater samples.

3.1 TEST PITS

On July 31, 2000, URS excavated six test pits in the subject area. These locations, shown on Figure 3, are designated TP1 through TP6. Between May 24 and June 1, 2001, URS excavated an additional 34 test pits at locations also shown on Figure 3. These test pits are designated PH1 through PH35. The purpose of the test pits was to evaluate the location and thickness of fill material and pyrite cinders. Each test pit was excavated using a backhoe from the ground surface to Bay sediments to a depth of approximately 7 feet. The results are shown on Table 1. In general, the groundwater surface and the top of the cinder layer is approximately 5 to 7 feet below ground surface (bgs). Assuming the groundwater surface varies seasonally and tidally, the cinders may be alternately saturated and unsaturated.

Based on available data, the thickness of the cinder layer, placed on Bay sediments, decreases from 6 ½ feet at the east end of the area to 0 feet thick at the west end. Conversely, the thickness of fill placed on the cinders generally increases from east to west. In the central portion of the area, fill and cinders average about 4 to 5 feet and 1 to 3 feet, respectively. Figure 4 shows locations with a cinder thickness greater than or equal to 2 feet.

Ten samples of cinders and the underlying Bay sediments were collected and analyzed for Priority Pollutant metals by EPA Method 6010. The analytical results are summarized in Table 2. The laboratory analytical reports are presented in Appendix C.

3.2 GEOPROBE BORINGS

As part of URS's work to define the extent of mercury in the Mercury Fulminate Area, on June 28, 2001, URS collected 21 soil samples and six groundwater samples from six Geoprobe borings within the upland portion of Subunit 2A installed by FastTek Engineering Support Services. The borings, designated MF114 through MF119, were located south of and down gradient from the Mercury Fulminate Area and the former seawall and both north and south of the Rectangular Pond as shown on Figure 3. Between September 21 and October 11, 2001, LFR and URS, collected 25 soil samples and 24 groundwater samples from 16 Geoprobe borings installed by Precision Sampling Incorporated within the Subunit 2A upland area. At seven boring locations, two screened intervals were selected to separately evaluate groundwater quality within the cinder layer from groundwater quality in sediments beneath the cinder layer. At these locations, a screen was generally installed from approximately 2 feet bgs to approximately 7 feet bgs. In a separate boring a few feet away from the first boring, using dual tube Geoprobe equipment in an attempt to isolate the underlying sediment from the cinder layer, a screen was installed from approximately 7 or 8 feet bgs to 12 feet or deeper depending on recharge rate.

The boring logs are shown in Appendix A. The laboratory analytical reports are presented in Appendix C. The analytical results for soil and groundwater samples are summarized in Tables 2, 3, and 4.

4.1 SOIL

URS collected and analyzed 89 soil samples. Twenty samples were analyzed for mercury by EPA Method 7471. Forty-five samples were analyzed for priority pollutant metals by EPA Method 6010 and EPA Method 7471 for mercury.

In October, URS completed a draft human health and ecological risk assessment for the RFS subunits 2A and 2B (SCR Task 1a and 1b). This report, titled "Human Health and Ecological Tiered Risk Evaluation, University of California, Berkeley", will be submitted to the RWQCB in November, along with this report. This study proposes site-specific target levels (SSTLs) for human and ecological receptors. The SSTLs are used to identify areas that have unacceptable risk. The relevant receptors that apply to the subject area are the red-tailed hawk, ground squirrel, industrial workers and construction workers. The analytical results for soil, consisting of fill material, cinders, and sediment, were screened against these SSTLs as summarized in Table 2. Table 5 identifies the samples by material type (fill, cinder, and sediment categories) and sample depth. The results for samples collected within these three layers are described below.

Fill

According to UC Berkeley personnel, the upper fill layer consists of clean imported engineered fill. Based on the visual observation of cinders and corresponding risk-based screening level exceedances where cinders are present, it appears that the metals are contained mainly in the cinders and sediment and not the fill. Thirteen soil samples were taken at the surface (0 feet) from the covering fill material and were analyzed for a full suite of metals. Nine were taken in a north-south alignment over the sewer line installed around 1999 between the Round and Rectangular Ponds in the eastern portion of the area. Two of those nine samples, B-1 (35 mg/kg arsenic) and B-7 (970 mg/kg copper), contained metals exceeding the risk screening levels. PB-102 (220 mg/kg arsenic) from the eastern end of the area also exceeded a risk screening level, although near-surface cinders were observed. The other three fill samples, SD-101 and 102 taken from above the sewer line at the western end of the area and MF-104 taken north of the Rectangular Pond, did not exceed risk screening levels. The remaining majority of the cover fill remains uncharacterized.

Cinders

Concentrations of arsenic, cadmium (in two samples), copper, mercury, and zinc exceeded the SSTLs in 19 cinder samples as shown in Table 5. Metal ranges and averages for the cinder samples are as follows:

- Arsenic 49 mg/kg to 220 mg/kg average = 113 mg/kg
- Cadmium 4.1 mg/kg to 2,200 mg/kg average = 157 mg/kg
- Copper 170 mg/kg to 10,000 mg/kg average = 2,438 mg/kg
- Mercury 0.63 mg/kg to 5,300 mg/kg average = 558 mg/kg
- Zinc 130 mg/kg to 23,000 mg/kg average = 4,271 mg/kg

The highest concentrations of mercury in cinders are from borings MF-104, A4-16, and MF115 that are located adjacent to the seawall and the Mercury Fulminate Area. Metals concentrations detected in the cinder layer are likely the result of metals intrinsic to the cinder material as well as stormwater discharges from both sites. In addition, the releases from the Mercury Fulminate facility appear to have commingled mercury with the cinder layer in the central portion of Subunit 2A.

Sediment

Thirty-two samples were collected from the Bay sediment underlying the cinder layer. These samples and their respective results are provided in Table 5. Location A4-15 (at 6 feet), located west of the Rectangular Pond, contained 3,800 mg/kg copper, but not elevated arsenic, mercury or zinc concentrations. Samples from test pits PH1 through PH7 were collected from the excavation spoil piles adjacent to the pits. These samples were collected between six and seven feet bgs just below the cinder layer and, in some cases, had depositional laminae of cinders within them. Concentrations of arsenic, copper, and zinc exceed SSTLs in six of these samples. Some of the pits are located down gradient from the Mercury Fulminate Area and may be near the former drainpipe location. Mercury concentrations exceed the SSTL in five of these six samples.

Twenty-one sediment samples (greater than 2 feet below the cinder layer) were collected from 15 locations. All 21 samples were analyzed for mercury and 11 samples were analyzed for Priority Pollutant metals. Of the 15 locations, three locations (MF-104, MF-114, and MF-116) contained mercury in excess of the mercury SSTL. These three locations are adjacent to the former seawall downgradient from the Mercury Fulminate Area.

4.2 GROUNDWATER

The dissolved metals and pH analytical results for groundwater, summarized in Table 3, are screened against 10 times the AWQC or the RWQCB Water Quality Control Plan, San Francisco Bay Basin (1995), whichever are lower. The highest concentration of mercury in groundwater (2 ug/L) occurred down gradient from the Mercury Fulminate Area at sample location MF116. Following the installation of borings to delineate mercury, LFR and URS cooperated in the collection of groundwater samples throughout the upland portion of Subunit 2A. For the locations with two screened intervals, Table 3 summarizes results for "groundwater in the cinder layer" and "groundwater below the cinder layer". In the remaining locations, the screen was installed across both zones.

The groundwater collected in the cinder zone, which also included some water from below the cinders, generally contains higher concentrations of arsenic, lead, nickel, and zinc and slightly lower pH. Of the 11 groundwater samples collected within the cinders, four locations (A4-5, A4-9, A4-10, and A4-13) contained concentrations of arsenic, lead, nickel, and/or zinc in excess of their respective screening levels. Maximum concentrations reported were 400 ug/L arsenic, 59 ug/L lead, 440 ug/L nickel, and 21,000 ug/L zinc. Four samples from other locations (A4-2, A4-3, A4-04, and A4-16) contained mercury exceeding the screening level of 0.25 ug/L with a maximum of 0.5 ug/L.

Groundwater samples were collected from beneath the cinders at seven locations. Three locations (A4-5, A4-12, and A4-13) contained nickel and zinc in excess of their respective screening levels and two sample locations (A4-1 and A4-2) contained mercury above the screening levels. The maximum concentrations for nickel (150 ug/L) and zinc (5,800 ug/L) in this layer were lower than the concentrations detected in the cinders. The maximum concentration of mercury (0.73 ug/L) was slightly above the mercury concentration detected in the groundwater sample collected from the cinder layer.

Fourteen groundwater samples were analyzed from temporary wells with a screen across the cinders and into the deeper sediment. Three of the fourteen locations contained exceedances for cadmium, copper, nickel, or zinc. Two locations near the Mercury Fulminate Area contained exceedances for mercury with a maximum of 2 ug/L.

One groundwater sample from location PB12, between the Round Pond and the Zeneca property boundary, was analyzed for volatile organic compounds (VOCs) by EPA Method 8260. The sample contained tetrachloroethene at a concentration of 6,500 ug/L, exceeding the screening value of 120 ug/L.

5.1 SOIL

Based upon interviews with UC Berkeley personnel, the engineered fill material was purchased from an off site source. Therefore, based upon the origin of the engineered fill (not from the Site), we believe that the fill material essentially covering the upland portion of Subunit 2A is not contaminated. Cinders are visible on the ground surface on the eastern end of the area indicating that fill material is thin or missing in this area. However, there is no data for metals other than mercury in the central and western portions of the area. It is recommended that four additional fill samples be collected and analyzed for metals to demonstrate that the fill material is below all applicable SSTLs.

The soil/pyrite cinder layer and the upper approximately one foot of sediment contains elevated concentrations (up to 30 times SSTLs) of several metals, most notably arsenic, copper, mercury, and zinc. Locations with SSTL exceedances are shown on Figure 5. We believe these materials have been adequately characterized and recommend no additional sampling.

It is recommended that, where appropriate, the conceptual remedial action plan designed for the Zeneca site be applied to portions of Subunit 2A where SSTL exceedances occur in soil/cinders and sediment. Remediation in this area will be addressed in more detail in the conceptual RAP to be submitted to the RWQCB in December 2001 as required under the SCR Task 2c of the Order.

5.2 GROUNDWATER

The groundwater appears to have been impacted by metals due to the deposition of pyrite cinders and historic releases from the Mercury Fulminate facility. The metals exceedances appear to vary from east to west, as does the thickness of the cinder layer. Table 6 shows concentrations of dissolved metals in groundwater at locations arranged from west to east (top to bottom of the table). East of the Rectangular Pond where the cinders are the thickest, metal exceedances in groundwater occur at 8 of 10 sampled locations. The metals that exceed the screening level are primarily arsenic, copper, and zinc. These metals appear to be associated with cinders. In the remaining area to the west, where the impact of the former Mercury Fulminate facility is more pronounced, the only metal that exceeds SSTLs is mercury at seven of 18 locations. Locations with dissolved metals concentrations in groundwater that exceed ten times the AWQC are shown on Figure 6.

In addition, it appears that VOC compounds may be migrating from the Zeneca site. Sample location PB12, near the property boundary at the northeast side of the Round Pond, contained 6,500 ug/L of tetrachloroethene. The VOC results are shown in Table 4. Due to the uncertainty of the source of VOCs in groundwater, it is recommended that the source of VOCs is confirmed and the extent of VOCs in groundwater is delineated.

Furthermore, it is recommended that, where appropriate, the conceptual remedial action plan designed for the Zeneca site, such as the permeable reactive barrier wall, be applied to portions of this area where exceedances of 10 times the AWQC occur in groundwater. Remediation in this area will be addressed in more detail in the conceptual RAP to be submitted to the RWQCB in December 2001 as required under the SCR Task 2c of the Order.

Based on the results of the additional characterization, it is recommended that up to seven groundwater monitoring wells be installed down gradient of the groundwater screening level exceedances. The approximate proposed locations are shown on Figure 6. The conceptual RAP (Task 2c) will better define the locations and the number of wells planned to be placed upon completion of remedial activities in the summer of 2002.

We propose that the wells be sampled on a quarterly basis for a period of two years to establish concentration trends and to evaluate the effectiveness of the remedial activities scheduled for the Summer of 2002. Based on the results of this monitoring, the frequency and analytes will be adjusted. The following is a brief description of the planned well installation and Groundwater Monitoring program.

6.1 MONITORING WELL INSTALLATION

The monitoring well locations have been selected to evaluate whether elevated concentrations of dissolved metals are migrating from the upland area of Subunit 2A into the marsh and to evaluate the effectiveness of the remedial activities. The wells will be installed in the summer of 2002 after the cinder excavation, placement of clean fill, and grading are completed in Subunit 2A.

We anticipate using a truck-mounted, hollow-stem, flight-auger drill rig to install the proposed monitoring wells. All drilling augers and well casing materials will be pressure washed with hot water prior to each well installation. Cleaning water will be contained and placed in 55-gallon drums for temporary storage and proper disposal later.

At each proposed location, a borehole will be advanced to a depth of approximately 15 feet using a rotary auger, truck-mounted drilling rig. Monitoring wells will be constructed of 2-inch diameter, flush threaded, Schedule 40 polyvinyl chloride (PVC) casing and screen with a 2.5-foot stickup above the ground surface. The screens will be 15 feet in length and slotted, with a slot size of 0.010 inches. A filter pack (20/40 graded sand) will be placed around the screen in each well from the total depth to one foot above the top of the screen (3 feet bgs). A minimum of six inches of bentonite (pelletized or slurry form) will be placed directly over the filter pack. The remaining annulus of each well will be grouted to the surface with a cement and bentonite mixture. Each surface completion will consist of a concrete pad, protective steel casing monument and an internal locking cap. Soil drill cuttings will be placed in 55-gallon drums for proper disposal. The drilling area will be left in a clean manner and be free of debris from the drilling activities.

A suitable qualified field geologist will record details of the drilling activities at each location and monitoring well installation. A licensed surveyor well will survey the location and elevation of the top of the casing for each well.

6.2 WELL DEVELOPMENT AND PURGING

Following well installation, each monitoring well will be developed by overpumping using a submersible pump or a centrifugal pump with the intake lowered to near the bottom of the screened interval to remove sediment from the well casing. A clean surge block may be used to loosen sediment from the well screen. Purging will continue until the developed water is free of observable sediment (the goal is less than 5 NTUs of turbidity). Development and purge water will be placed in 55-gallon drums, or suitable containers, for proper disposal. If the well is

pumped dry, the well will be allowed to recover and purging should continue until the well is developed. Equipment that is placed in the well will be decontaminated by pressure washing prior to use in each well. Each well will be allowed to recover for a minimum of 24 hours prior to sampling.

Purging prior to sampling may be accomplished by evacuating three casing volumes before sampling using a bailer or positive displacement or bladder type pump, as described in Chapter Eleven of *Test Methods for Evaluating Solid Waste*, USEPA SW-846. In the event that the field parameters do not stabilize, the well may be sampled after three casing volumes have been removed. As an alternative, low-flow purging techniques and dedicated sampling equipment may be used if well recovery rates are slow.

Prior to groundwater sampling, the static water level and total well depth will be measured in each of the four wells.

6.3 GROUNDWATER COLLECTION AND LABORATORY ANALYSES

Groundwater samples will be collected using a peristaltic pump, dedicated pumps, or bailers. The samples will be collected in 500-mL polyethylene bottles with no preservative. Groundwater samples will be submitted to a California Certified Laboratory to be filtered within 24 hours and analyzed for the following: Priority Pollutant Metals using EPA Method 6010/7400 and pH using EPA Method 9040/9045. The laboratory will provide preservatives, bottles, and coolers.

6.4 DECONTAMINATION PROCEDURES

When dedicated or disposable purging or sampling equipment is not used the equipment will be decontaminated by the following procedure prior to, and between, each purging or sampling event.

- Wash equipment with a solution of non-phosphate detergent.
- Rinse twice, initially using potable water followed by a second rinse using de-ionized water.

Decontamination of sampling and monitoring equipment will include (but not necessarily be limited to) the following items: bailers, water level probes, and stainless steel drop weights for Teflon tubing. Decontamination water should be contained and disposed of appropriately.

6.5 SAMPLE LABELS

Sample labels should be affixed to each sample bottle. These labels should be durable and water-resistant so they remain legible when wet. Each label will contain the following information.

- Sample Identification
- Initials of sample collector
- Time and date of sample collection
- Preservatives (if any); and

- Required Analysis.

6.6 CHAIN OF CUSTODY

Tracing sample possession will be accomplished by using the Chain-of-Custody (COC) record. A COC entry will be recorded for every sample and will accompany every shipment of samples to the laboratory.

6.7 QUALITY ASSURANCE / QUALITY CONTROL SAMPLES

The purpose of QA/QC procedures is to produce data of known high quality that meet or exceed the requirements of standard analytical methods. It is essential that data collection personnel adhere to strict QA/QC procedures to establish quality. The objectives of the quality assurance program are twofold:

- To provide the mechanism for ongoing control, and
- Evaluation of measurement data quality throughout the course of the project and to qualify data precision and accuracy.

The following data quality indicators will be used to evaluate the data usability and certainty:

- Accuracy
- Precision
- Representativeness
- Completeness
- Comparability

A discussion of each of these data quality indicators is provided below.

Accuracy

Accuracy is a measure of how close a reported value is to the true value and is evaluated using spike analyses. Spike analyses are performed by adding a known quantity of analyte to a sample, analyzing the sample, and comparing the observed result to the known addition. Accuracy is expressed as percent recovery (the difference between known and observed concentrations divided by the known concentration) and is calculated as:

$$\%R = \left(\frac{C_{OB} - C_X}{C_{sp}} \right) x\,100$$

Where:

%R	=	percent recovery
C_{sp}	=	concentration of spike
C_{OB}	=	concentration measured in spiked sample analysis

C_x = concentration measured in unspiked sample analysis

Accuracy is evaluated using matrix spike (MS), laboratory control spikes (LCS), and surrogate spikes. Matrix spikes are spikes of target analytes into environmental samples and are used to evaluate impacts of matrix interference on accuracy. Laboratory control spikes are spikes of target analytes into clean water or sand and are used to evaluate accuracy of laboratory performance. Surrogate spikes are spikes of non-target analytes (compounds that are not likely to be detected in the sample but that behave similarly to the target analytes) into each sample. Surrogate spikes can only be performed for organic analyses and are used to evaluate accuracy on a sample specific basis.

Matrix spikes and LCS will be analyzed with each analytical batch. (A batch is up to 20 samples extracted and analyzed together under a given method protocol. Samples in an analytical batch should be of the same matrix. Reagent lots and handling procedures should be the same for all samples in a batch.) Surrogate spikes will be analyzed with each sample. Matrix spikes, LCS, and surrogate spike percent recoveries will be calculated and compared to the control limits provided in Appendix B. Analyses exhibiting recoveries outside control limits will be considered for re-analysis.

Precision

Precision refers to the level of agreement among repeated measurements of the same parameter. Precision is expressed as the relative percent difference (RPD) between duplicate measurements, calculated as:

$$RPD = \left(\frac{(C_1 - C_2)}{\left[\frac{(C_1 + C_2)}{2} \right]} \right) \times 100$$

Where:

RPD = relative percent difference

C_1 = result from first sample

C_2 = result from second sample

Precision is evaluated using duplicate analyses and analyses of duplicate matrix spike samples (MS/MSD). Objectives for precision are provided in Appendix B.

Representativeness

Representativeness is the degree to which data accurately and precisely represent variations at a sampling point. Representativeness is a qualitative parameter.

To ensure representativeness in the samples being collected for this investigation, standard sampling procedures, as described above, will be strictly adhered to. Any deviations from these procedures will be noted in permanent ink in the field notebook. The field notebooks will be reviewed for deviations as part of evaluation of representativeness.

To ensure representativeness in the analyses being performed, the laboratory will follow standard procedures for collecting the aliquot of sample used for analysis as representative of the whole. Additional laboratory procedures to ensure representativeness include proper log-in, storage, handling, and tracking of samples to minimize possibility of sample contamination, loss, or cross-labeling, and discrete sampling and analysis of immiscible layers, if present in sufficient quantity.

Completeness

Completeness will be evaluated as the amount of valid, usable data obtained from a measurement system compared to the amount that was expected. The quantitative description of completeness will be evaluated as the percentage of analytical results that are usable (i.e., results that do not require rejection based on review of QA/QC data). The objective for completeness for this investigation is 90 percent for each analytical parameter.

Comparability

Comparability is a qualitative evaluation of the confidence with which one data set can be compared to another measuring the same parameters. Comparability will be ensured through the use of the standard operating procedures for sampling and field operations as described in this Sampling and Analysis Plan.

Field Sampling Quality Control

Field quality assurance data are provided by the analysis of rinsate blanks and field duplicate samples. The following field QA/QC sample will be submitted for laboratory analysis:

- Rinsate Blanks - Rinsate blanks will be obtained by the collection of water used to rinse the sampling equipment following decontamination. Rinsate blanks will be collected and analyzed at a frequency of about 10 percent of the number of sediment samples collected.
- Field Duplicate Samples - Blind field duplicate samples will be collected and analyzed at a frequency of about 5 percent of the number of samples collected for each medium.

6.8 QUARTERLY MONITORING REPORTS

Quarterly groundwater monitoring reports will be prepared for submittal to RWQCB following each monitoring event. The quarterly reports will contain a discussion of the groundwater sampling observations, groundwater levels, a groundwater gradient map, a tabular summary of detected compounds, and a discussion of changes or trends in reported concentrations of Constituents of Concern. Copies of laboratory analytical reports will be included in each quarterly report.

TABLES

TABLE 1
THICKNESS OF FILL AND CINDER LAYERS
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

Location	Fill (ft bgs)	Fill thickness (ft)	Cinders (ft bgs)	Cinder thickness (ft)	Depth to Groundwater (ft bgs)	
Geoprobe borings						
MF114	0-4	4	4-9	5	5.3	
MF115	0-5.5	5.5	5.5-8.5	3	5.2	
MF116	0-5.5	5.5	5.5-9	3.5	5.4	
MF117	0-5.5	5.5	5.5-9.5	4	5.5	
MF118	0-5.5	5.5	5.5-6.5	1	5.6	
MF119	0-5.5	5.5	5.5-8.5	3	5.6	
Potholes						
TP1	0-3.5	3.5	3.5-6	2.5		
TP2	0-6	6		0		
TP3	0-5	5		0		
TP4	0-5	5		0		
TP5	0-2	2		0		
TP6	0-2	2	2-7+	5+		
PH1	0 - 5.5	5.5	5.5 - 6.5	1	6.5	
PH2	0 - 5	5	5 - 6.5	1.5	6.5	
PH3	0 - 5.5	5.5	5.5 - 6.5	1	6.5	
PH4	0 - 5.8	5.8	5.8 - 7	1.2		
PH5	0 - 4.8	4.8	4.8 - 7	2.2	6.1	
PH6	0 - 5	5	5 - 6	1	6	
PH7	0 - 3.5	3.5	3.5 - 6	2.5	5.4	
PH8	0 - 6.5	6.5		0		
PH9	0 - 8	8		0	6.8	
PH10	0 - 7	7		0	6	
PH11	0 - 7	7		0	6.5	
PH12	0 - 6	6	6 - 8	2	6	
PH13	0 - 5	5	5 - 8	3	5.5	
PH14	0 - 4	4	4 - 7.5	3.5	5.5	
PH15	0 - 4	4	4 - 7	3	6.5	cinder surface varies from 4' to 6'
PH16	0 - 5	5	5 - 7	2	6.7	
PH17	0 - 3.5	3.5	3.5 - 5.5	2		
PH18	0 - 4.5	4.5		0		
PH19	0 - 3.5	3.5	3.5 - 5.5	2	4.3	
PH20	0 - 4	4	4 - 6	2	6	
PH21	0 - 4.5	4.5	4.5 - 5.5	1	5	cinder pocket
PH22	0 - 5.5	5.5	5.5 - 7	1.5	5.5	cinders interlayered with sediment

TABLE 1
THICKNESS OF FILL AND CINDER LAYERS
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

PH23	0 - 9	9		0	8	
PH24	0 - 5.5	5.5	5.5 - 6.5	1	5.5	
PH25	0 - 4.5	4.5	4.5 - 6.5	2	5.8	
PH26	0 - 0.5		0.5 - 7+	6.5	6.5	trench, cinder surface varies
PH27	0 - 4.5		4.5 - 7	2.5	6.5	cinders intermixed with sulfurous matl.
PH28	0 - 2	2	2 - 6	4	6	cinder pocket against seawall
PH29	0 - 2	2	2 - 3.5	1.5		cinder pocket
PH30	0 - 2.5	2.5	2.5 - 4.5	2		
PH31	0 - 5	5	5 - 6.5	1.5	6	
PH32	0 - 5.5	5.5	5.5 - 6.8	1.3	7	cinder pocket
PH33	0 - 5.5	5.5	5.5 - 5.7	0.2		
PH34	0 - 2	2		0		
PH35	0 - 2			0		
Geoprobe borings with LFR						
A4-1	0-4?	4	4-4.5?	0.5?	4.52	very poor recovery in upper 7 feet
A4-2	0-4?	4	4-6?	2?		very poor recovery in upper 7 feet
A4-3	0-5	5	5-6	1	5.5	
A4-4	0-5	5	5-10?	5	5	no recovery from 7 to 9.5'. Lower cinders
A4-5	0-4.5	4.5	4.5-7	2.5	6	could be sluff
A4-6	0-4	4	4-6	1	6.3	
A4-7	0-4.5	4.5	4.5-8	3.5	5.8	
A4-9	0-4	4	4-7	3	4.7	
A4-10	0-1	1	1-7.5	6.5	5.4	
A4-12	0-7.5	7.5	7.5-8.5	1	5.9	very poor recovery in upper 7 feet
A4-13	0-4.5	4.5	4.5-8.5?	4	5.8	
A4-14	0-1.5	1.5	1.5-5	3.5	8.7	
A4-15	0-0.5	0.5	0.5-5	4.5	3.3	
A4-16	0-4.5	4.5	4.5-11	6.5	5.3	
A4-17	0-4?	4	4-8	4	5.8	very poor recovery in upper 7 feet
Access road to EBRPD trail						
AR1	0	0	0-6	6	3.8	
AR2	0	0	0-6	6	5.8	
AR3	0-5	5	0	0	6.4	

notes: 1) depth to bottom of cinders is frequently uncertain because of sloughing
2) where no water depth shown, either slow recharge or no groundwater encountered
3)bgs = below ground surface

TABLE 2
METALS IN SOIL
HISTORICAL AND RECENT SAMPLES
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

EPA Method 6010 (7471 for Mercury), units = mg/kg

Sample Location	depth	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES														
E-SSTL (hawk)					230	**157**	**412**	**437**	**42**	**621**				**760**
H-SSTL (Comm. Ind. Worker)			**27.3**		**147**				264					
Recent Analytical Results														
Test pits - pyrite cinders														
PH1-cinder		3.6	**53**	<0.12	9.5	0.91	**640**	55	8.7	37	1.4 J	8	0.76	**2,000**
PH4-cinder		5.8	**210**	<0.12	13	1.5	**780**	40	10	33	0.79 J	11	<0.3	**2,800**
PH7-cinder		6.3	**210**	<0.12	10	1.2	290	92	2.7	38	1 J	8.6	<0.31	**1,300**
Test pits - sediment														
PH1-6.5-sed	6.5	3.9	**320**	0.14	11	23	**1,700**	320	22	37	2.6 J	3.5	2	**3,000**
PH2-6.5-sed	6.5	<4.2	**75**	0.24	4.2	34	**850**	150	**140**	45	0.76 J	1.1	<0.35	**830**
PH3-6.5-sed	6.5	6	**560**	<0.14	25	27	**2,000**	210	**390**	35	38 J	7	1.9	**3,800**
PH4-7-sed	7	9.9	**1,600**	0.46	27	110	**4,100**	**570**	**500**	120	28 J	6.4	<0.51	**6,500**
PH5-7-sed	7	<3.9	**210**	<0.13	13	12	**1,600**	110	**94**	32	1.7 J	3.4	1.2	**2,600**
PH7-6-sed	6	16	**1,000**	0.18	34	56	**2,200**	410	**140**	81	50 J	11	<0.38	**6,700**
PH16-sed*	7	na	na	na	na	na	na	na	38	na	na	na	na	na
Geoprobe borings														
MF-104-B-0	0	<3.6	6.8	0.37	1.9	24 J	39	19	12	42 J	0.41	<0.3	<0.3	130
MF-104-B-3	3	<4.3	**95**	<0.14	7.7	3.4 J	**430**	19	**5,300**	30 J	3	5.7	1.3	**1,400**
MF-104-B-9	9	<3.4	1.8	<0.11	1.3	28	65	13	**2,200**	24 J	0.39	<0.29	<0.29	48
MF114-0	0	na	na	na	na	na	na	na	0.87	na	na	na	na	na
MF114-2	2	na	na	na	na	na	na	na	0.11	na	na	na	na	na
MF114-9.5	9.5	na	na	na	na	na	na	na	0.23	na	na	na	na	na
MF-114-11.3	11.3	<3.6	3.9	0.91	2.4	58	39	9.9	0.3	56	0.56	<0.3	<0.3	64
MF114-13	13	na	na	na	na	na	na	na	**170**	na	na	na	na	na
MF115-0	0	na	na	na	na	na	na	na	0.14	na	na	na	na	na
MF115-6	6	na	na	na	na	na	na	na	**3,900**	na	na	na	na	na
MF115-9.2	9.2	na	na	na	na	na	na	na	3.4	na	na	na	na	na
MF115-12	12	na	na	na	na	na	na	na	5.3	na	na	na	na	na
MF116-0	0	na	na	na	na	na	na	na	0.23	na	na	na	na	na
MF116-9.5	9.5	na	na	na	na	na	na	na	**510**	na	na	na	na	na
MF116-12	12	na	na	na	na	na	na	na	**930**	na	na	na	na	na
MF117-0	0	na	na	na	na	na	na	na	0.67	na	na	na	na	na

TABLE 2
METALS IN SOIL
HISTORICAL AND RECENT SAMPLES
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

Sample Location	depth	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES														
E-SSTL (hawk)					230	157	412	437	42	621				760
H-SSTL (Comm. Ind. Worker)			27.3		147				264					
MF117-10	10	na	na	na	na	na	na	na	0.31	na	na	na	na	na
MF117-13.5	13.5	na	na	na	na	na	na	na	0.21	na	na	na	na	na
MF118-0	0	na	na	na	na	na	na	na	0.28	na	na	na	na	na
MF118-6.5	6.5	na	na	na	na	na	na	na	64	na	na	na	na	na
MF118-9	9	na	na	na	na	na	na	na	0.75	na	na	na	na	na
MF119-0	0	na	na	na	na	na	na	na	0.13	na	na	na	na	na
MF119-9	9	na	na	na	na	na	na	na	0.36	na	na	na	na	na
MF119-13	13	na	na	na	na	na	na	na	<0.23	na	na	na	na	na
Borings with LFR/Zeneca														
A4-2	4	<4.8 UJ	150	0.21	8.3	32	1,900	180	85	47	2.2	2.3	<0.4	2,000
A4-6	5.5	<3.5	64	0.12	5	11	680	160	57	34	1.2	1.9	<0.29	590
A4-6	7	<3.5	3.5	0.39	1.6	28	21	5.9	0.22	46	0.61	<0.29	<0.29	36
A4-7	5.5	<4.1	57	<0.14	4.1	0.88	430	91	62	18	1.3	1.6	<0.34	220
A4-7	9.5	<3.5	3.1	0.17	1.2	22	35	9.8	0.44	29	<0.29	<0.29	<0.29	40
A4-9	4.5	<3.2	140	<0.11	10	1.9	470	94	5	27	2.7	3.3	<0.27	2,400
A4-9	8	<3.7	10	0.36	3.2	53	88	8.5	0.21	75	0.86	<0.31	<0.31	120
A4-9	11.5	<3.1	4.8	0.34	2.1	34	27	4.8	0.074	60	0.51	<0.26	<0.26	57
A4-10	4.5	<3.8	67	<0.13	13	1	620	32	11	36	2.3	3.7	<0.32	2,800
A4-10	10	<3.5	5.2	0.45	2.1	54	22	4.5	0.069	70	0.43	<0.29	<0.29	180
A4-12	7.5	<3.3	130	<0.11	280	8.4	10,000	81	62	59	7.5	24	<0.27	16,000
A4-12	10	<3.4	5.4	0.31	2.2	54	21	7.4	1.2	40	0.5	<0.28	<0.28	170
A4-13	7	<3.4	150	0.17	2200	12	10,000	210	27	65	8.1	3.4	20	23,000
A4-13	9.5	<3.2	6.2	0.42	2.5	39	22	5.8	0.82	63	0.51	<0.27	<0.27	72
A4-14	4.5	<3.4	49	<0.11	29	2	2,300	62	0.63	29	1.8	9.2	<0.28	2,900
A4-14	7	<3.5	1.6	0.29	1.8	20	57	3.1	0.063	30	<0.29	<0.29	<0.29	690
A4-15	4	<3.9	57	<0.13	13	1.8	2,700	82	0.82	56	7.2	12	<0.33	2,300
A4-15	6	<3.5	11	0.14	2	24	3,800	180	0.33	20	0.81	0.35	<0.29	170
A4-16	5.5	<3.8	100	<0.13	24	2.6	860	71	1,000	36	2.4	5	<0.32	6,400
A4-16	11.5	<3.4	1.9	0.23	1.3	30	19	6.8	5.4	43	<0.28	<0.28	<0.28	81
A4-17	7	<3.6	74	<0.12	36	3.4	8,900	120	1.4	62	5.9	4.1	2	6,200
A4-17	10	<3.5	4.6	0.24	2	33	36	8.5	0.85	43	0.34	<0.29	<0.29	180
PB12	0	<3.4	220	<0.11	8.1	17	170	190	8.8	42	32	2.1	<0.29	130

TABLE 2
METALS IN SOIL
HISTORICAL AND RECENT SAMPLES
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

Sample Location	depth	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES														
E-SSTL (hawk)					230	**157**	**412**	**437**	**42**	**621**				**760**
H-SSTL (Comm. Ind. Worker)			**27.3**		**147**				264					
PB12	4	<2.7	**89**	<0.091	6.4	2.2	270	73	1.3	29	2.2	4.5	<0.23	160
PB12	11	<3.6	6.8	0.49	2.9	39	27	7	0.17	74	0.38	<0.3	<0.3	230
Historical Analytical Results														
Ecological Control Industries - 7/31/98														
B-1	0	ND	15	na	ND	18	120	27	4.6	23	na	ND	na	160
B-1	4.5	8	**62**	na	ND	ND	**490**	91	6.4	ND	na	ND	na	580
B-1	8.5	ND	**160**	na	ND	ND	**2,600**	98	8	11	na	ND	na	**1,600**
B-2	0	ND	**35**	na	ND	15	190	43	0.35	20	na	ND	na	210
B-2	4.5	5.1	6.5	na	ND	36	19	ND	0.16	39	na	ND	na	41
B-2	8	ND	**54**	na	6	ND	**870**	61	7.3	ND	na	ND	na	730
B-3	0	ND	7.9	na	ND	12	65	21	0.64	25	na	ND	na	84
B-3	4	ND	14	na	ND	47	65	12	0.18	64	na	ND	na	250
B-3	8.5	ND	**110**	na	**340**	7.7	**20,000**	43	1.3	21	na	12	na	**7,900**
B-4	0	ND	17	na	ND	16	71	15	0.7	25	na	ND	na	110
B-4	4	ND	17	na	ND	26	34	8.3	4.7	33	na	ND	na	220
B-4	8	9.7	**110**	na	ND	ND	**770**	50	8	ND	na	5.3	na	**1,000**
B-5	0	ND	ND	na	ND	11	12	13	0.22	19	na	6.5	na	37
B-5	4	7.7	**140**	na	53	15	**9,300**	160	10	8.3	na	8.8	na	**2,300**
B-5	8	ND	**120**	na	20	5.7	**17,000**	80	32	23	na	ND	na	**1,800**
B-6	0	ND	ND	na	ND	7	9.8	6.9	0.59	15	na	ND	na	26
B-6	4	ND	14	na	ND	43	24	12	0.65	42	na	ND	na	87
B-6	8.5	7.4	**160**	na	22	6.4	**1,100**	140	32	ND	na	ND	na	**7,100**
B-7	0	ND	8.6	na	ND	18	**970**	18	4.1	22	na	ND	na	130
B-7	4.5	ND	8.8	na	ND	33	16	ND	3.2	27	na	ND	na	22
B-7	8	ND	**260**	na	27	ND	**1,300**	72	9.5	5.9	na	7.8	na	**4,600**
B-8	0	ND	16	na	ND	22	36	16	6.7	34	na	ND	na	96
B-8	4.5	ND	**160**	na	ND	17	330	71	2	25	na	9.9	na	**770**
B-8	8.5	ND	**210**	na	ND	ND	380	84	12	ND	na	ND	na	**1,400**
URS - December 2000 Results														
SL-101	0	<3.2	1.2	0.33	0.91	6.4	6.5	5	0.43	16 J	<0.26	<0.26	<0.26	22
SL-101	3	<3.6	3	0.52	1.2	31	15	6.8	0.15	46	<0.3	<0.3	0.73	24
SL-101	6	<4.2	**160**	0.25	14	17	**3,500**	130	**77**	85	3.7	3.6	3.6	**13,000**

TABLE 2
METALS IN SOIL
HISTORICAL AND RECENT SAMPLES
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

Sample Location	depth	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES														
E-SSTL (hawk)					230	**157**	**412**	**437**	**42**	**621**				**760**
H-SSTL (Comm. Ind. Worker)			**27.3**		**147**				264					
SL-101	10	<3.5	7.3	0.19	1.9	48	110	6.6	0.43	31	<0.29	<0.29	<0.29	440
SD-101	0	<3.8	5.2	0.46	1.6	33	38	18	0.19	35	0.82	<0.32	0.6	60
SD-101	3	<3.5	16	0.34	3.4	31	**710**	35	36 J	49	1.2	0.72	1.2 J	460
SD-101	8	<3.7	4.8	0.43	1.7	42	27	5.2	0.42 J	62	0.74	<0.31	0.83 J	44
SD-102	0	<3.6	4.8	0.44	1.5	33	20	5.9	0.12	42	0.32	<0.3	0.38	35
SD-102	3	<3.5	12	0.39	3	29	150	32	4.5	42	1.1	0.8	0.73 J	230
SD-102	8	<3.8	13	0.38	4.7	37	**640**	180	0.14 J	62	1.2	0.9	1.2 J	420
Older Historical Analytical Results														
B01-SH	1.3	na	<0.9	na	2.3	64.1	187	81.3	1.1	na	<9	na	na	125
B07-SH	1.3	na	3	na	<0.76	17.8	38.9	20.6	**80.1**	na	<0.73	na	na	47.6
B40	0-3	na	na	na	na	na	na	na	2.7	na	na	na	na	na
B36	0-3	na	na	na	na	na	na	na	0.23	na	na	na	na	na

Notes:

1) ND = not detected, the reporting limit is unknown. Data collected by others.
2) na = not analyzed
3) J = estimated concentration (Please see Appendix B for additional information.)
[ ] = exceeds screening value

TABLE 3
METALS AND pH IN GROUNDWATER
HISTORICAL AND RECENT SAMPLES
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

EPA Method 6010 (7470 for mercury); units = ug/L

Sample Location	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	ph
10 X AWQC (1)	NA	**360**	NA	NA	**93**	**500**	**31**	**56***	**0.25***	**82**	**710**	**1.9**	NA	**580***	
Groundwater in cinder layer															
A4-1B (LFR)	<60	66	58	<2	<5	<10	<10	<3	0.25	<20	<5	<5	<5	<20	6.6
A4-2B (LFR)	<60	72	190	<2	<5	<10	<10	<3	**0.5**	<20	<5	<5	<5	<20	8.0
A4-3B (LFR)	<60	190	160	<2	<5	<10	<10	<3	**0.38**	<20	<5	<5	<5	<20	7.5
A4-4B (LFR)	<60	28	49	<2	<5	<10	<10	<3	**0.47**	<20	<5	<5	<5	<20	6.5
A4-4B-DUP (LFR)	<60	99	52	<2	<5	<10	<10	<3	**0.51**	<20	<5	<5	<5	26	6.5
A4-5B (LFR)	<60	**400**	39	<2	<5	<10	<10	<3	<3	<20	<5	<5	<5	31	6.9
A4-9B (LFR)	<60	**370**	52	<2	51	<10	<10	<3	<3	**440**	12	<5	<5	**21,000**	5.7
A4-10B (LFR)	<60	59	89	<2	46	<10	<10	3.2	<0.2	**420**	9.3	<5	<5	**21,000**	5.1
A4-12B (LFR)	<60	89	130	<2	6.4	<10	<10	3.2	<0.2	**43**	<5	<5	<5	130	6.2
A4-13B (LFR)	<60	25	140	<2	37	<10	<10	**59**	<0.2	**380**	24	<5	7.6	**19,000**	4.2
A4-16B	<60	15	150	<2	<5	<10	<10	<3	**0.39**	<20	<5	<5 UJ	<5	270	6.8
A4-17B (LFR)	<60	13	210	<2	7.9	<10	<10	3.5	<0.2	54	9.4	<5	14	35	6.1
Groundwater below cinder layer															
A4-1A (LFR)	<60	6.3	20	<2	<5	<10	<10	<3	**0.73**	<20	<5	<5	<5	<20	7.2
A4-2A (LFR)	<60	<5	31	<2	<5	<10	<10	<3	**0.35**	<20	<5	<5	<5	<20	7.1
A4-3A (LFR)	<60	5.4	18	<2	<5	<10	<10	<3	0.25	<20	<5	<5	<5	<20	7.0
A4-5A	<60	16	13	<2	<5	<10	<10	<3	<0.20	21	8.3	<5 UJ	13	**600**	6.5
A4-9A (LFR)	<60	<5	18	<2	<5	<10	<10	<3	<0.20	<20	<5	<5 UJ	<5	<20	7.3
A4-9A (URS)	<60	<5	18	<2	<5	<10	<10	<3	<0.20	<20	<5	<5	<5	<20	7.1
A4-12A	<60	18	18	<2	6.6	<10	<10	<3	<0.20	**150**	5.6	<5 UJ	22	**5,800**	6.3
A4-13A (LFR)	<60	15	14	<2	<5	<10	<10	<3	<0.20	22	8.2	<5 UJ	10	**600**	7.0
A4-13A (URS)	<60	<5	na	<2	<5	<10	<10	<3	<0.20	**110**	<5	<5	7.7	38	6.7
Groundwater screened across both zones															
A4-6	<60	<5	na	<2	<5	<10	14	<3	<0.20	<20	<5	<5 UJ	<5	<20	7.5
A4-7	<60	58	na	<2	<5	<10	<10	<3	<0.20	<20	10	<5 UJ	<5	60	6.9
A4-14	<60	95	na	<2	**150**	<10	<10	8.3	<0.20	**530**	38	<5 UJ	130	**27,000**	6.1
A4-15	<60	8.9	na	<2	<5	<10	<10	<3	<0.20	<20	<5	<5 UJ	<5	54	7.1
PB-12	<60	92	27	4.1	**160**	190	**14,000**	54	<0.2	**790**	12	<5	18	**33,000**	5.1
SL-101-GW	<60	17	na	<2	13	<10	<10	<3	<0.2	**320**	7.5	<5 UJ	11	**12,000**	na

TABLE 3
METALS AND pH IN GROUNDWATER
HISTORICAL AND RECENT SAMPLES
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

Sample Location	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	ph
10 X AWQC (1)	NA	**360**	NA	NA	**93**	**500**	**31**	**56***	**0.25***	**82**	**710**	**1.9**	NA	**580***	
SD-101-GW	<60	<5	na	<2	<5	<10	<10	<3	<0.2	<20	<5	<5	<5	30	na
SD-102-GW	<60	<5	na	<2	<5	<10	**89**	<3	<0.2	<20	<5	<5	<5	80	na
Geoprobe borings for mercury delineation															
MF-104	<60	24	na	<2	<5	<10	10	<3	**1.5**	<20	<5	<5	<5	22	na
MF114-GW	<60	<5	na	<2	<5	<10	<10	<3	0.24	<20	8.5	<5	<5	88	na
MF115-GW	<60	32	na	<2	<5	<10	<10	<3	<0.2	<20	7.4	<5	<5	<20	na
MF116-GW	<60	26	na	<2	<5	<10	<10	<3	**2**	<20	8.3	<5	<5	<20	na
MF117-GW	<60	92	na	<2	<5	<10	<10	3.5	<0.2	<20	10	<5	<5	40	na
MF118-GW	<60	24	na	<2	<5	<10	<10	<3	<0.2	<20	8.9	<5	<5	41	na
MF119-GW	<60	45	na	<2	<5	<10	<10	<3	<0.2	<20	8.7	<5	<5	<20	na
Ecological Control Industries - 7/31/98															
B-2-W	ND	220	15	na	6.3	2.4	ND	ND	ND	15	na	ND	na	**1,600**	na
B-7-W	ND	210	6.9	na	ND	19	ND	ND	ND	ND	na	ND	na	120	na

Notes: 1) NOAA Ambient Water Quality Criteria for chronic marine exposure
* Based on current SFRWQCB Water Quality Objectives - will change upon amendment of Basin Plan to incorporate CA Toxic Rule Levels
2) ND = non detect, reporting limit is unknown. Data collected by others.
3) na = not analyzed
4) UJ = estimated non detect (Please see Appendix B for additional information.)
160 = exceeds 10 x NOAA Ambient Water Quality Criteria for chronic marine exposure

TABLE 4
VOCs IN GROUNDWATER
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

EPA Method 8260B, Units = ug/L

Location	PB12B	Screening Value[a]
Parameter		
Freon 12	< 40	na
Chloromethane	< 40	na
Vinyl Chloride	< 20	4.9
Bromomethane	< 40	na
Chloroethane	< 40	na
Trichlorofluoromethane	< 20	na
Acetone	< 400	1500
Freon 113	< 200	na
1,1-Dichloroethene	< 20	9.6
Methylene Chloride	< 400	na
Carbon Disulfide	< 20	na
MTBE	< 20	na
trans-1,2-Dichloroethene	< 20	590
Vinyl Acetate	< 400	na
1,1-Dichloroethane	< 20	na
2-Butanone	< 400	na
cis-1,2-Dichloroethene	< 20	590
2,2-Dichloropropane	< 20	na
Chloroform	< 20	28
Bromochloromethane	< 20	na
1,1,1-Trichloroethane	< 20	na
1,1-Dichloropropene	< 20	na
Carbon Tetrachloride	< 20	9.8
1,2-Dichloroethane	< 20	420
Benzene	< 20	46
Trichloroethene	**120**	360
1,2-Dichloropropane	< 20	na
Bromodichloromethane	< 20	na
Dibromomethane	< 20	na
4-Methyl-2-Pentanone	< 400	na
cis-1,3-Dichloropropene	< 20	na
Toluene	< 20	130
trans-1,3-Dichloropropene	< 20	na
1,1,2-Trichloroethane	< 20	930
2-Hexanone	< 400	na
1,3-Dichloropropane	< 20	na
Tetrachloroethene	6500	120
Dibromochloromethane	< 20	na
1,2-Dibromoethane	< 20	na
Chlorobenzene	< 20	50
1,1,1,2-Tetrachloroethane	< 20	na
Ethylbenzene	< 20	na
m,p-Xylenes	< 20	13

TABLE 4
VOCs IN GROUNDWATER
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

EPA Method 8260B, Units = ug/L

Location	PB12B	Screening Value[a]
Parameter		
o-Xylene	< 20	na
Styrene	< 20	na
Bromoform	< 40	na
Isopropylbenzene	< 20	na
1,1,2,2-Tetrachloroethane	< 20	na
1,2,3-Trichloropropane	< 20	na
Propylbenzene	< 20	na
Bromobenzene	< 20	na
1,3,5-Trimethylbenzene	< 20	na
2-Chlorotoluene	< 20	na
4-Chlorotoluene	< 20	na
tert-Butylbenzene	< 20	na
1,2,4-Trimethylbenzene	< 20	na
sec-Butylbenzene	< 20	na
para-Isopropyl Toluene	< 20	na
1,3-Dichlorobenzene	< 20	na
1,4-Dichlorobenzene	< 20	na
n-Butylbenzene	< 20	na
1,2-Dichlorobenzene	< 20	na
1,2-Dibromo-3-Chloropropane	< 20	na
1,2,4-Trichlorobenzene	< 20	na
Hexachlorobutadiene	< 20	na
Naphthalene	< 20	na
1,2,3-Trichlorobenzene	< 20	na

[a] SF-RWQCB RBSLs (2000) Lowest value was selected from RBSLs protective of groundwater that is not a current or potential drinking water resource.
Gray indicates exceedance of screening level.

TABLE 5
METALS IN FILL, CINDERS, AND SEDIMENT
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

EPA Method 6010 (7471 for Mercury), units = mg/kg

Sample Location	depth	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES														
E-SSTL (hawk)					230	**157**	**412**	**437**	**42**	**621**				**760**
H-SSTL (Comm. Ind. Worker)			**27.3**		**147**				264					
Fill material														
MF-104-B-0	0	<3.6	6.8	0.37	1.9	24 J	39	19	12	42 J	0.41	<0.3	<0.3	130
MF114-0	0	na	na	na	na	na	na	na	0.87	na	na	na	na	na
MF115-0	0	na	na	na	na	na	na	na	0.14	na	na	na	na	na
MF116-0	0	na	na	na	na	na	na	na	0.23	na	na	na	na	na
MF117-0	0	na	na	na	na	na	na	na	0.67	na	na	na	na	na
MF118-0	0	na	na	na	na	na	na	na	0.28	na	na	na	na	na
MF119-0	0	na	na	na	na	na	na	na	0.13	na	na	na	na	na
B-1	0	ND	15	na	ND	18	120	27	4.6	23	na	ND	na	160
B-2	0	ND	**35**	na	ND	15	190	43	0.35	20	na	ND	na	210
B-3	0	ND	7.9	na	ND	12	65	21	0.64	25	na	ND	na	84
B-4	0	ND	17	na	ND	16	71	15	0.7	25	na	ND	na	110
B-5	0	ND	ND	na	ND	11	12	13	0.22	19	na	6.5	na	37
B-6	0	ND	ND	na	ND	7	9.8	6.9	0.59	15	na	ND	na	26
B-7	0	ND	8.6	na	ND	18	**970**	18	4.1	22	na	ND	na	130
B-8	0	ND	16	na	ND	22	36	16	6.7	34	na	ND	na	96
SL-101	0	<3.2	1.2	0.33	0.91	6.4	6.5	5	0.43	16 J	<0.26	<0.26	<0.26	22
SD-101	0	<3.8	5.2	0.46	1.6	33	38	18	0.19	35	0.82	<0.32	0.6	60
SD-102	0	<3.6	4.8	0.44	1.5	33	20	5.9	0.12	42	0.32	<0.3	0.38	35
PB12	0	<3.4	**220**	<0.11	8.1	17	170	190	8.8	42	32	2.1	<0.29	130
Pyrite Cinders														
PH1-cinder		3.6	**53**	<0.12	9.5	0.91	**640**	55	8.7	37	1.4 J	8	0.76	**2,000**
PH4-cinder		5.8	**210**	<0.12	13	1.5	**780**	40	10	33	0.79 J	11	<0.3	**2,800**
PH7-cinder		6.3	**210**	<0.12	10	1.2	290	92	2.7	38	1 J	8.6	<0.31	**1,300**
MF-104-B-3	3	<4.3	**95**	<0.14	7.7	3.4 J	**430**	19	**5,300**	30 J	3	5.7	1.3	**1,400**
MF115-6	6	na	na	na	na	na	na	na	**3,900**	na	na	na	na	na
MF118-6.5	6.5	na	na	na	na	na	na	na	**64**	na	na	na	na	na
A4-2	4	<4.8 UJ	**150**	0.21	8.3	32	**1,900**	180	**85**	47	2.2	2.3	<0.4	**2,000**
A4-6	5.5	<3.5	**64**	0.12	5	11	**680**	160	**57**	34	1.2	1.9	<0.29	590
A4-7	5.5	<4.1	**57**	<0.14	4.1	0.88	**430**	91	**62**	18	1.3	1.6	<0.34	220

TABLE 5
METALS IN FILL, CINDERS, AND SEDIMENT
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

Sample Location	depth	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES														
E-SSTL (hawk)					230	**157**	**412**	**437**	**42**	**621**				**760**
H-SSTL (Comm. Ind. Worker)			**27.3**		**147**				264					
A4-9	4.5	<3.2	**140**	<0.11	10	1.9	**470**	94	5	27	2.7	3.3	<0.27	**2,400**
A4-10	4.5	<3.8	**67**	<0.13	13	1	**620**	32	11	36	2.3	3.7	<0.32	**2,800**
A4-12	7.5	<3.3	**130**	<0.11	**280**	8.4	**10,000**	81	**62**	59	7.5	24	<0.27	**16,000**
A4-13	7	<3.4	**150**	0.17	**2200**	12	**10,000**	210	27	65	8.1	3.4	20	**23,000**
A4-14	4.5	<3.4	**49**	<0.11	29	2	**2,300**	62	0.63	29	1.8	9.2	<0.28	**2,900**
A4-15	4	<3.9	**57**	<0.13	13	1.8	**2,700**	82	0.82	56	7.2	12	<0.33	**2,300**
A4-16	5.5	<3.8	**100**	<0.13	24	2.6	**860**	71	**1,000**	36	2.4	5	<0.32	**6,400**
A4-17	7	<3.6	**74**	<0.12	36	3.4	**8,900**	120	1.4	62	5.9	4.1	2	**6,200**
PB12	0	<3.4	**220**	<0.11	8.1	17	170	190	8.8	42	32	2.1	<0.29	130
PB12	4	<2.7	**89**	<0.091	6.4	2.2	270	73	1.3	29	2.2	4.5	<0.23	160
Sediment - sorted by depth														
PH7-6-sed	6	16	**1,000**	0.18	34	56	**2,200**	410	**140**	81	50 J	11	<0.38	**6,700**
A4-15	6	<3.5	11	0.14	2	24	**3,800**	180	0.33	20	0.81	0.35	<0.29	170
PH1-6.5-sed	6.5	3.9	**320**	0.14	11	23	**1,700**	320	22	37	2.6 J	3.5	2	**3,000**
PH2-6.5-sed	6.5	<4.2	**75**	0.24	4.2	34	**850**	150	**140**	45	0.76 J	1.1	<0.35	**830**
PH3-6.5-sed	6.5	6	**560**	<0.14	25	27	**2,000**	210	**390**	35	38 J	7	1.9	**3,800**
PH4-7-sed	7	9.9	**1,600**	0.46	27	110	**4,100**	**570**	**500**	120	28 J	6.4	<0.51	**6,500**
PH5-7-sed	7	<3.9	**210**	<0.13	13	12	**1,600**	110	**94**	32	1.7 J	3.4	1.2	**2,600**
PH16-sed*	7	na	na	na	na	na	na	na	38	na	na	na	na	na
A4-6	7	<3.5	3.5	0.39	1.6	28	21	5.9	0.22	46	0.61	<0.29	<0.29	36
A4-14	7	<3.5	1.6	0.29	1.8	20	57	3.1	0.063	30	<0.29	<0.29	<0.29	690
A4-9	8	<3.7	10	0.36	3.2	53	88	8.5	0.21	75	0.86	<0.31	<0.31	120
MF-104-B-9	9	<3.4	1.8	<0.11	1.3	28	65	13	**2,200**	24 J	0.39	<0.29	<0.29	48
MF118-9	9	na	na	na	na	na	na	na	0.75	na	na	na	na	na
MF119-9	9	na	na	na	na	na	na	na	0.36	na	na	na	na	na
MF115-9.2	9.2	na	na	na	na	na	na	na	3.4	na	na	na	na	na
MF114-9.5	9.5	na	na	na	na	na	na	na	0.23	na	na	na	na	na
MF116-9.5	9.5	na	na	na	na	na	na	na	**510**	na	na	na	na	na
A4-7	9.5	<3.5	3.1	0.17	1.2	22	35	9.8	0.44	29	<0.29	<0.29	<0.29	40
A4-13	9.5	<3.2	6.2	0.42	2.5	39	22	5.8	0.82	63	0.51	<0.27	<0.27	72
MF117-10	10	na	na	na	na	na	na	na	0.31	na	na	na	na	na
A4-10	10	<3.5	5.2	0.45	2.1	54	22	4.5	0.069	70	0.43	<0.29	<0.29	180

TABLE 5
METALS IN FILL, CINDERS, AND SEDIMENT
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

Sample Location	depth	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES														
E-SSTL (hawk)					230	**157**	**412**	**437**	**42**	**621**				**760**
H-SSTL (Comm. Ind. Worker)			**27.3**		**147**				264					
A4-12	10	<3.4	5.4	0.31	2.2	54	21	7.4	1.2	40	0.5	<0.28	<0.28	170
A4-17	10	<3.5	4.6	0.24	2	33	36	8.5	0.85	43	0.34	<0.29	<0.29	180
PB12	11	<3.6	6.8	0.49	2.9	39	27	7	0.17	74	0.38	<0.3	<0.3	230
MF-114-11.3	11.3	<3.6	3.9	0.91	2.4	58	39	9.9	0.3	56	0.56	<0.3	<0.3	64
A4-9	11.5	<3.1	4.8	0.34	2.1	34	27	4.8	0.074	60	0.51	<0.26	<0.26	57
A4-16	11.5	<3.4	1.9	0.23	1.3	30	19	6.8	5.4	43	<0.28	<0.28	<0.28	81
MF115-12	12	na	na	na	na	na	na	na	5.3	na	na	na	na	na
MF116-12	12	na	na	na	na	na	na	na	**930**	na	na	na	na	na
MF114-13	13	na	na	na	na	na	na	na	**170**	na	na	na	na	na
MF119-13	13	na	na	na	na	na	na	na	<0.23	na	na	na	na	na
MF117-13.5	13.5	na	na	na	na	na	na	na	0.21	na	na	na	na	na

Notes:

1) ND = not detected, the reporting limit is unknown. Data collected by others.
2) na = not analyzed
3) J = estimated concentration (Please see Appendix B for additional information.)
[ ] = exceeds screening value

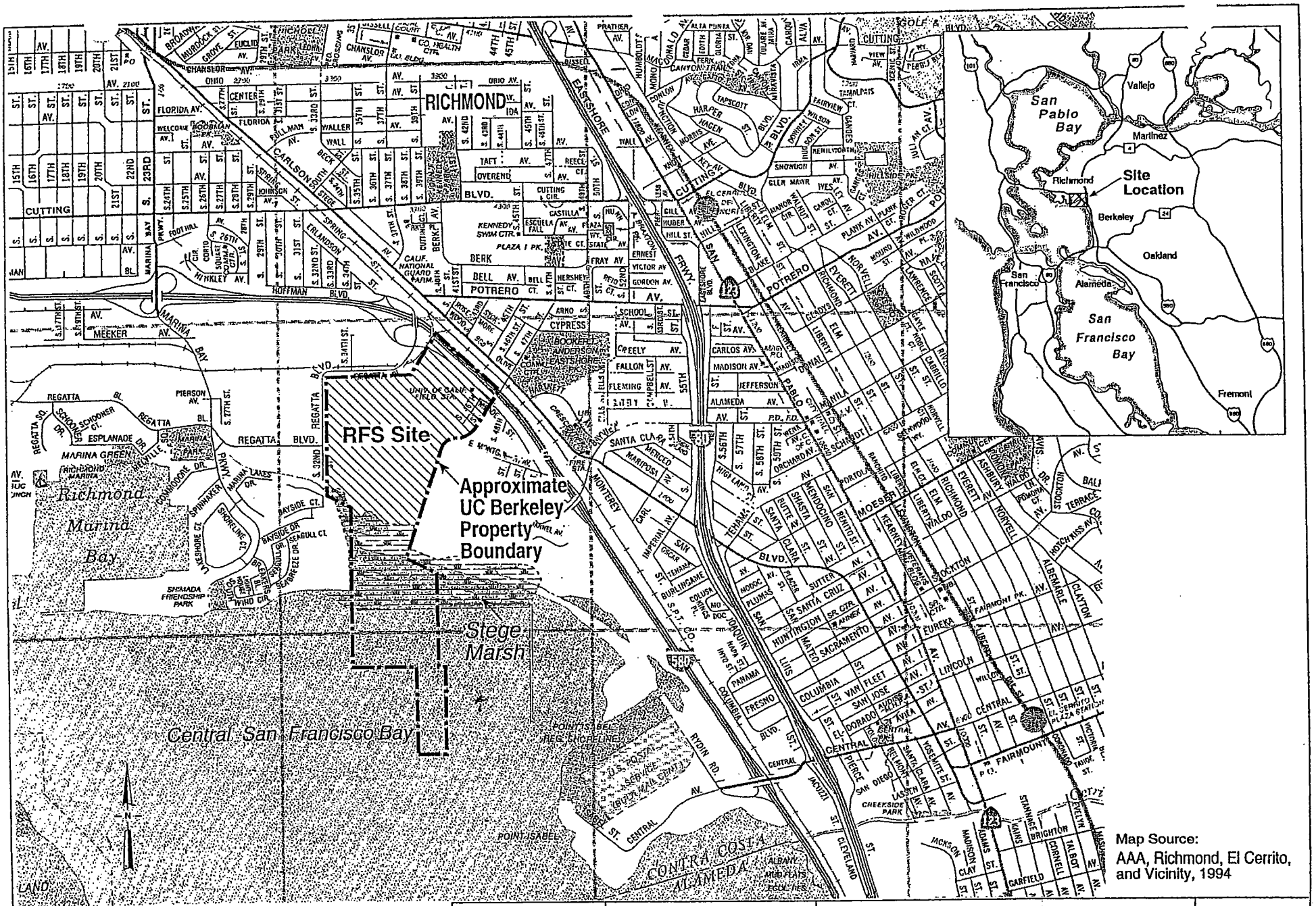
TABLE 6
METALS AND pH IN GROUNDWATER FROM WEST TO EAST
UPLAND SUBUNIT 2A
RICHMOND FIELD STATION

EPA Method 6010 (7470 for mercury); units = ug/L. See table 3 for notes.

Sample Location	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	ph
10 X AWQC (1)	**NA**	**360**	**NA**	**NA**	**93**	**500**	**31**	**56***	**0.25***	**82**	**710**	**1.9**	**NA**	**580***	
Samples are listed by location from west to east															
SD-101-GW	<60	<5		<2	<5	<10	<10	<3	<0.2	<20	<5	<5	<5	30	
SD-102-GW	<60	<5		<2	<5	<10	**89**	<3	<0.2	<20	<5	<5	<5	80	
A4-1B (LFR)	<60	66	58	<2	<5	<10	<10	<3	0.25	<20	<5	<5	<5	<20	5.94
A4-1A (LFR)	<60	6.3	20	<2	<5	<10	<10	<3	**0.73**	<20	<5	<5	<5	<20	7.45
A4-6	<60	<5	na	<2	<5	<10	14	<3	<0.20	<20	<5	<5 UJ	<5	<20	7.5
A4-14	<60	95	na	<2	**150**	<10	<10	8.3	<0.20	530	38	<5 UJ	130	**27,000**	6.1
A4-2B (LFR)	<60	72	190	<2	<5	<10	<10	<3	**0.5**	<20	<5	<5	<5	<20	na
A4-2A (LFR)	<60	<5	31	<2	<5	<10	<10	<3	**0.35**	<20	<5	<5	<5	<20	6.48
A4-15	<60	8.9	na	<2	<5	<10	<10	<3	<0.20	<20	<5	<5 UJ	<5	54	7.1
A4-3B (LFR)	<60	190	160	<2	<5	<10	<10	<3	**0.38**	<20	<5	<5	<5	<20	na
A4-3A (LFR)	<60	5.4	18	<2	<5	<10	<10	<3	0.25	<20	<5	<5	<5	<20	6.74
A4-7	<60	58	na	<2	<5	<10	<10	<3	<0.20	<20	10	<5 UJ	<5	60	6.9
MF116-GW	<60	26	na	<2	<5	<10	<10	<3	**2**	<20	8.3	<5	<5	<20	
MF119-GW	<60	45	na	<2	<5	<10	<10	<3	<0.2	<20	8.7	<5	<5	<20	
MF115-GW	<60	32	na	<2	<5	<10	<10	<3	<0.2	<20	7.4	<5	<5	<20	
MF-104	<60	24	na	<2	<5	<10	10	<3	**1.5**	<20	<5	<5	<5	22	
MF118-GW	<60	24	na	<2	<5	<10	<10	<3	<0.2	<20	8.9	<5	<5	41	
A4-16B	<60	15	150	<2	<5	<10	<10	<3	**0.39**	<20	<5	<5 UJ	<5	270	6.8
MF114-GW	<60	<5	na	<2	<5	<10	<10	<3	0.24	<20	8.5	<5	<5	88	
MF117-GW	<60	92	na	<2	<5	<10	<10	3.5	<0.2	<20	10	<5	<5	40	
A4-4B (LFR)	<60	28	49	<2	<5	<10	<10	<3	**0.47**	<20	<5	<5	<5	<20	6.44
A4-4B-DUP (LFR)	<60	99	52	<2	<5	<10	<10	<3	**0.51**	<20	<5	<5	<5	26	
A4-5B (LFR)	<60	**400**	39	<2	<5	<10	<10	<3	<3	<20	<5	<5	<5	31	6.9
A4-5A	<60	16	13	<2	<5	<10	<10	<3	<0.20	21	8.3	<5 UJ	13	**600**	6.5
A4-12B (LFR)	<60	89	130	<2	6.4	<10	<10	3.2	<0.2	43	<5	<5	<5	130	
A4-12A	<60	18	18	<2	6.6	<10	<10	<3	<0.20	**150**	5.6	<5 UJ	22	**5,800**	6.3
A4-17B (LFR)	<60	13	210	<2	7.9	<10	<10	3.5	<0.2	54	9.4	<5	14	35	6.1
B-2-W	ND	220	15	na	6.3	2.4	ND	ND	ND	15	na	ND	na	**1,600**	
B-7-W	ND	210	6.9	na	ND	19	ND	ND	ND	ND	na	ND	na	120	
SL-101-GW	<60	17		<2	13	<10	<10	<3	<0.2	**320**	7.5	<5 UJ	11	**12,000**	
A4-9B (LFR)	<60	**370**	52	<2	51	<10	<10	<3	<3	**440**	12	<5	<5	**21,000**	5.7
A4-9A (LFR)	<60	<5	18	<2	<5	<10	<10	<3	<0.20	<20	<5	<5 UJ	<5	<20	7.3
A4-9A (URS)	<60	<5	18	<2	<5	<10	<10	<3	<0.20	<20	<5	<5	<5	<20	7.1
A4-10B (LFR)	<60	59	89	<2	46	<10	<10	3.2	<0.2	**420**	9.3	<5	<5	**21,000**	5.1
A4-13B (LFR)	<60	25	140	<2	37	<10	<10	**59**	<0.2	**380**	24	<5	7.6	**19,000**	
A4-13A (LFR)	<60	15	14	<2	<5	<10	<10	<3	<0.20	**22**	8.2	<5 UJ	10	**600**	7
A4-13A (URS)	<60	<5	na	<2	<5	<10	<10	<3	<0.20	**110**	<5	<5	7.7	38	6.7
PB-12	<60	92	27	4.1	**160**	190	**14,000**	54	<0.2	**790**	12	<5	18	**33,000**	5.1

UJ = estimated non-detect (Please see Appendix B for additional information.)

160 = exceeds 10 x NOAA Ambient Water Quality Criteria for chronic marine exposure



Map Source:
AAA, Richmond, El Cerrito, and Vicinity, 1994

URS

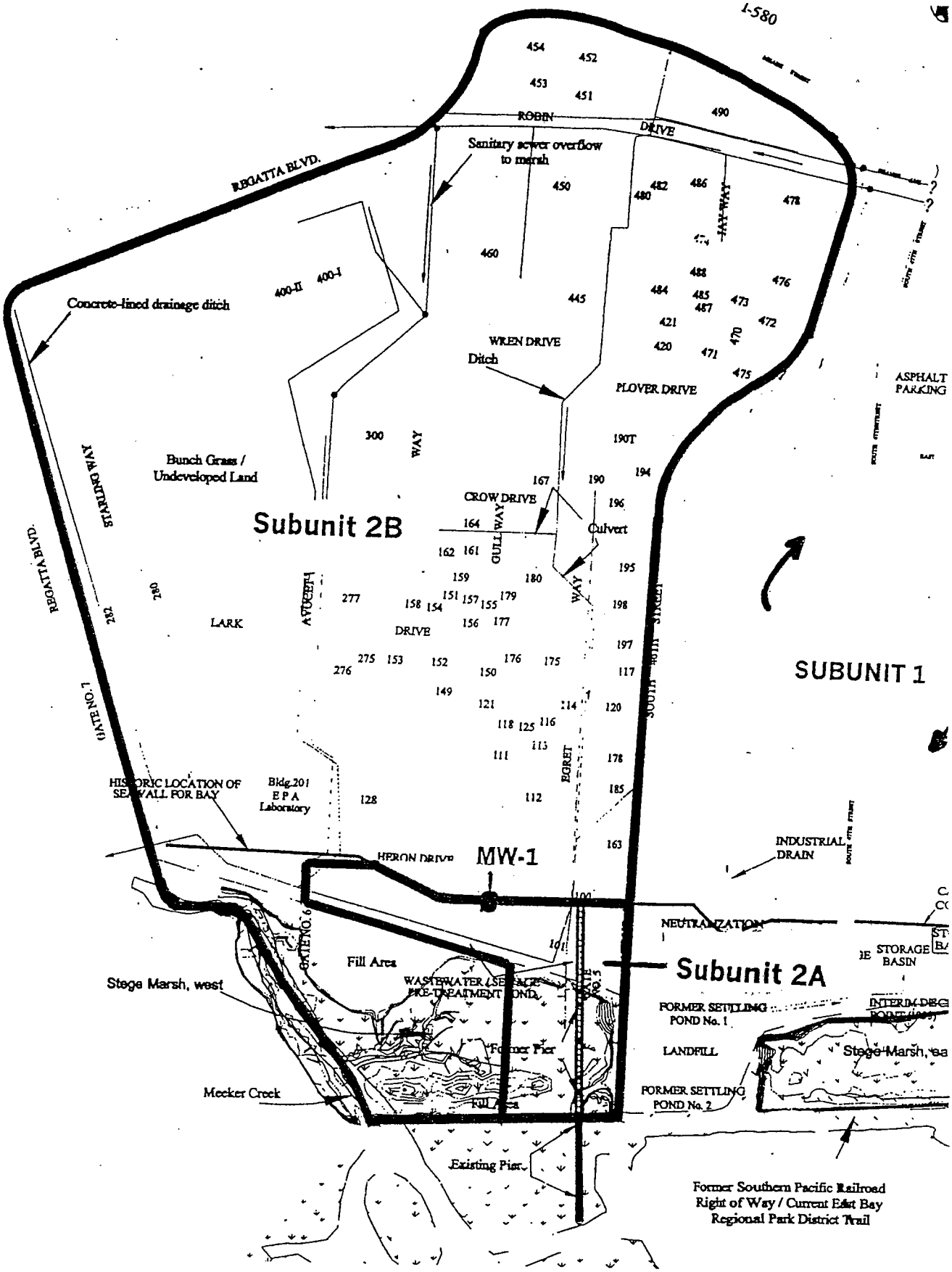
Project No. 51-09967067.00

UC Berkeley
Richmond Field Station

UNIVERSITY OF CALIFORNIA, BERKELEY
RICHMOND FIELD STATION
SITE LOCATION MAP

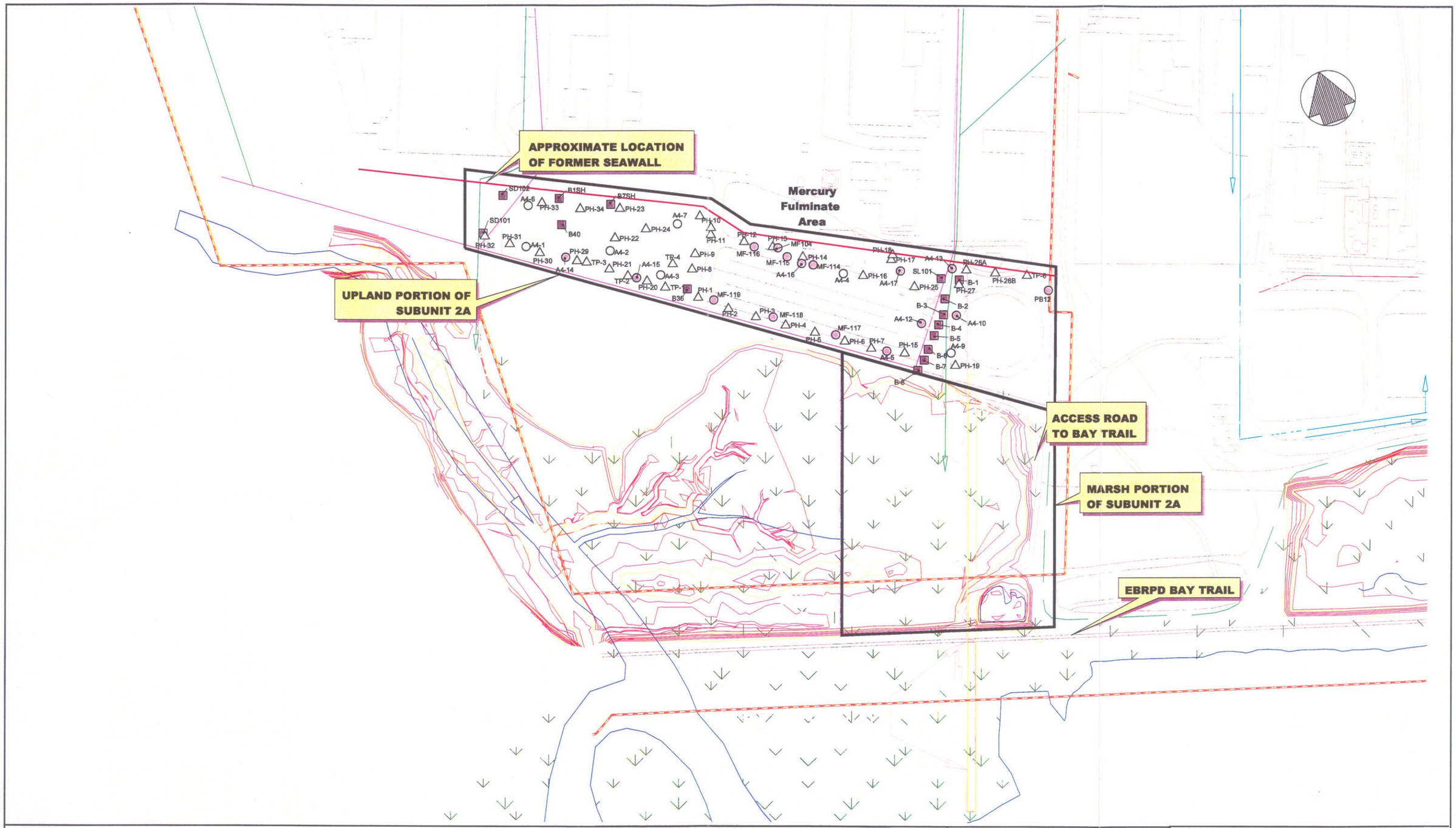
Figure 1

51-09967067.00-00003/101701/gos



Subunits 2A and 2B
Locations and Boundaries

Figure 2



LEGEND

- Surveyed Sampling Location (Borings)
- Historical Surveyed Sampling Location (Borings)
- Surveyed Sampling Location (Test Pits)
- Storm Drain System (Approximate)
- Industrial Drain (Approximate)
- Sanitary Sewer System (Approximate) (dashed line to be verified)
- Edge of Surface Water
- Stege Marsh
- Property Boundary

NOTES :

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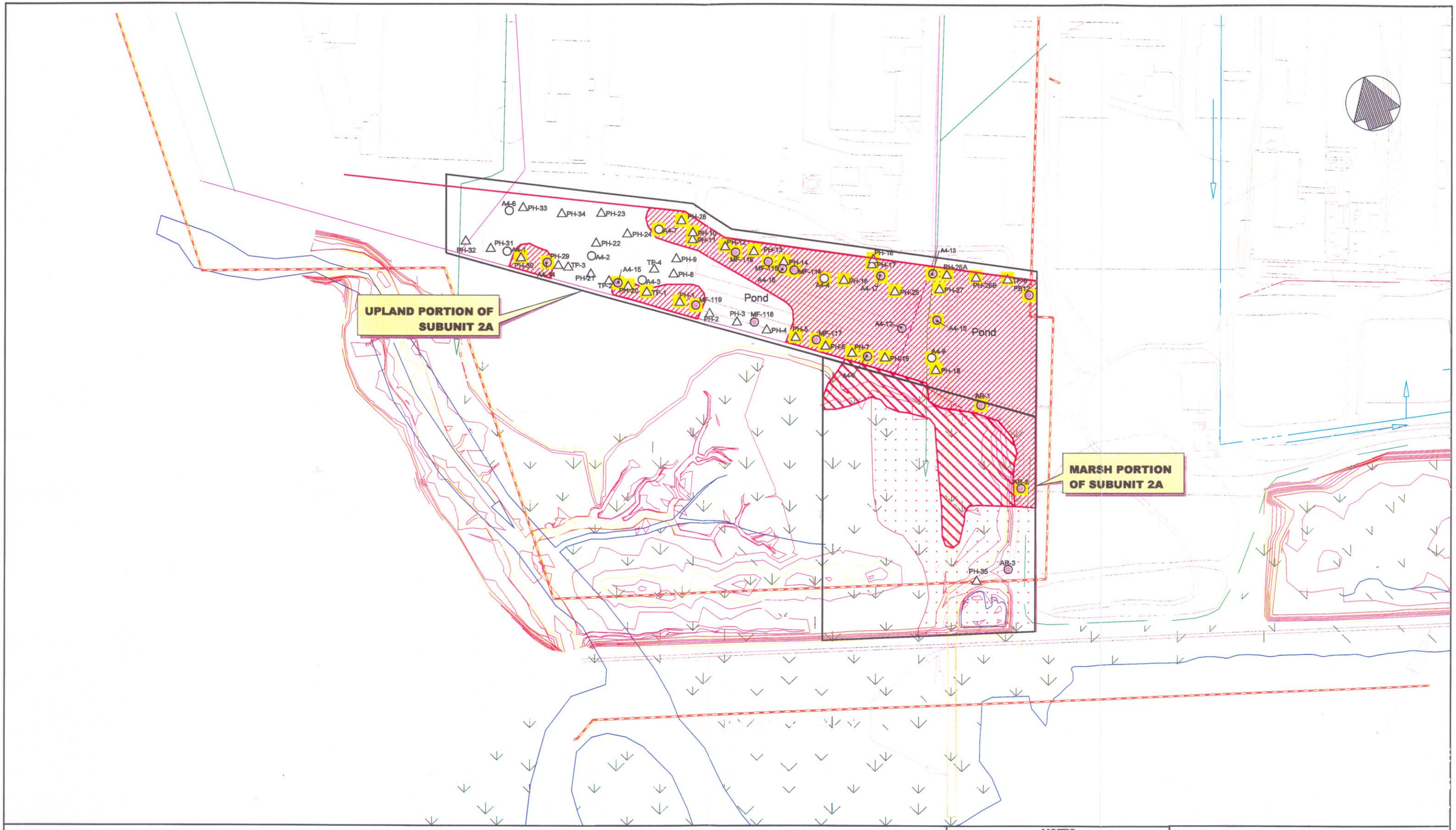
Sampling Locations

November 2001 | Scale 1" = 150' | Figure 3



LEGEND

- Sampling Location (Borings)
- Sampling Location (Test Pits)
- Approximate area with cinder thickness greater than 2 feet
- Approximate area with cinder thickness 2 feet or less
- Approximate area with cinder impacts
- Storm Drain System (Approximate)
- Industrial Drain (Approximate)
- Sanitary Sewer System (Approximate) (dashed line to be verified)
- Edge of Surface Water
- Stege Marsh
- Property Boundary
- Location with Cinder greater than or equal to 2 feet thick

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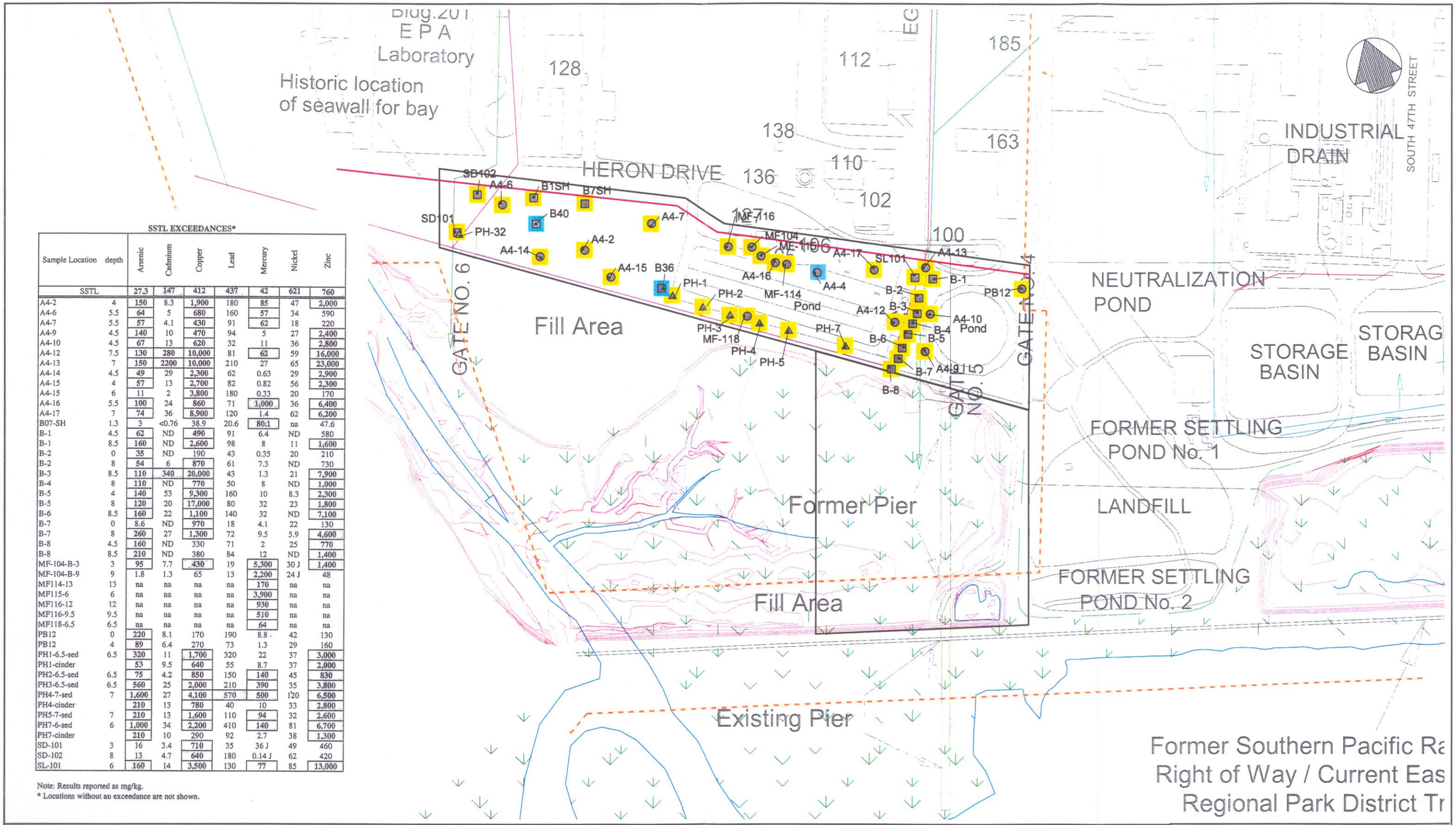
Area with cinders greater than or equal to 2 feet

November 2001 | Scale 1" = 150' | Figure 4

SSTL EXCEEDANCES*

Sample Location	depth	Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	Zinc
SSTL		27.3	147	412	437	42	621	760
A4-2	4	150	8.3	1,900	180	85	47	2,000
A4-6	5.5	64	5	680	160	57	34	590
A4-7	5.5	57	4.1	430	91	62	18	220
A4-9	4.5	140	10	470	94	5	27	2,400
A4-10	4.5	67	13	620	32	11	36	2,800
A4-12	7.5	130	280	10,000	81	62	59	16,000
A4-13	7	150	2200	10,000	210	27	65	23,000
A4-14	4.5	49	29	2,300	62	0.63	29	2,900
A4-15	4	57	13	2,700	82	0.82	56	2,300
A4-15	6	11	2	3,800	180	0.33	20	170
A4-16	5.5	100	24	860	71	1,000	36	6,400
A4-17	7	74	36	8,900	120	1.4	62	6,200
B07-SH	1.3	3	<0.76	38.9	20.6	80:1	na	47.6
B-1	4.5	62	ND	490	91	6.4	ND	580
B-1	8.5	160	ND	2,600	98	8	11	1,600
B-2	0	35	ND	190	43	0.35	20	210
B-2	8	54	6	870	61	7.3	ND	730
B-3	8.5	110	340	20,000	43	1.3	21	7,900
B-4	8	110	ND	770	50	8	ND	1,000
B-5	4	140	53	9,300	160	10	8.3	2,300
B-5	8	120	20	17,000	80	32	23	1,800
B-6	8.5	160	22	1,100	140	32	ND	7,100
B-7	0	8.6	ND	970	18	4.1	22	130
B-7	8	260	27	1,300	72	9.5	5.9	4,600
B-8	4.5	160	ND	330	71	2	25	770
B-8	8.5	210	ND	380	84	12	ND	1,400
MF-104-B-3	3	95	7.7	430	19	5,300	30 J	1,400
MF-104-B-9	9	1.8	1.3	65	13	2,200	24 J	48
MF114-13	13	na	na	na	na	170	na	na
MF115-6	6	na	na	na	na	3,900	na	na
MF116-12	12	na	na	na	na	930	na	na
MF116-9.5	9.5	na	na	na	na	510	na	na
MF118-6.5	6.5	na	na	na	na	64	na	na
PB12	0	220	8.1	170	190	8.8	42	130
PB12	4	89	6.4	270	73	1.3	29	160
PH1-6.5-sed	6.5	320	11	1,700	320	22	37	3,000
PH1-cinder		53	9.5	640	55	8.7	37	2,000
PH2-6.5-sed	6.5	75	4.2	850	150	140	45	830
PH3-6.5-sed	6.5	560	25	2,000	210	390	35	3,800
PH4-7-sed	7	1,600	27	4,100	570	500	120	6,500
PH4-cinder		210	13	780	40	10	33	2,800
PH5-7-sed	7	210	13	1,600	110	94	32	2,600
PH7-6-sed	6	1,000	34	2,200	410	140	81	6,700
PH7-cinder		210	10	290	92	2.7	38	1,300
SD-101	3	16	3.4	710	35	36 J	49	460
SD-102	8	13	4.7	640	180	0.14 J	62	420
SL-101	6	160	14	3,500	130	77	85	13,000

Note: Results reported as mg/kg.
* Locations without an exceedance are not shown.



LEGEND

- Sampling Location (Borings)
- Historic Sampling Location (Borings)
- Sampling Location (Test Pits)
- SSTL Exceedance
- No Exceedance
- Storm Drain System (Approximate)
- Industrial Drain (Approximate)
- Sanitary Sewer System (Approximate) (dashed line to be verified)
- Edge of Surface Water
- Stege Marsh
- Property Boundary

NOTES :

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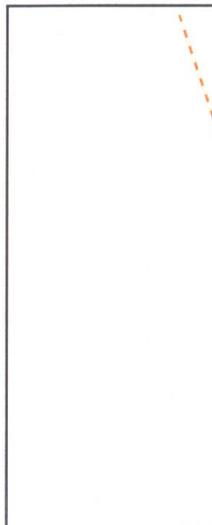
SSTL Exceedances

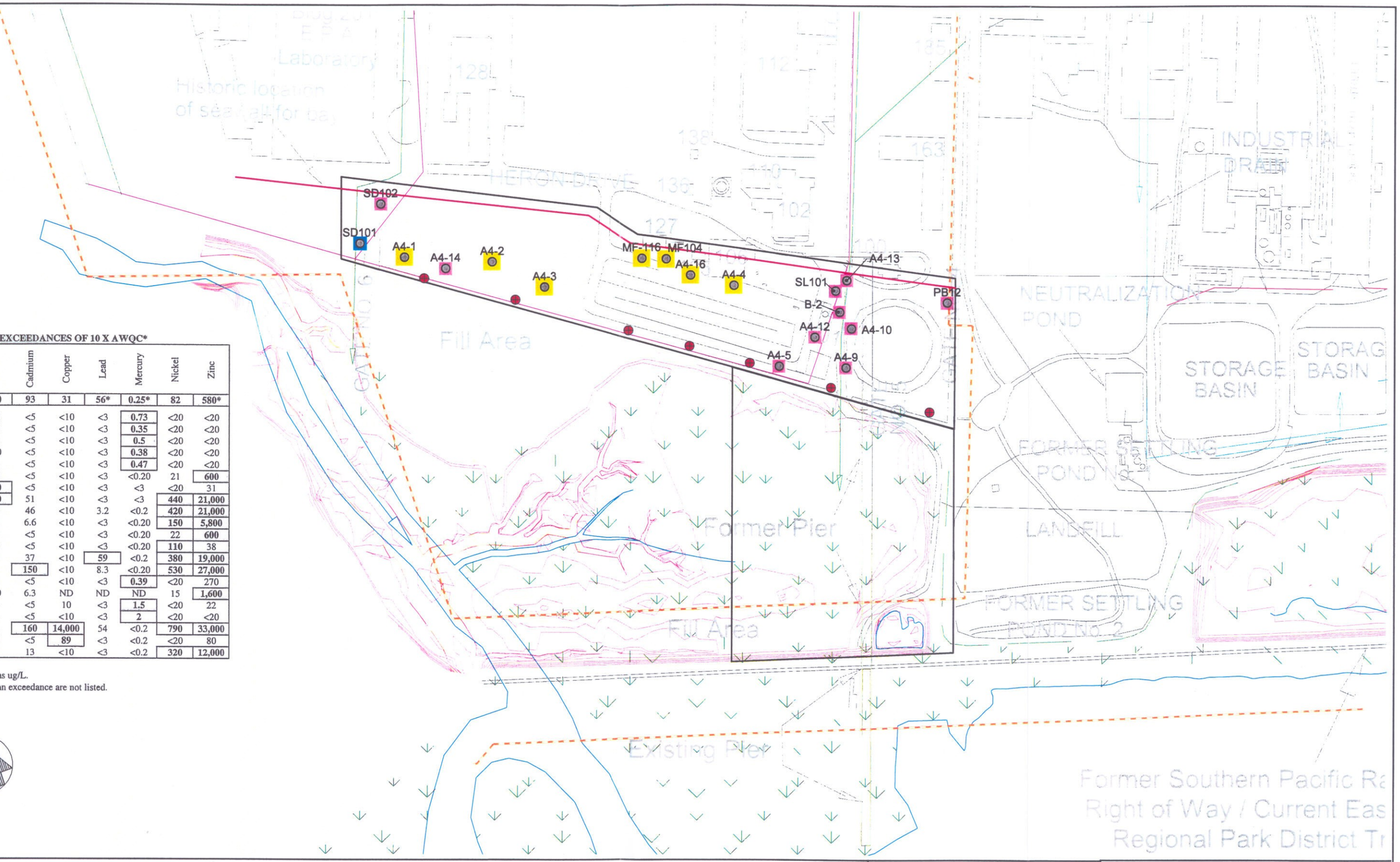
November 2001 | Scale 1" = 150' | Figure 5

EXCEEDANCES OF 10 X AWQC*

Location	Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	Zinc
10 X AWQC	**360**	**93**	**31**	**56***	**0.25***	**82**	**580***
A4-1A	6.3	<5	<10	<3	**0.73**	<20	<20
A4-2A	<5	<5	<10	<3	**0.35**	<20	<20
A4-2B	72	<5	<10	<3	**0.5**	<20	<20
A4-3B	190	<5	<10	<3	**0.38**	<20	<20
A4-4B	28	<5	<10	<3	**0.47**	<20	<20
A4-5A	16	<5	<10	<3	<0.20	21	**600**
A4-5B	**400**	<5	<10	<3	<3	<20	31
A4-9B	**370**	51	<10	<3	<3	**440**	**21,000**
A4-10B	59	46	<10	3.2	<0.2	**420**	**21,000**
A4-12A	18	6.6	<10	<3	<0.20	**150**	**5,800**
A4-13A	15	<5	<10	<3	<0.20	22	**600**
A4-13A	<5	<5	<10	<3	<0.20	**110**	38
A4-13B	25	37	<10	**59**	<0.2	**380**	**19,000**
A4-14	95	**150**	<10	8.3	<0.20	**530**	**27,000**
A4-16B	15	<5	<10	<3	**0.39**	<20	270
B-2-W	220	6.3	ND	ND	ND	15	**1,600**
MF-104	24	<5	10	<3	**1.5**	<20	22
MF116-GW	26	<5	<10	<3	**2**	<20	<20
PB-12	92	**160**	**14,000**	54	<0.2	**790**	**33,000**
SD-102-GW	<5	<5	**89**	<3	<0.2	<20	80
SL-101-GW	17	13	<10	<3	<0.2	**320**	**12,000**

Note: units reported as ug/L.
* Locations without an exceedance are not listed.





LEGEND

- Sampling Location (Borings)
- Sampling Location (Test Pits)
- Mecury exceedance
- As, Cd, Cu, Pb, Ni, Zn exceedances
- No Exceedance
- Proposed monitoring well
- Property Boundary
- Stege Marsh
- Storm Drain System (Approximate)
- Industrial Drain (Approximate)
- Sanitary Sewer System (Approximate) (dashed line to be verified)
- Edge of Surface Water

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Metals in Groundwater > 10 x AWQC

November 2001 | Scale 1" = 150' | Figure 6

APPENDIX A

Appendix A
Boring Logs

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Key to Log of Boring** Sheet 1 of 1

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
1		2	3	4	5	6	7	8

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

1 **Depth:** Distance in feet below the ground surface.

2 **Sample Interval:** Graphic depiction of field sampling depths and intervals from which laboratory samples were collected; sampler symbols are explained below.

3 **Lab ID Number:** Identification number of samples collected for possible chemical analysis.

4 **Headspace PID:** Photoionization detector (PID) reading in sample headspace, reported in parts per million vapor.

5 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

6 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

7 **Temporary Well Schematic:** Schematic of piezometer or well installation; materials are listed in header block and alongside well schematic; graphic symbols are explained below.

8 **Field Notes and Well Details:** Comments and observations regarding drilling or sampling made by driller or field personnel. Well construction materials and installation details are also listed in this column.

TYPICAL SOIL GRAPHIC SYMBOLS

SAND

SAND with SILT

SILTY SAND

CLAY, low to medium plasticity

CLAY, high plasticity

CLAYEY SAND

SILT

SILTY CLAY

CLAYEY SILT

GRAVEL

SILTY GRAVEL

Cinders

TYPICAL WELL GRAPHIC SYMBOLS

Blank casing in concrete

Blank casing in cement grout with bentonite

Blank casing in hydrated bentonite chips

Blank casing in filter sand

Slotted casing in filter sand

Native backfill / slough

TYPICAL SAMPLER GRAPHIC SYMBOLS

Recovery in geoprobe continuous core sampler

No recovery zone in geoprobe sampler

Sample retained for possible chemical testing

OTHER GRAPHIC SYMBOLS

▽ First water encountered at during drilling

▼ Water level measured at completion of drilling

▼ Water level measured after 24 hrs

--- Inferred contact due to no recovery or gradational change in lithology

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Report: ENV_3PW_SOLON_KEY; File: BERKRICH.GPJ; 11/19/2001 keywell

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring A4-1** Sheet 1 of 1

Date(s) Drilled	9/21/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	13.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 4.52 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	West end of Area 4	Borehole Completion	3/4-in.-dia. PVC temporary wells, 0.010-in.-slot screen 8-13 ft ("A") and 2-7 ft ("B"); PVC pulled after water sampling and borehole grouted to surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0		(no samples retained)			SANDY SILT [FILL], dark brown, dry, medium stiff, some gravel		Cinders at least 1 ft thick.
						Cinders		Temporary Well "B"; 3/4-in. PVC casing, 0.010-in. slotted screen 2-7 ft **Groundwater Sample A4-1B, pH=5.94**
	5					SILTY SAND [SEDIMENT], dark gray, wet, fine sand		
						CLAY, light brown, wet, stiff, some silt, little fine sand, trace to some gravel (increasing with depth)		
						GRAVELLY SAND, light brown, wet, medium to coarse sand, gravel to 2 inches dia.		Temporary Well "A"; 3/4-in. PVC casing, 0.010-in. slotted screen 8-13 ft **Groundwater Sample A4-1A, pH=7.45**
	10					SANDY CLAY, orange-brown, wet, medium stiff		
						SAND, brown, wet, coarse, some gravel to 1/2 inch dia.		
						BOTTOM OF BORING AT 13 FEET		
	15							
	20							
	25							

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-01

URS

Project: UC Berkeley Richmond Field Station
Project Location: Richmond, California
Project Number: 51-09967067.00

Log of Boring A4-2

Sheet 1 of 1

Date(s) Drilled	9/21/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	19.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Level(s)	First: None Completion: Not measured	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Area 4	Borehole Completion	3/4-in.-dia. PVC temporary wells, 0.010-in.-slot screen 9-19 ft ("A") and 2-7 ft ("B"); PVC pulled after water sampling and borehole grouted to surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					CLAY [FILL], very dark gray, dry, hard, little gravel		
						← Concrete fragment		Recovery limited by concrete piece in sampler shoe.
						← Concrete fragment		← Temporary Well "B"; 3/4-in. PVC casing, 0.010-in. slotted screen 2-7 ft **Groundwater Sample A4-2B, pH=8.0**
	5		A4-2-4'-5'			SILTY SAND [SEDIMENT + CINDERS], black, wet, very fine sand, mixed with cinders		Cinders approx. 2-1/2 ft thick (in soil mixture).
						CLAY [SEDIMENT], mottled gray and orange-brown, wet, stiff		
						← Increasing silt		
	10					← Trace gravel to 1/4 inch dia.		← Temporary Well "A"; 3/4-in. PVC casing, 0.010-in. slotted screen 9-19 ft **Groundwater Sample A4-2A, pH=7.1**
						← Decreasing silt		
						CLAYEY SAND, light brown and orange-brown, wet, fine sand		
	15							Temporary Well "A" initially screened 7-13 ft, but produced no water. Pushed deeper to find a sand lens.
						CLAYEY SILT, light brown, wet, medium stiff, minor black stringers, contains mm-size clay clasts		
	20					**BOTTOM OF BORING AT 19 FEET**		
	25							

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-02

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring A4-5** Sheet 1 of 1

Date(s) Drilled	10/10/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	18.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 6.0 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	SE corner of Rectangular Pond	Borehole Completion	3/4-in.-dia. PVC temporary wells, 0.010-in.-slot screen 13-18 ft ("A") and 3-13 ft ("B"); PVC pulled after water sampling and borehole grouted to surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					SILTY GRAVEL [FILL], tan, dry, gravel to 1/2 inch dia., plant material		
						SILTY CLAY [FILL], reddish brown, moist, some fine angular gravel		
	5					Cinders		Temporary Well "B"; 3/4-in. PVC casing, 0.010-in. slotted screen 3-13 ft **Groundwater Sample A4-5B, pH=6.5**
			A4-5-7'-7.5'			SAND [SEDIMENT + CINDERS], maroon and black, wet, fine; interlaminated cinders and fine sediment		Cinders sample at 7-7.5 ft. Cinders approx. 4-1/2 ft thick.
	10		A4-5-10'-10.5'			CLAY [SEDIMENT], reddish brown and gray, wet, stiff, trace gravel		
						SANDY CLAY, light brown, wet, soft, fine sand		
						CLAYEY SAND, light brown, wet, some gravel to 3/4 inch dia.		
						[Boring was terminated at 13 feet. Temporary Well "A" was installed in adjacent borehole, which was advanced to 18 feet without sampling.]		
	15							Temporary Well "A"; 3/4-in. PVC casing, 0.010-in. slotted screen 13-18 ft **Groundwater Sample A4-5A, pH=6.5**
						BOTTOM OF BORING AT 18 FEET		
	20							
	25							

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-05

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring A4-6** Sheet 1 of 1

Date(s) Drilled	10/12/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	13.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 6.32 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	NW corner of Upland Subarea 2A	Borehole Completion	3/4-in.-dia. PVC temporary well, 0.010-in.-slot screen 13-18 ft; PVC pulled after water sampling and borehole grouted to surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					SILTY CLAY [FILL], brown, dry, little gravel to 1/4 inch dia., 1/4-inch white concretions		
						Becomes darker brown		Temporary Well, 3/4-in. PVC casing, 0.010-in. slotted screen 3-13 ft **Groundwater Sample A4-6, pH=7.5**
						Cinders		
	5					SAND, grayish brown, dry, loose, fine		
			A4-6-5.5'-6'			Cinders		Cinders sample at 5.5-6 ft. Two cinder layers, each approx. 1/2 ft thick.
						CLAY [SEDIMENT], mottled gray and reddish brown, moist, stiff, high plasticity, black particles		
			A4-6-7'-7.5'					
	10					SILTY CLAY, grayish brown, moist, medium plasticity, trace coarse sand		
						Becomes wet, with interbedded coarse sand with some gravel		
						BOTTOM OF BORING AT 13 FEET		
	15							
	20							
	25							

Report: ENV_3PS\W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-06

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring A4-7** Sheet 1 of 1

Date(s) Drilled	10/12/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	12.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: 5.2 ft Completion: 5.77 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	NW of Rectangular Pond	Borehole Completion	3/4-in.-dia. PVC temporary well, 0.010-in.-slot screen 0-7 ft; PVC pulled after water sampling and borehole grouted to surface		

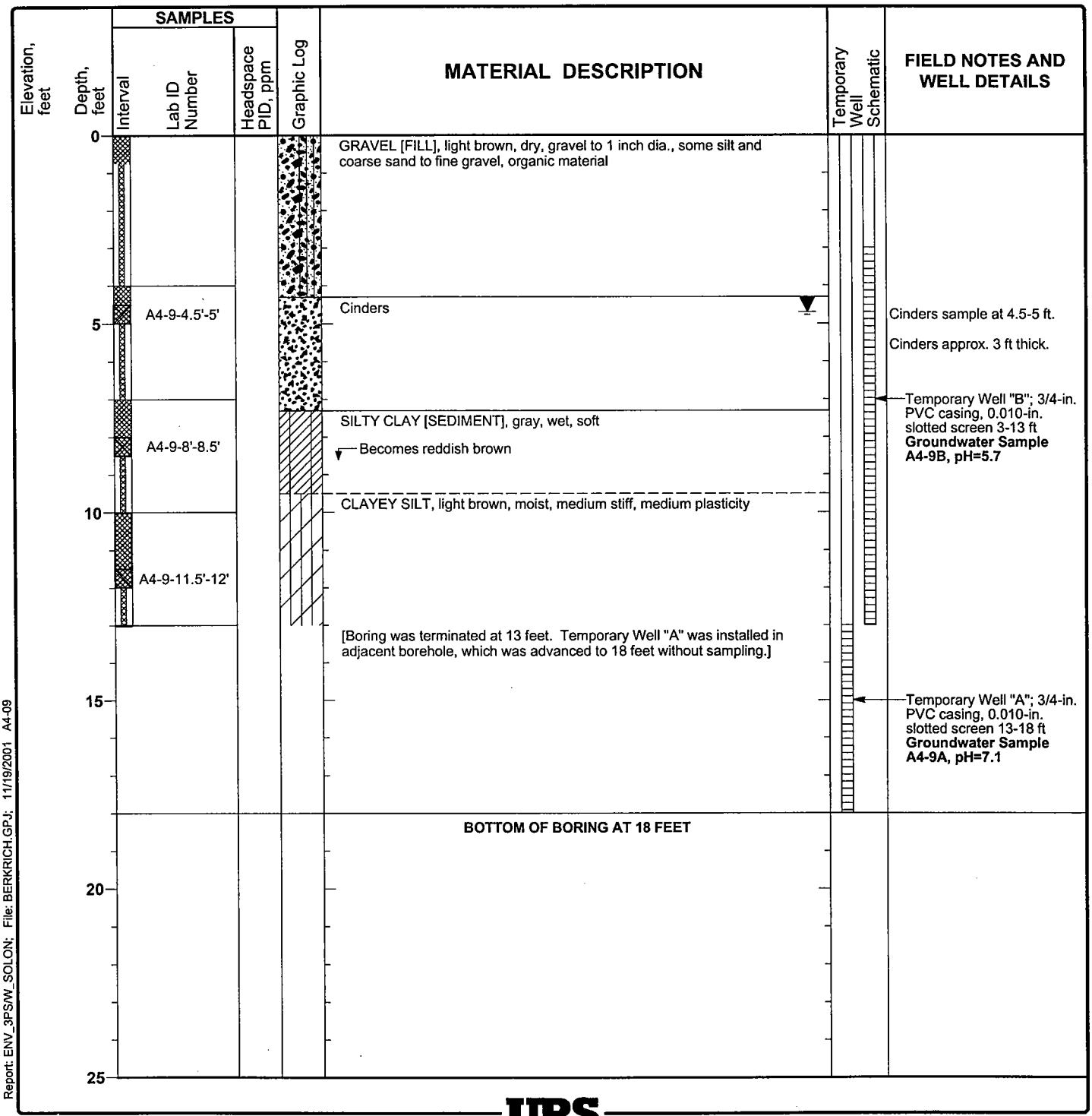
Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					SILTY CLAY [FILL], dark brown, dry, little angular gravel to 1-1/2 inches dia., friable		
						SILT [FILL], very dark brown, dry, little gravel to 1/4 inch dia.		Temporary Well, 3/4-in. PVC casing, 0.010-in. slotted screen 0-7 ft **Groundwater Sample A4-7, pH=6.9**
	5		A4-7-5.5'-6'			Cinders ▽ ▼		Cinders approx. 3-1/2 ft thick.
						SANDY CLAY [SEDIMENT], mottled gray and brown, wet, some rounded gravel to 3/4 inch dia.		Hole collapsed to 7 ft.
	10		A4-7-9.5'-9.8'					Sampler advanced from 10-12 ft returned slough.
						BOTTOM OF BORING AT 12 FEET		
	15							
	20							
	25							

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-07

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring A4-9** Sheet 1 of 1

Date(s) Drilled	10/10/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	18.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 4.70 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	SW edge of Round Pond	Borehole Completion	3/4-in.-dia. PVC temporary wells, 0.010-in.-slot screen 13-18 ft ("A") and 3-13 ft ("B"); PVC pulled after water sampling and borehole grouted to surface		



Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-09

URS

Project: UC Berkeley Richmond Field Station
Project Location: Richmond, California
Project Number: 51-09967067.00

Log of Boring A4-10

Sheet 1 of 1

Date(s) Drilled	10/10/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	12.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 5.40 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	West edge of Round Pond	Borehole Completion	3/4-in.-dia. PVC temporary well, 0.010-in.-slot screen 2-12 ft; PVC pulled after water sampling and borehole grouted to surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					GRAVELLY SILT [FILL], orange, dry, gravel to 1/4 inch dia.		
						Cinders		Cinders approx. 6-1/2 ft thick.
	5		A4-10-4.5'-5'					Temporary Well, 3/4-in. PVC casing, 0.010-in. slotted screen 2-12 ft **Groundwater Sample A4-10, pH=5.1**
						CLAY [SEDIMENT], mottled gray and reddish brown, moist, medium plasticity, some silt		
	10		A4-10-10'-10.5'			SILTY CLAY, mottled gray and reddish brown, moist, low plasticity		
						BOTTOM OF BORING AT 12 FEET		
	15							
	20							
	25							

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-10

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Abandoned Boring A4-10** Sheet 1 of 1

Date(s) Drilled	10/9/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	7.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: None	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	West edge of Round Pond	Borehole Completion	Backfilled with grout to ground surface; moved location 5 ft to redrill		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
	0					FILL	
						← Concrete storm drain encountered	
						GRAVELLY SILT [FILL]	
	5					Cinders	
			A4-10-5.5'-6'			[No recovery in last foot; thickness of cinders unknown]	
						BOTTOM OF BORING AT 7 FEET	Stopped at 7 ft; rods bent and sampler would not drop down. Abandon borehole; move approx. 5 ft to redrill.
	10						
	15						
	20						
	25						

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-10A

URS

Project: UC Berkeley Richmond Field Station
Project Location: Richmond, California
Project Number: 51-09967067.00

Log of Boring A4-12

Sheet 1 of 1

Date(s) Drilled	10/10/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	17.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 5.92 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	West edge of Round Pond	Borehole Completion	3/4-in.-dia. PVC temporary wells, 0.010-in.-slot screen 12-17 ft ("A") and 2-12 ft ("B"); PVC pulled after water sampling and borehole grouted to surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					GRAVELLY SILT [FILL], light brown, dry, angular gravel to 3/4 inch dia.		
						[Poor recovery to 7 feet; some silt at 4 feet]		Temporary Well "B"; 3/4-in. PVC casing, 0.010-in. slotted screen 2-12 ft **Groundwater Sample A4-12B, pH=6.0**
	5							
			A4-12-7.5'-8'			Cinders		Cinders sample at 7.5-8 ft. Cinders approx. 1 ft thick.
						CLAYEY SAND [SEDIMENT], greenish gray, wet, fine sand, some gravel to 1/2 inch dia.		
	10		A4-12-10'-10.5'					
						[Boring was terminated at 12 feet. Temporary Well "A" was installed in adjacent borehole, which was advanced to 17 feet without sampling.]		Temporary Well "A"; 3/4-in. PVC casing, 0.010-in. slotted screen 12-17 ft **Groundwater Sample A4-12A, pH=6.3**
	15							
						BOTTOM OF BORING AT 17 FEET		
	20							
	25							

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-12

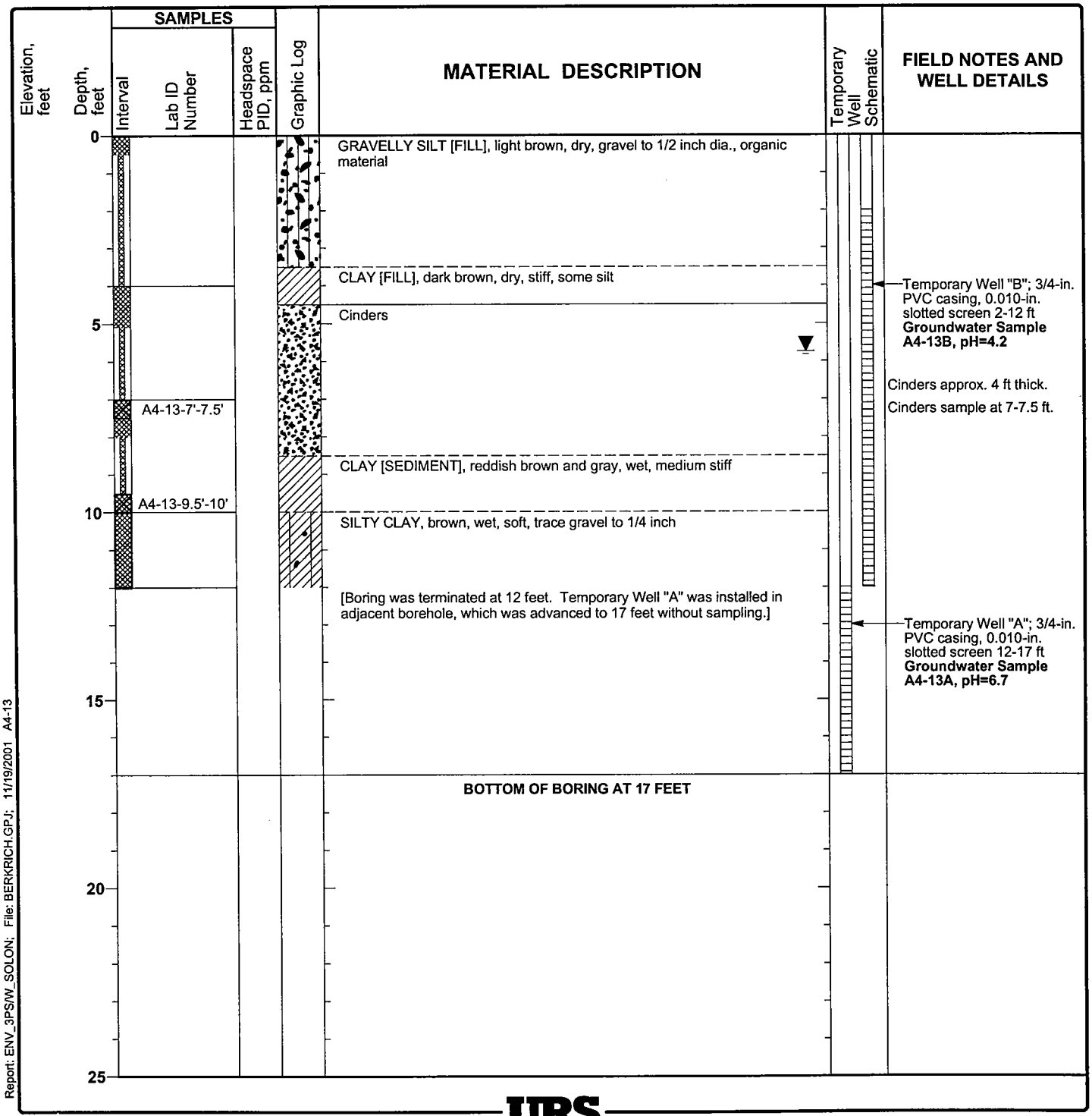
URS

Project: UC Berkeley Richmond Field Station
Project Location: Richmond, California
Project Number: 51-09967067.00

Log of Boring A4-13

Sheet 1 of 1

Date(s) Drilled	10/10/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	17.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 5.75 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	West of Building 100	Borehole Completion	3/4-in.-dia. PVC temporary wells, 0.010-in.-slot screen 12-17 ft ("A") and 2-12 ft ("B"); PVC pulled after water sampling and borehole grouted to surface		



Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-13

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring A4-14** Sheet 1 of 1

Date(s) Drilled	10/12/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	10.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: 2.5 ft Completion: 8.65 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	West end of Upland Subunit 2A	Borehole Completion	3/4-in.-dia. PVC temporary well, 0.010-in.-slot screen 0-10 ft; PVC pulled after water sampling and borehole grouted to surface		

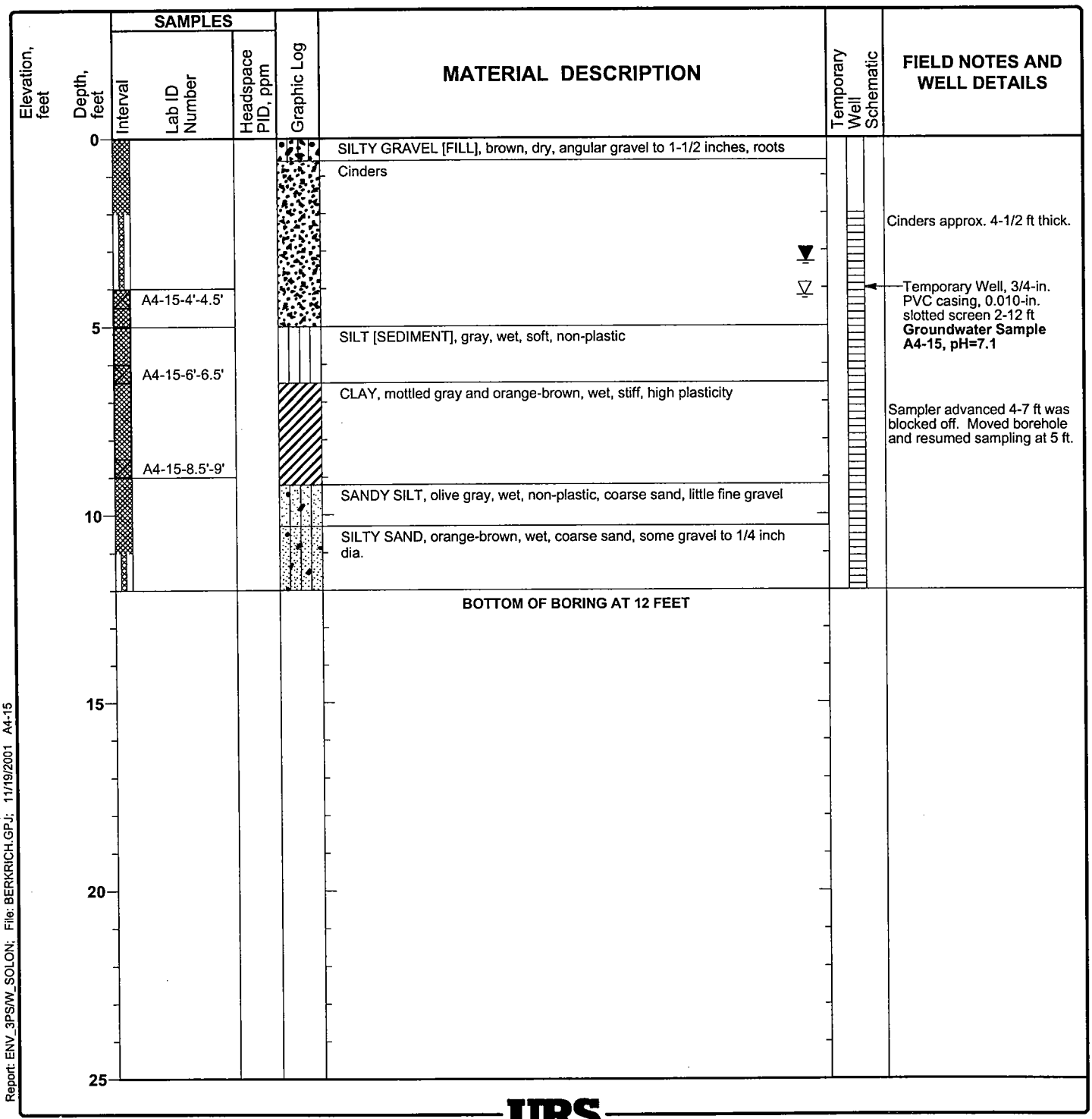
Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					SILTY GRAVEL [FILL], gray and tan, dry, angular gravel to 1/2 inch dia.		
						Cinders ▽		← Temporary Well, 3/4-in. PVC casing, 0.010-in. slotted screen 0-10 ft **Groundwater Sample A4-14, pH=6.1**
	5		A4-14-4.5'-5'			CLAY [SEDIMENT], olive gray, moist, stiff, iron oxide particles		Cinders approx. 3-1/2 ft thick.
			A4-14-7'-7.5'			← Trace angular gravel to 1/2 inch dia. ▼		
	10					← Becomes orange-brown, medium stiff, with trace coarse sand **BOTTOM OF BORING AT 10 FEET**		
	15							
	20							
	25							

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-14

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring A4-15** Sheet 1 of 1

Date(s) Drilled	10/12/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	12.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: 4.2 ft Completion: 3.30 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Not recorded	Borehole Completion	3/4-in.-dia. PVC temporary well, 0.010-in.-slot screen 2-12 ft; PVC pulled after water sampling and borehole grouted to surface		



Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-15

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring A4-16** Sheet 1 of 1

Date(s) Drilled	10/12/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	13.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: 5.5 ft Completion: None	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Mercury Fulminate Area	Borehole Completion	3/4-in.-dia. PVC temporary well, 0.010-in.-slot screen 0-9 ft; PVC pulled after water sampling and borehole grouted to surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					GRAVELLY CLAY [FILL], brown, dry, angular gravel, plant material		
						Becomes dark gray		
						Becomes orange		Temporary Well, 3/4-in. PVC casing, 0.010-in. slotted screen 0-9 ft **Groundwater Sample A4-16, pH=6.8**
	5		A4-16-5.5'-6'			Cinders		Cinders approx. 6 ft thick.
	10		A4-16-11.5'-12'			SAND [SEDIMENT], gray, wet, coarse, little gravel to 1/4 inch dia.		Hole collapsed to 9 ft.
						GRAVELLY SILT, light brown, wet, gravel to 1/2 inch dia., little clay		
						BOTTOM OF BORING AT 13 FEET		
	15							
	20							
	25							

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-16

URS

Project: UC Berkeley Richmond Field Station
Project Location: Richmond, California
Project Number: 51-09967067.00

Log of Boring A4-17

Sheet 1 of 1

Date(s) Drilled	10/10/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	12.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 5.76 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	East of Building 106	Borehole Completion	3/4-in.-dia. PVC temporary well, 0.010-in.-slot screen 2-12 ft; PVC pulled after water sampling and borehole grouted to surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	Temporary Well Schematic	FIELD NOTES AND WELL DETAILS
	0					SILTY GRAVEL [FILL], gray, dry, angular gravel to 1/4 inch dia.		
						Cinders		Temporary Well, 3/4-in. PVC casing, 0.010-in. slotted screen 2-12 ft **Groundwater Sample A4-17, pH=6.1**
	5							Cinders at least 4 ft thick.
			A4-17-7'-7.5'			CLAYEY SAND [SEDIMENT], gray, wet, fine sand, some gravel to 1/2 inch dia.		
	10		A4-17-10'-10.5'					
						BOTTOM OF BORING AT 12 FEET		
	15							
	20							
	25							

URS

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 A4-17

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring MF114** Sheet 1 of 1

Date(s) Drilled	6/28/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	20.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	8.89 feet MSL
Groundwater Levels(s)	First: 4.0 ft Completion: 5.3 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Mercury Fulminate Area	Borehole Completion	Backfilled with grout to ground surface		

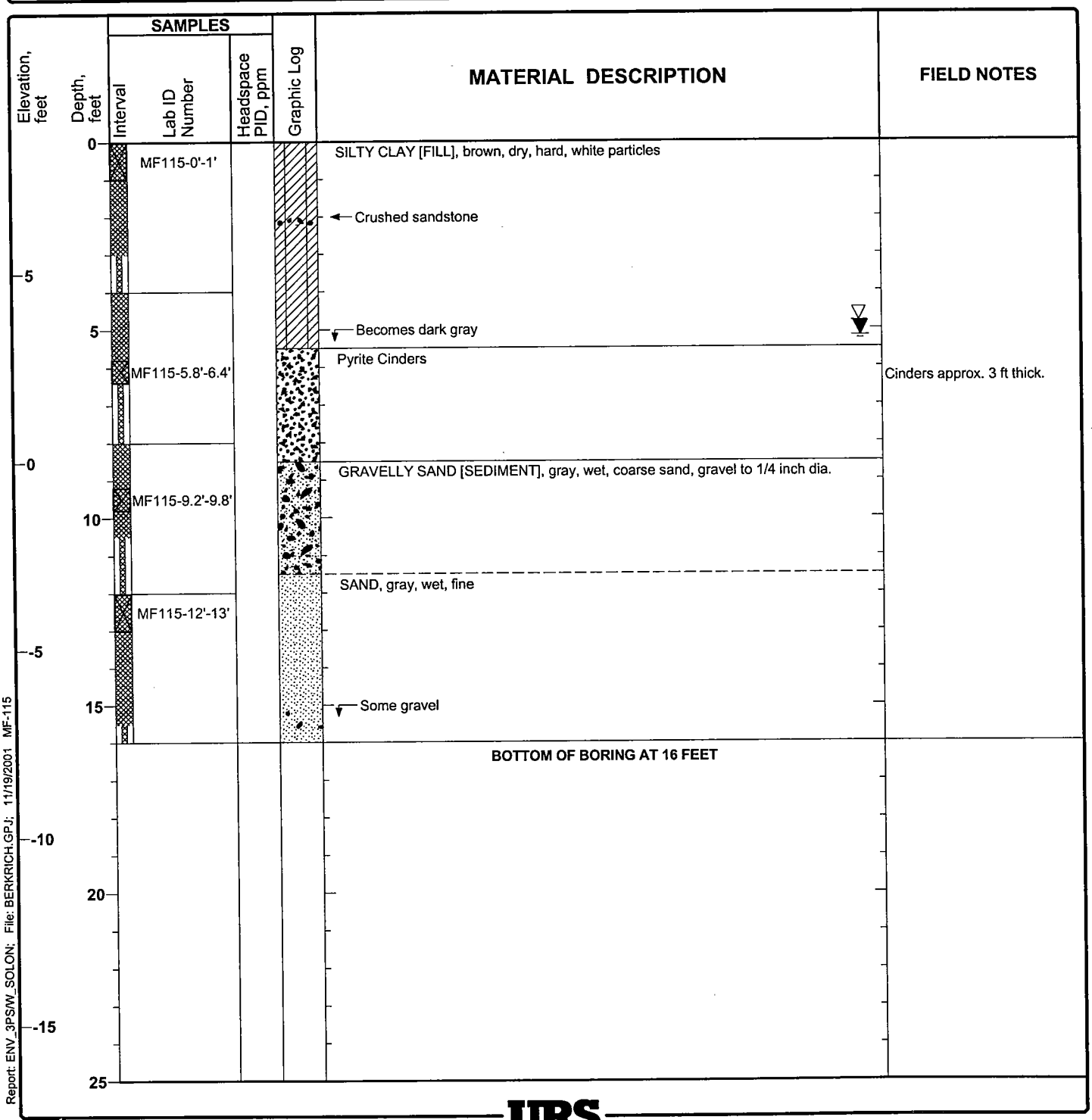
Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
	0		MF114-0'-1'			SILTY CLAY [FILL], brown, dry, hard, little gravel, white particles	
5							
	5					Pyrite Cinders	Cinders approx. 5 ft thick.
0						SILT to SAND [SEDIMENT], brown, wet, fine grains	
	10		MF114-9.5'-10'			GRAVELLY SAND, brown, wet, angular gravel to 1/2 inch dia., some silt and clay	
						Sand becomes coarse, with little gravel	Pyrite cinders on inside surface of core tube.
			MF114-13'-13.5'			CLAY, brownish gray, wet, soft, trace sand 1-inch gravel	
-5	15						
-10	20					BOTTOM OF BORING AT 20 FEET	
-15	25						

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 MF-114

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring MF115** Sheet 1 of 1

Date(s) Drilled	6/28/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	16.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	8.52 feet MSL
Groundwater Levels(s)	First: 4.8 ft Completion: 5.2 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Mercury Fulminate Area	Borehole Completion	Backfilled with grout to ground surface		



Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 MF-115

URS

Project: UC Berkeley Richmond Field Station
Project Location: Richmond, California
Project Number: 51-09967067.00

Log of Boring MF116

Sheet 1 of 1

Date(s) Drilled	6/28/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	16.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	8.71 feet MSL
Groundwater Levels(s)	First: None Completion: 5.4 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Mercury Fulminate Area	Borehole Completion	Backfilled with grout to ground surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
	0					SILTY GRAVEL [FILL], brown, dry, gravel to 1 inch dia.	
						SILTY CLAY [FILL], orange-brown, dry, stiff	
5							
	5					Pyrite Cinders	Cinders approx. 3-1/2 ft thick.
0							
	10		MF116-9.5'-10.2			SAND [SEDIMENT], gray and brown, wet, fine	
			MF116-12'-13'			GRAVEL, very dark gray, wet, medium rounded gravel, little sand	
-5							
	15					SAND, gray, wet, fine	
						BOTTOM OF BORING AT 16 FEET	
-10							
	20						
-15							
	25						

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 MF-116

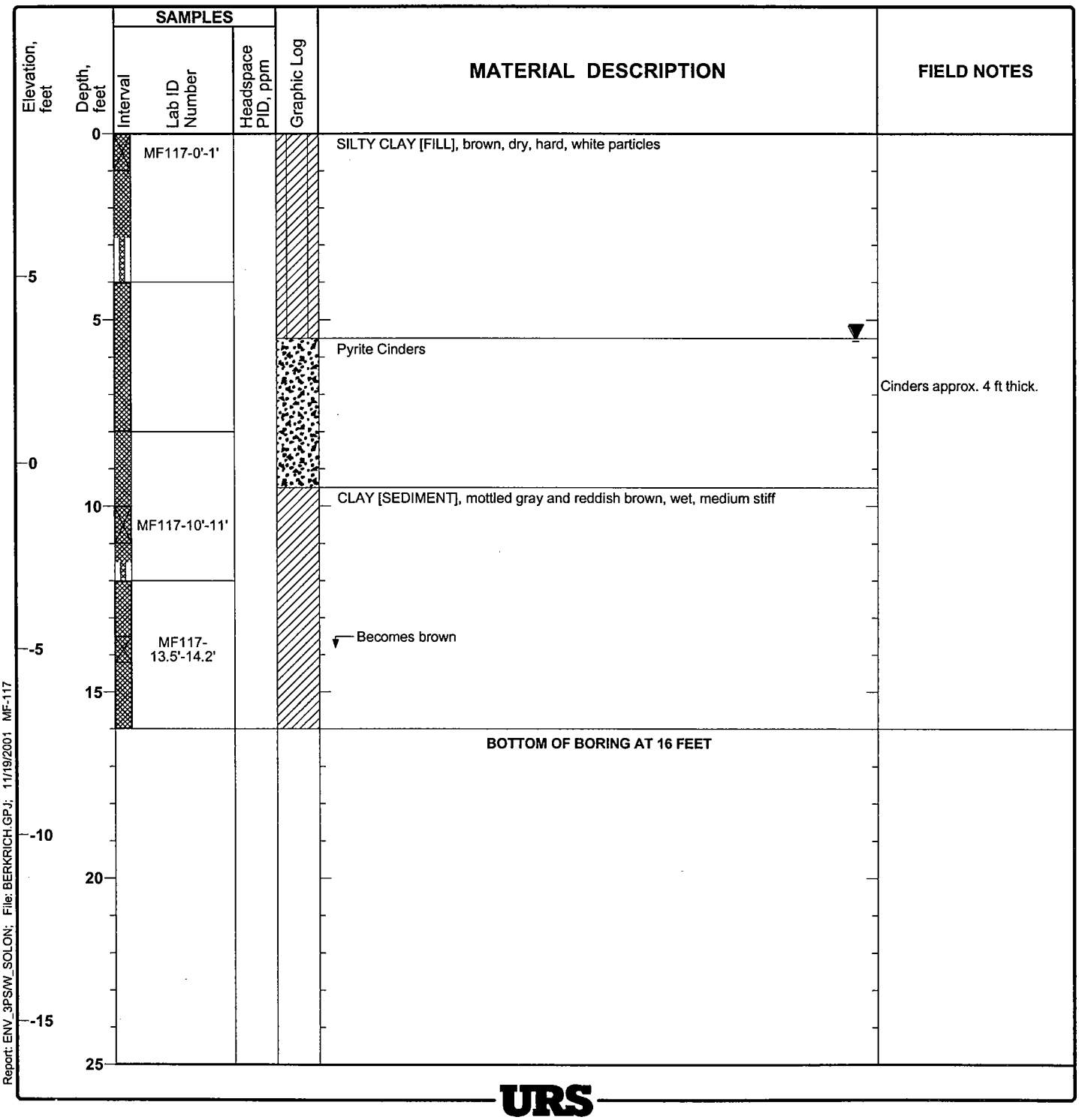
URS

Project: UC Berkeley Richmond Field Station
Project Location: Richmond, California
Project Number: 51-09967067.00

Log of Boring MF117

Sheet 1 of 1

Date(s) Drilled	6/28/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	16.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	8.84 feet MSL
Groundwater Levels(s)	First: 5.5 ft Completion: 5.5 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Mercury Fulminate Area, near PH6	Borehole Completion	Backfilled with grout to ground surface		



Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 MF-117

URS

Project: UC Berkeley Richmond Field Station Project Location: Richmond, California Project Number: 51-09967067.00	**Log of Boring MF118** Sheet 1 of 1

Date(s) Drilled	6/28/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	16.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	8.85 feet MSL
Groundwater Levels(s)	First: None Completion: 5.6 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Mercury Fulminate Area	Borehole Completion	Backfilled with grout to ground surface		

Elevation, feet	Depth, feet	SAMPLES: Interval	SAMPLES: Lab ID Number	SAMPLES: Headspace PID, ppm	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
	0		MF118-0'-1'			SILTY CLAY [FILL], brown, dry, hard, orange and white particles	
5							
	5					Pyrite Cinders	Cinders and/or cinders and soil approx. 4 ft thick.
			MF118-6'-6.8'			SILT [SEDIMENT + CINDERS], very dark gray to black, wet, soft, some very soft cinders	
0							
	10		MF118-10'-10.5'			CLAYEY SAND, light brown, wet, some coarse sand and gravel	
-5							
	15					CLAY, brown, wet, medium stiff	
						BOTTOM OF BORING AT 16 FEET	
-10							
	20						
-15							
	25						

Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 MF-118

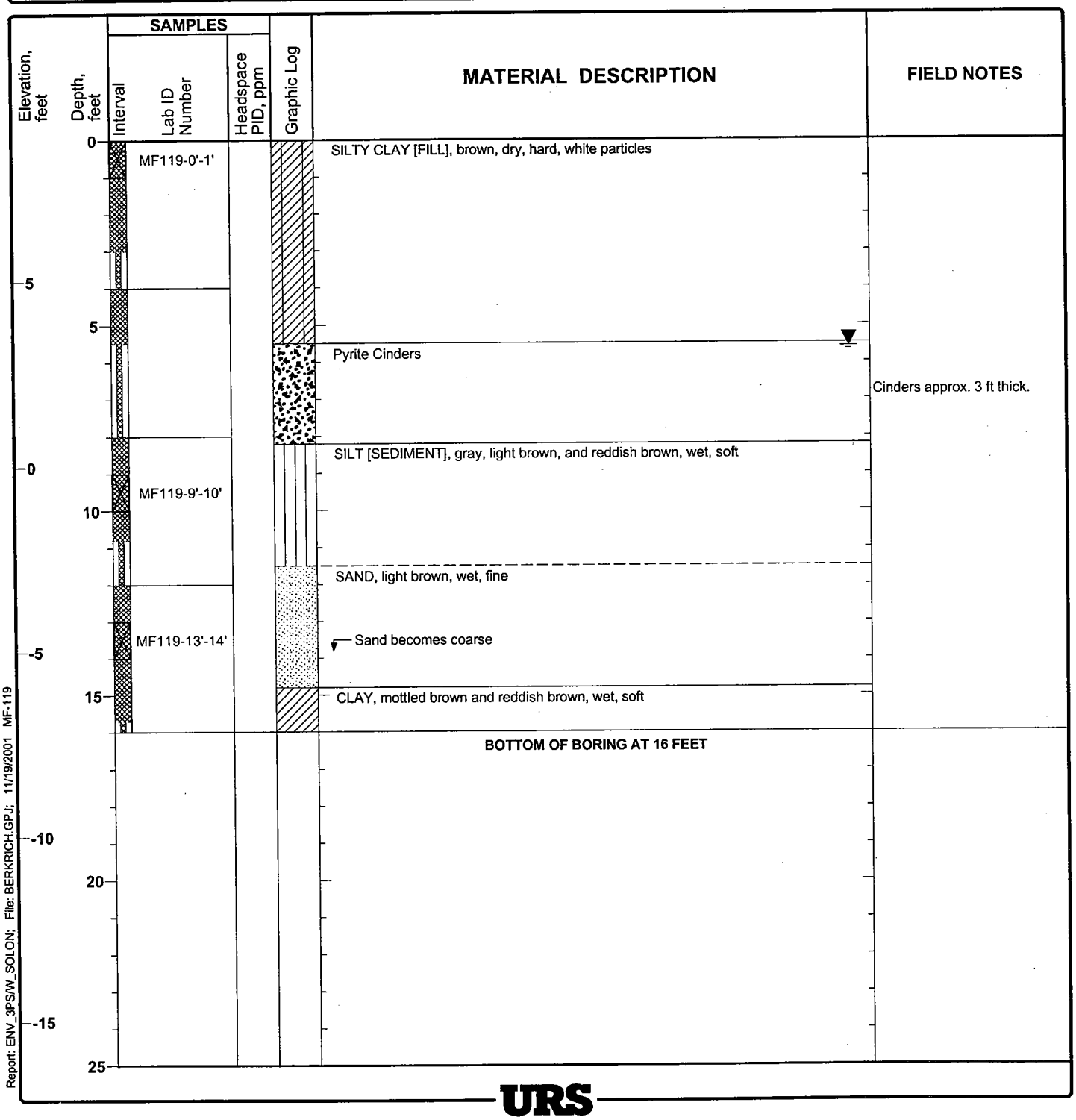
URS

Project: UC Berkeley Richmond Field Station
Project Location: Richmond, California
Project Number: 51-09967067.00

Log of Boring MF119

Sheet 1 of 1

Date(s) Drilled	6/28/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	16.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	8.82 feet MSL
Groundwater Levels(s)	First: None Completion: 5.6 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	Mercury Fulminate Area	Borehole Completion	Backfilled with grout to ground surface		

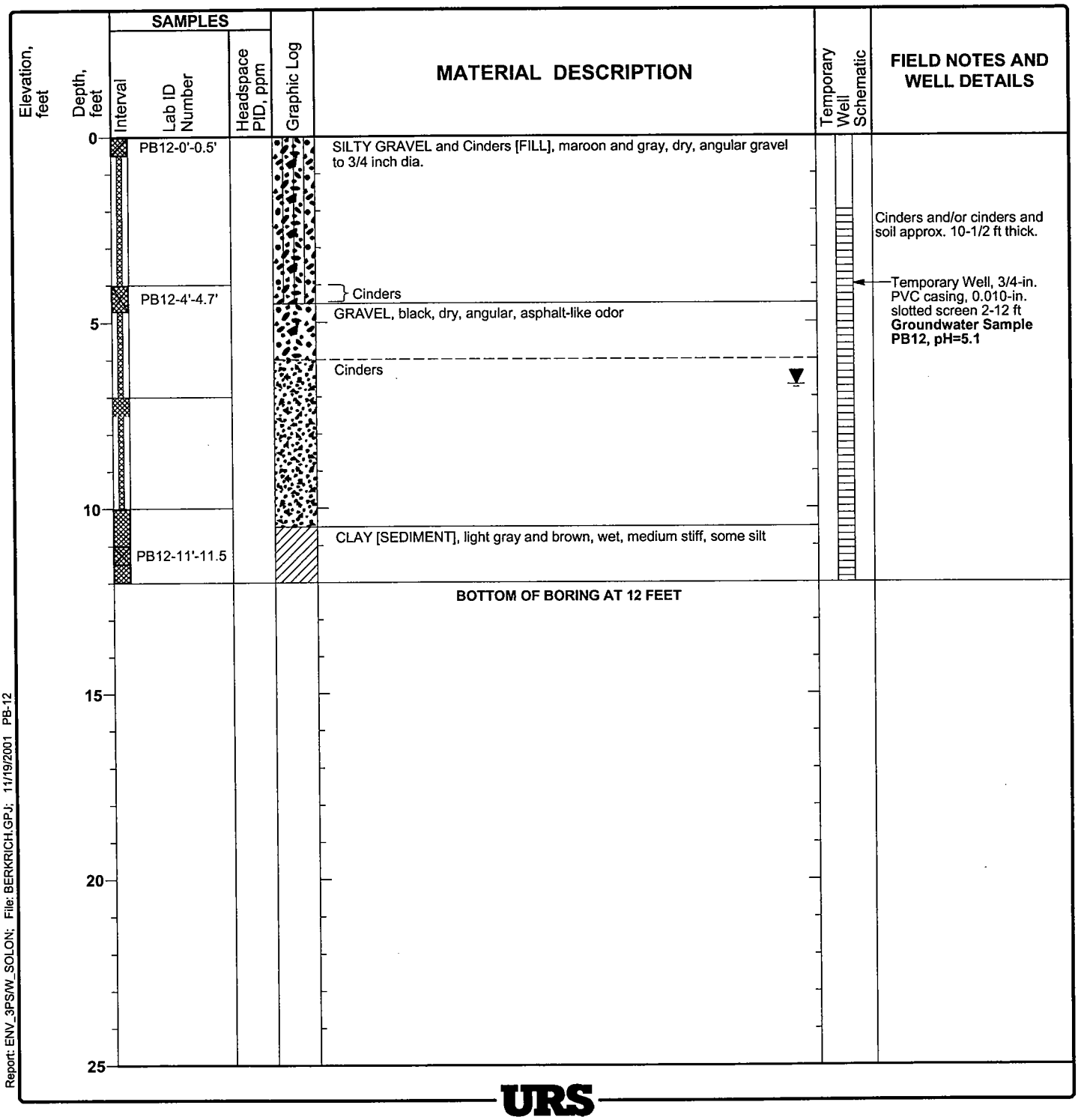


Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 MF-119

URS

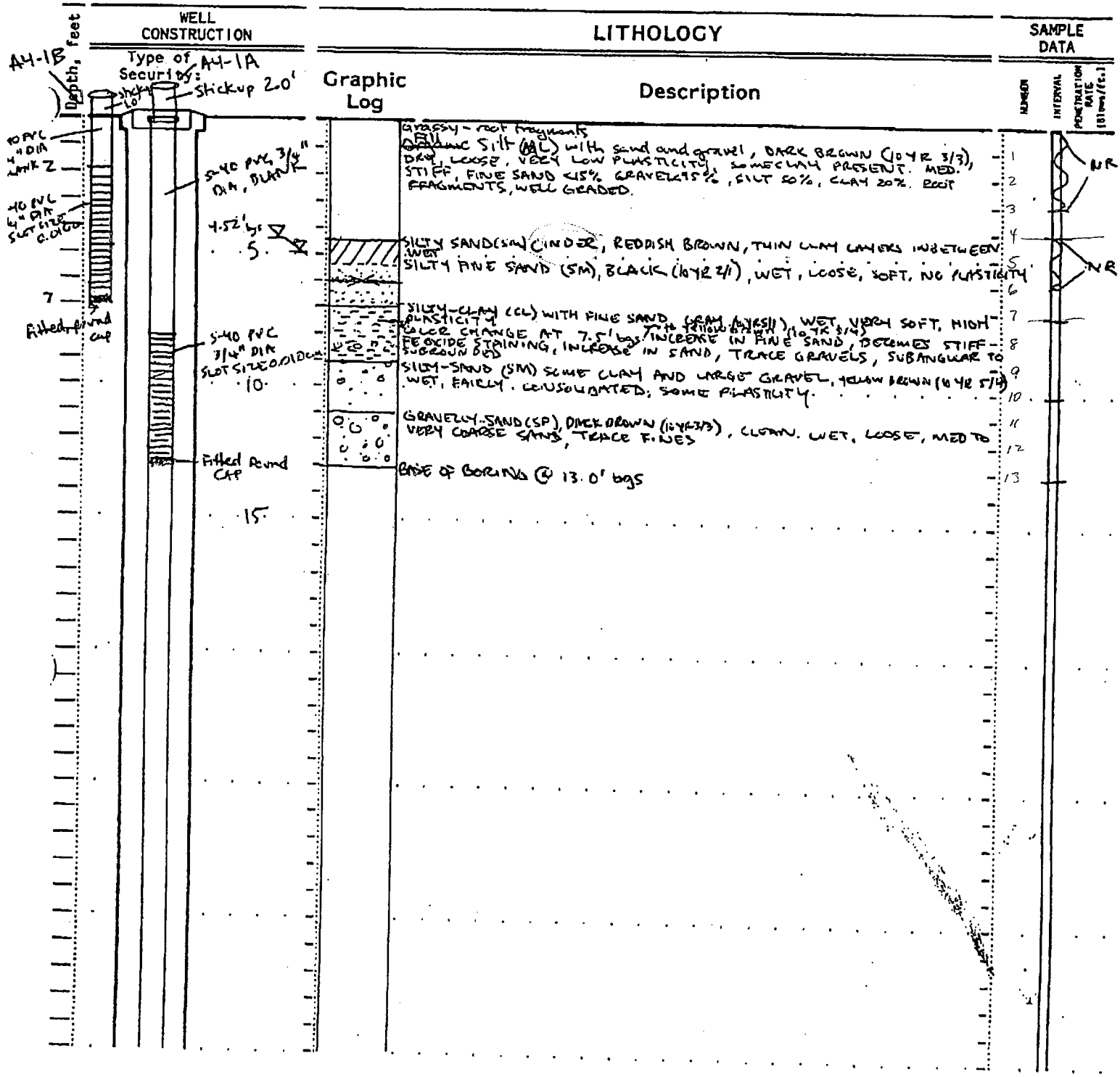
Project: UC Berkeley Richmond Field Station **Project Location:** Richmond, California **Project Number:** 51-09967067.00	**Log of Boring PB12** Sheet 1 of 1

Date(s) Drilled	10/10/01	Logged By	B. Copeland	Checked By	J. Durkin
Drilling Method	Direct Push	Drill Bit Size/Type	2-inch-OD drive point	Total Depth of Borehole	12.0 feet
Drill Rig Type	Geoprobe	Drilling Contractor	Precision Drilling	Surface Elevation	Not available
Groundwater Levels(s)	First: None Completion: 6.7 ft bgs	Sampling Method(s)	4-foot dual tube Geoprobe sampler with acetate liner		
Location	NE of Round Pond	Borehole Completion	3/4-in.-dia. PVC temporary well, 0.010-in.-slot screen 2-12 ft; PVC pulled after water sampling and borehole grouted to surface		



Report: ENV_3PS/W_SOLON; File: BERKRICH.GPJ; 11/19/2001 PB-12

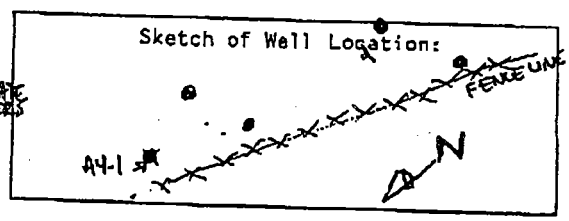
URS



Well Permit No.:
Date well drilled: 9/21/01
Date water level measured: 9/21/01 4.52' bgs
Well elevation:

Drilling Company: PRECISION
Driller: EUGENE
Sampling Method: DNAL TUBE/ACETATE LINERS
Hammer Weight: AUTO

Sketch of Well Location:

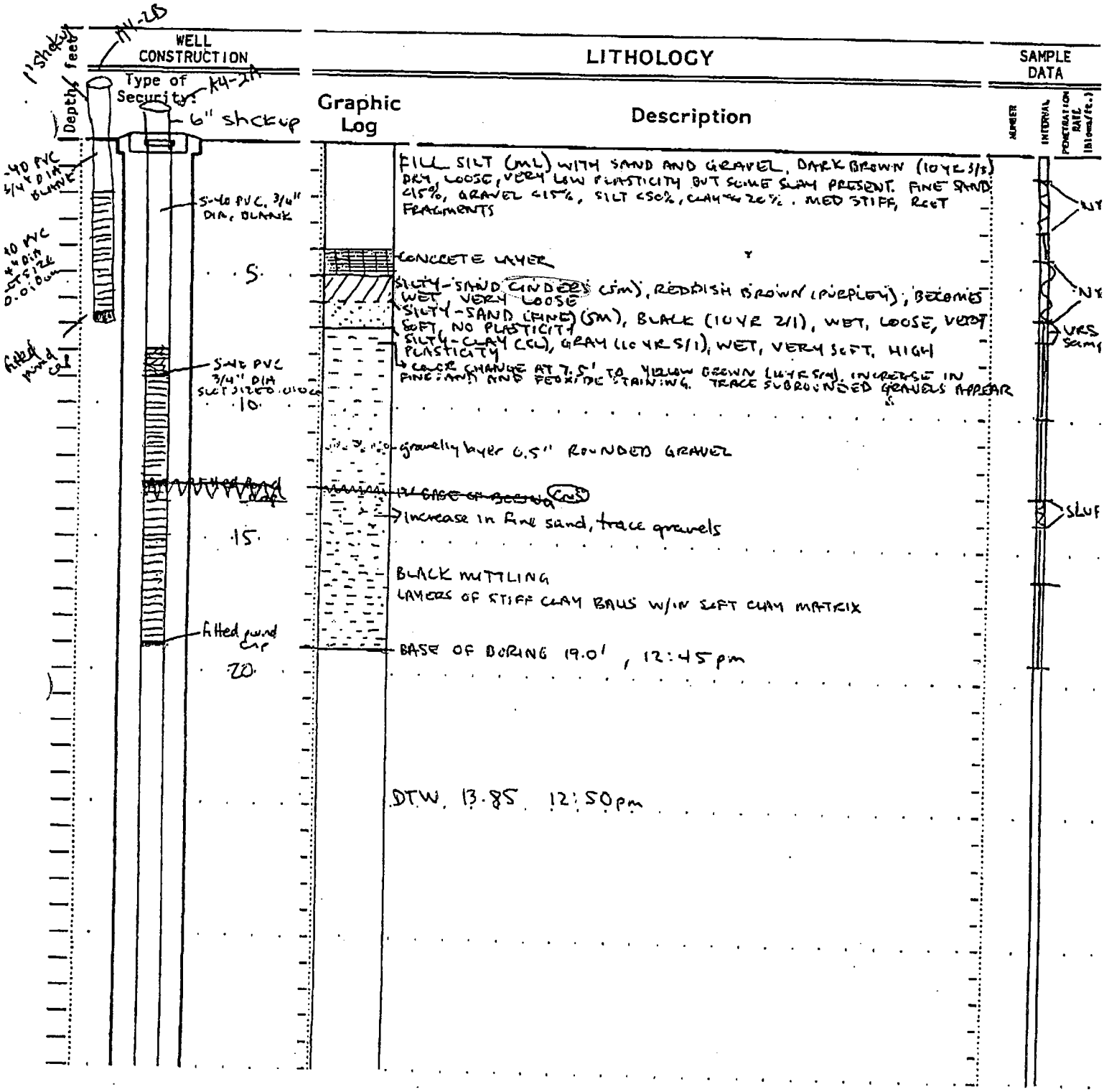


LF Geologist/Engineer: CHRISTY SWINDLING

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-1A

Project No. 7545.00

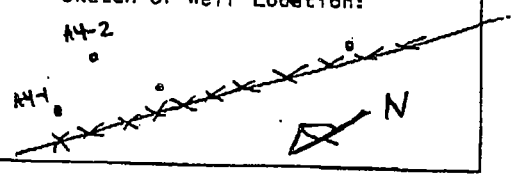
LEVINE-FRICKE
CONSULTING ENGINEERS AND HYDROGEOLOGISTS



Well Permit No.:
Date well drilled: 9/21/01
Date water level measured: 9/21/01 13.85
Well elevation:

Drilling Company: PRECISION
Driller: EUGENE
Sampling Method: MAL TUBE/METAL LINERS
Hammer Weight: AUTO

Sketch of Well Location:



LF Geologist/Engineer: CHRISTY SWINDLING

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-2A

Project No. 7545.00

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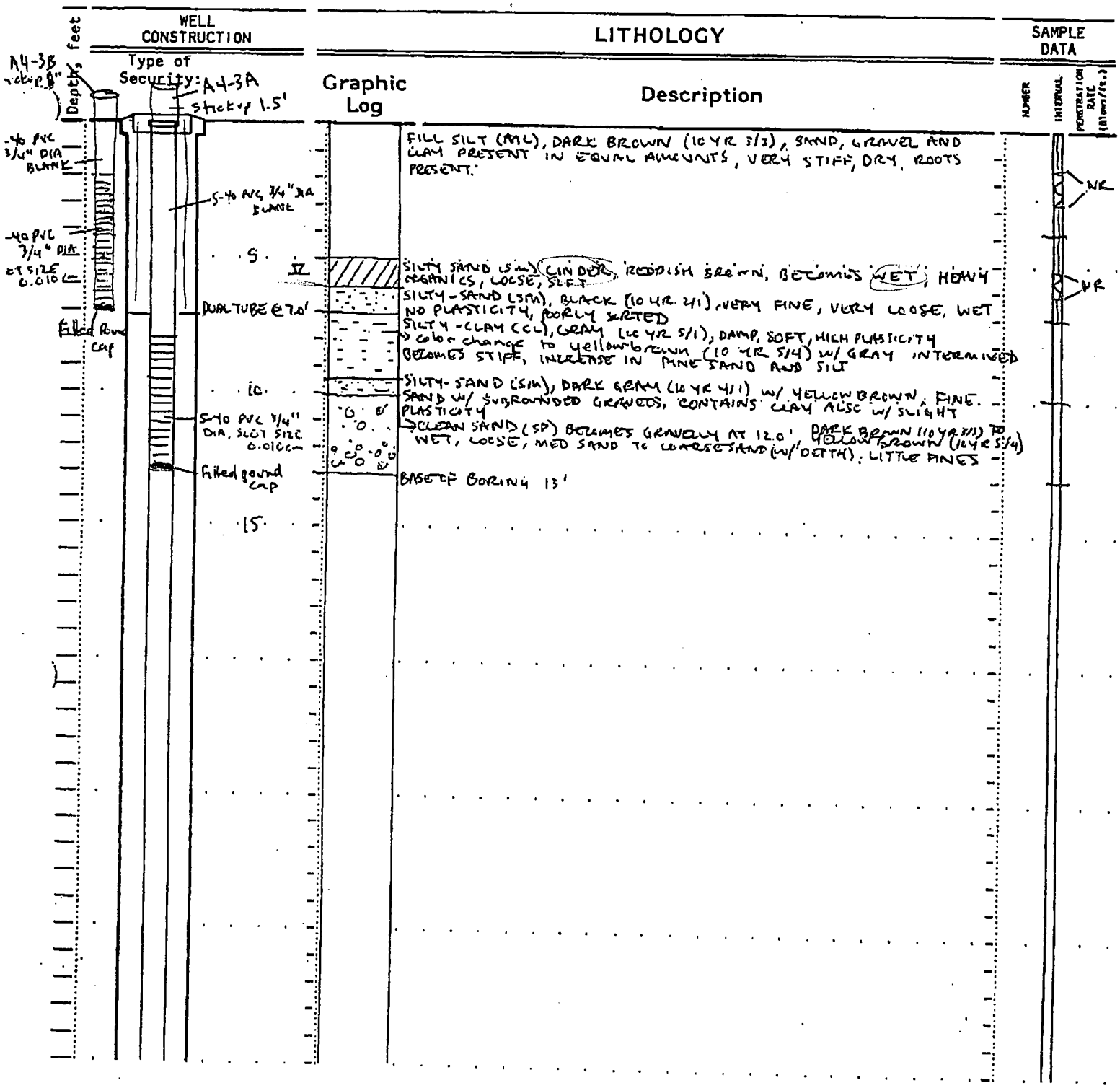
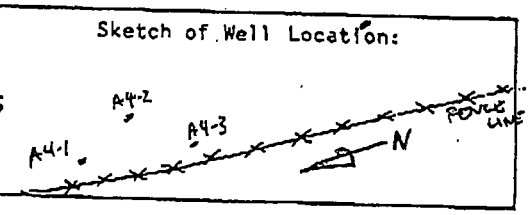


Well Permit No.:
Date well drilled: 9/24/01
Date water level measured:
Well elevation:

Drilling Company: PRECISION
Driller: EUGENE
Sampling Method: DUAL TUBE/ACETATE LINERS
Hammer Weight: MTD

Sketch of Well Location:



LF Geologist/Engineer: CHRISTY SWINDLING

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-3A

Project No. 7545.00

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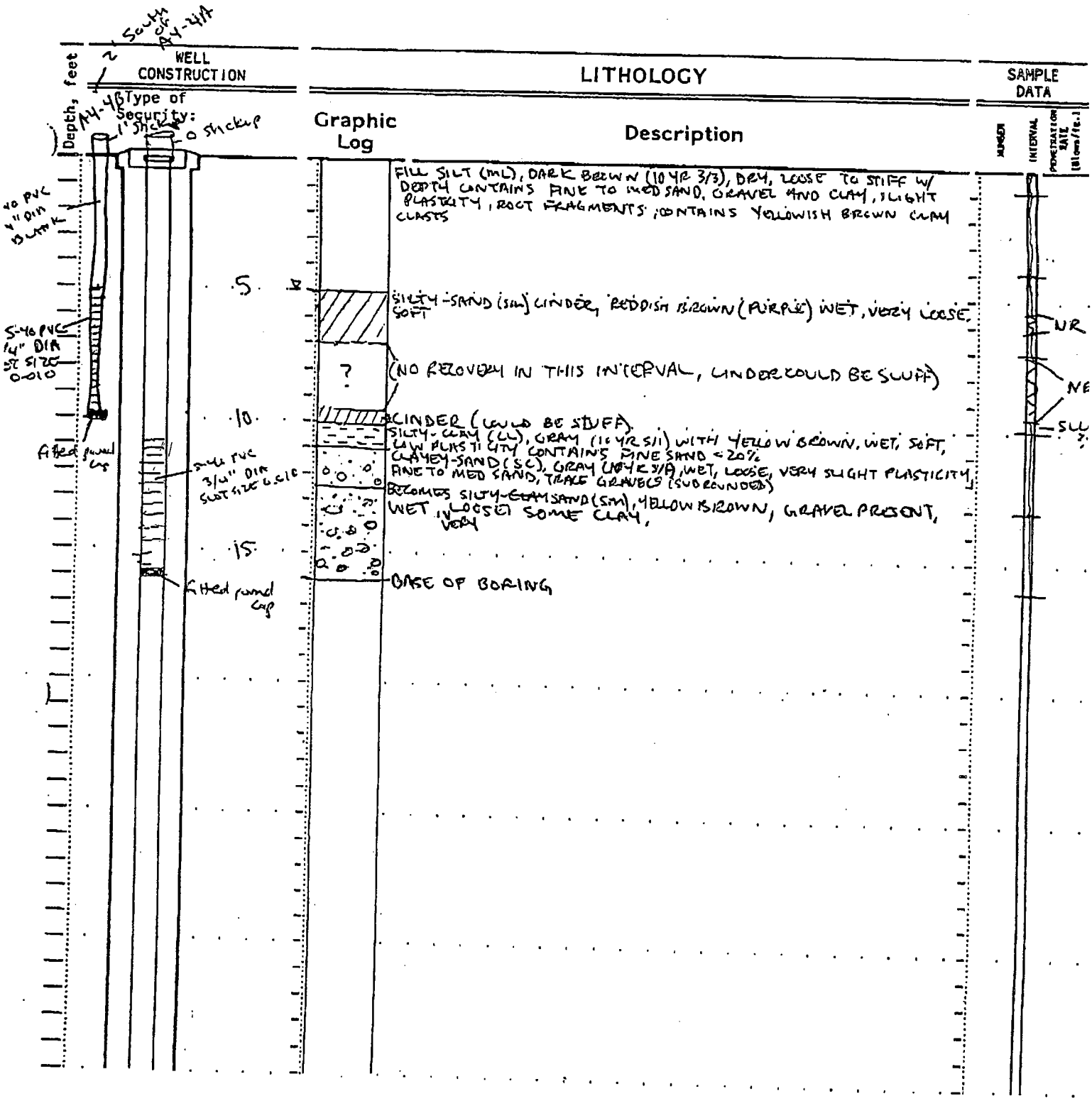
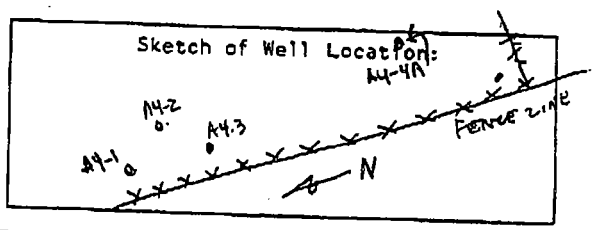


Well Permit No.:
Date well drilled: 9/24/01
Date water level measured:
Well elevation:

Drilling Company: PRECISION
Driller: EUGENE
Sampling Method: DRIVE/ACETATE LINERS
Hammer Weight: AUTO

Sketch of Well Location:



LF Geologist/Engineer: CHRISTY SWINDLING

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-4A

Project No. 7545.00

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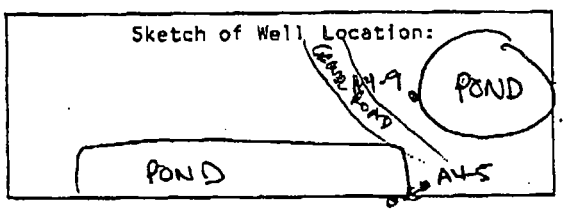
Depth, feet	WELL CONSTRUCTION	Graphic Log	LITHOLOGY Description	SAMPLE DATA NUMBER	INTERVAL	PENETRATION RATE (blows/ft.)
	Type of Security: A4-5B; Stickup is 1'					
3	DTW = 6.00 ▽ 5.	? PAINT ? PAINT	FILL SILT (ML), DARK BROWN (10YR 4/4), DRY LOOSE, ROOT FRAG. NO PLASTICITY			NR
			CINDERS (SM) SILTY-SAND, REDDISH BROWN, WET, LOOSE POOR RECOVERY. HARD TO TELL INTERVAL CINDERS CAME IN. NEARBY POTHOLE # 7, CINDERS 3.5-6.0' bgs.			NR
			7.5 FINE SAND (SM), BLACK, CLEAN, NO FINES, LOOSE, DRY WET			
			8.0 SILTY ~~SAND~~ (CL), DARK YELLOWISH BROWN (10 YR 3/5), DAMP, MED STIFF, LOW TO MED PLASTICITY, SOME MED SAND PRESENT. FE OXIDE STAINING, BLACK MOTTLING.			
10			BECOMES GRAVELLY W/ SUBANGULAR GRAVELS AND COARSE SANDS			
	5-40 PVC, 1" DIA SLOT SIZE 0.010 3-13' bgs					
13			BASE OF BORING @ 13.0' bgs			
15	Filled pond cap					
			pH ≈ 6.5			

Well Permit No.:
Date well drilled: 10/10/01
Date water level measured: 10/10/01
Well elevation:

Drilling Company: PRECISION
Driller: CHRIS/WAYNE
Sampling Method: DUAL TUBE
Hammer Weight: AUTO

LF Geologist/Engineer: CHRISTY SWINDLING

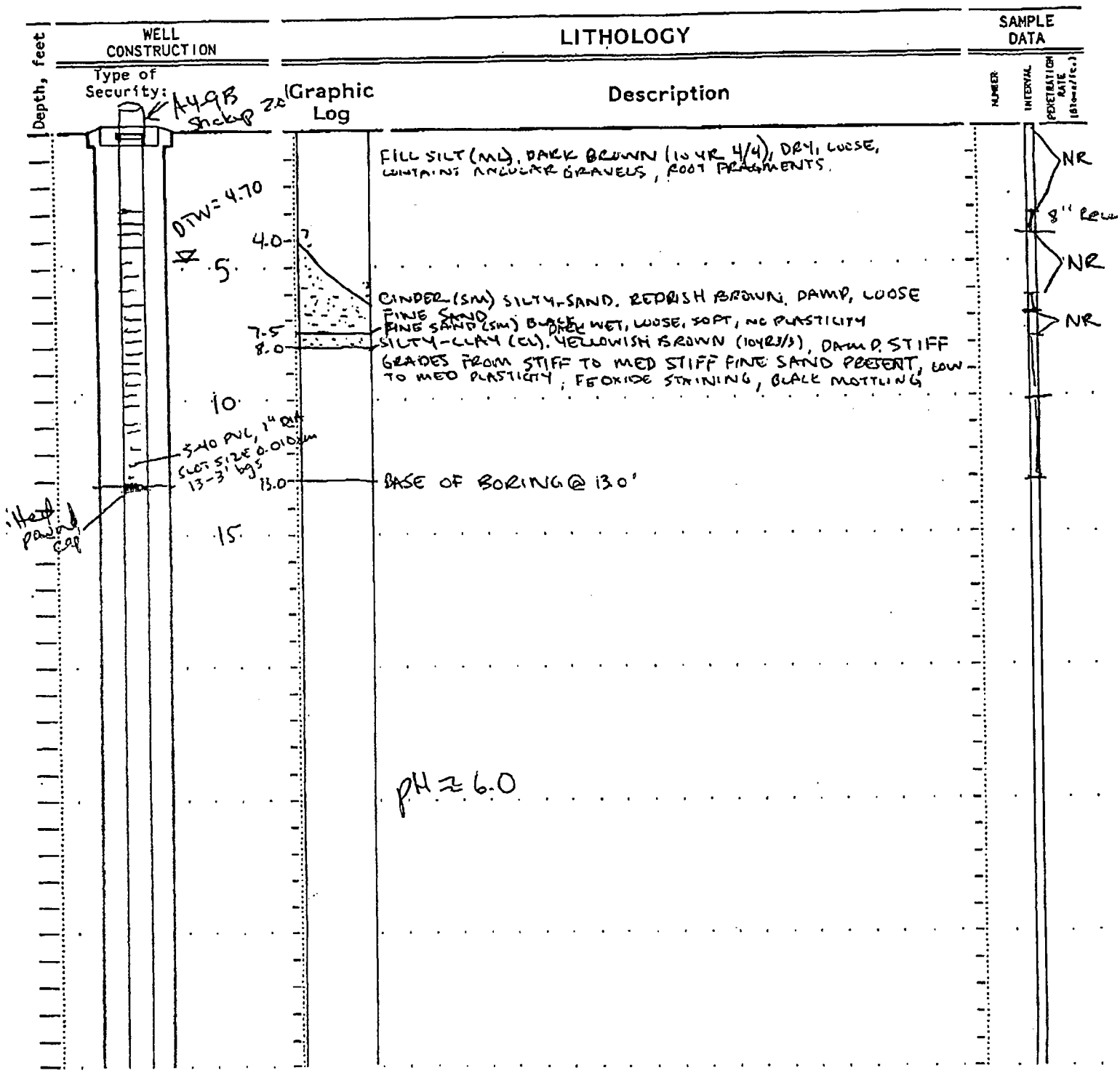
Sketch of Well Location:



FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-5

Project No. 7545.00-078

LEVINE-FRICKE
CONSULTING ENGINEERS AND HYDROGEOLOGISTS

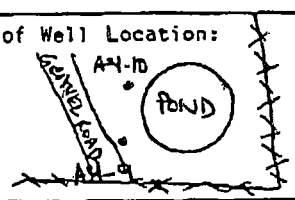


Well Permit No.:
Date well drilled: 10/10/01
Date water level measured: 10/10/01
Well elevation:

Drilling Company: PRECISION
Driller: CHRIS/WAYNE
Sampling Method: DUAL TUBE
Hammer Weight: AUTO

LF Geologist/Engineer: CHRISTY SWINDLING

Sketch of Well Location:



FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-9

Project No. 7545.00-078

LEVINE·FRICKE
CONSULTING ENGINEERS AND HYDROGEOLOGISTS

Depth, feet	WELL CONSTRUCTION Type of Security:	LITHOLOGY Graphic Log	Description	SAMPLE DATA NUMBER	INTERVAL	PENETRATION RATE (Blows/ft.)
		FILL	Hit Concrete @ 1.0' bgs			NR
		FILL	CINDERS (sm) SILTY-SAND; REDDISH BROWN; DAMP, LOOSE			NR
			BASE OF BORING @ 7' Couldn't get sampler in hole. Couldn't step out any closer to pond Possible concrete to N.			

NO WELL INSTALLED
COULDN'T GET TO BASE OF CINDERS

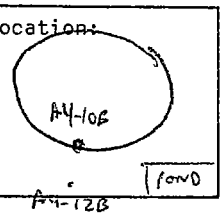
SPOKE W/ LARRY 14:30
HIT STORM DRAIN LINE IN THIS BORING - BILL COPELAND SAID HE WOULD PAY FOR IT. ☺ STORM DRAIN WILL BE TAKEN OUT FOR REMEDIATION IN FUTURE SO NOTHING WILL BE REPAIRED AS FAR AS HOLE IN SD.

Well Permit No.:
Date well drilled: 10/10/01
Date water level measured: 10/10/01
Well elevation:

Drilling Company: PRECISION
Driller: CHRIS/WAYNE
Sampling Method: DUAL TUBE
Hammer Weight: AUTO

LF Geologist/Engineer: CHRISTY SWINDLUN

Sketch of Well Location:



FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-10B (EW5)

Project No. 7545.00-078

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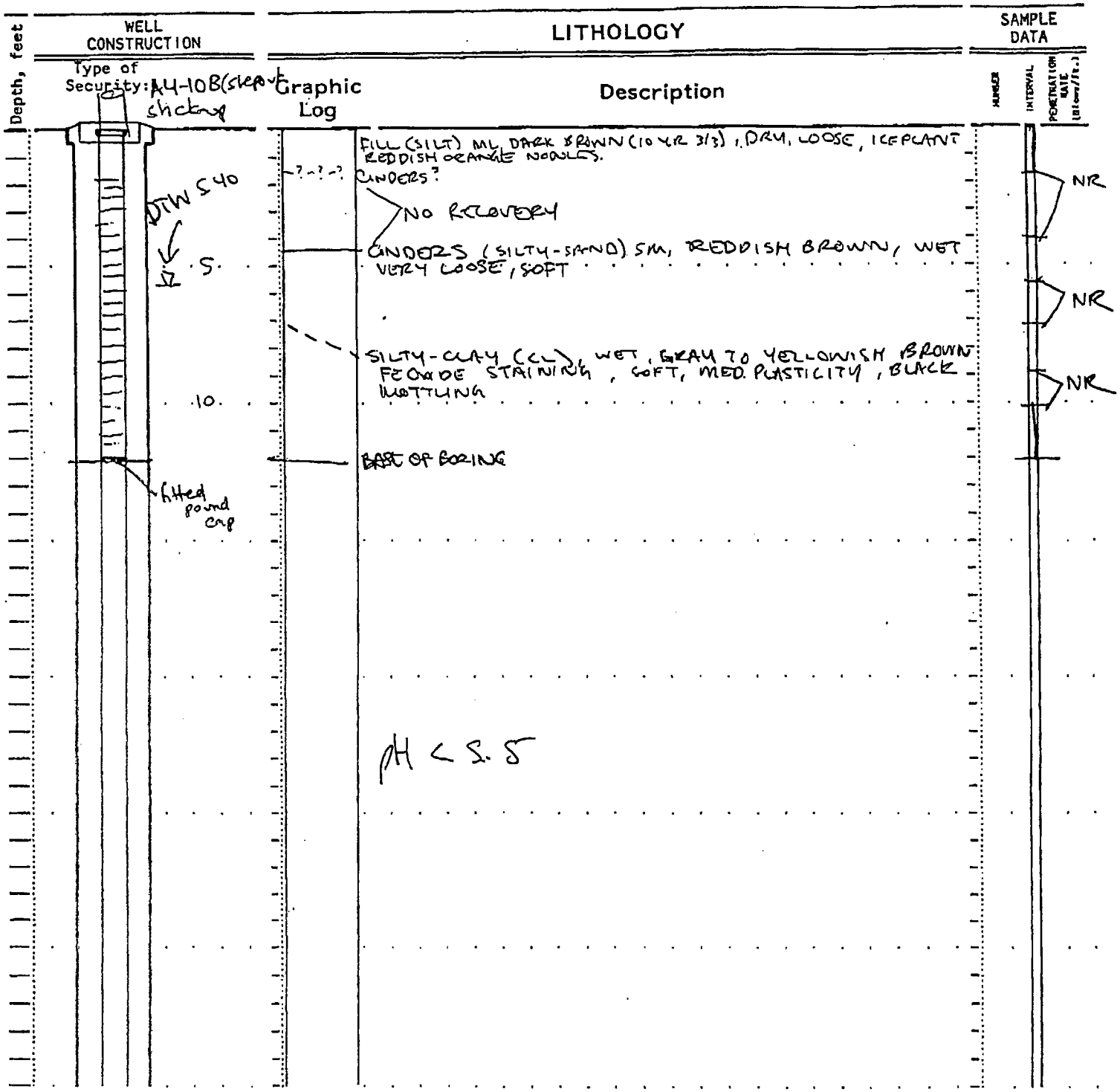
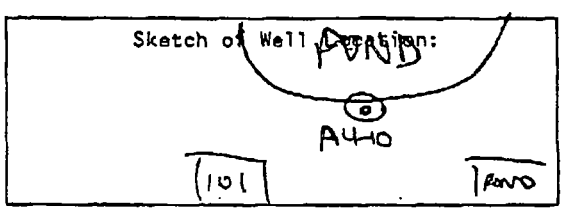


Well Permit No.:
Date well drilled: 10/9/01 to 10
Date water level measured: 10/10/01
Well elevation:

Drilling Company: PRECISION
Driller: CHRIS / WAYNE
Sampling Method: DUAL TUBE
Hammer Weight: AUTO

Sketch of Well Location:



LF Geologist/Engineer: CHRISTY SWINDLING

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR STEPOUT BORING FOR A4-10

Project No. 7545.00-088

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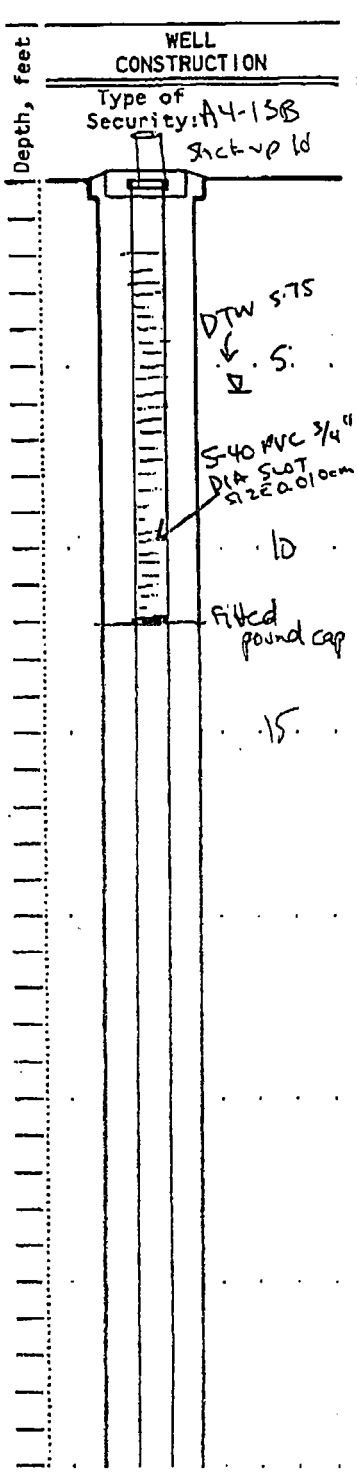

LITHOLOGY

Graphic Log	Description	SAMPLE DATA: NUMBER	INTERVAL	PENETRATION RATE (Blows/ft.)
	FILL (SANDY-SILT) SM, DRY, LOOSE, DARK BROWN, SOME PLASTICITY, BECOME CEMENTED, TRACE ANGULAR GRAVELS.			NR
	CINDER (SM) SILTY-SAND, REDDISH BROWN, FINE TO MED SAND, WET, NO PLASTICITY			NR
	DID NOT RECOVER BLACK FINE SAND LAYER			
	SILTY-CLAY (CL), DARK YELLOWISH BROWN W/ GRAY (10YR 4/4), DAMP TO WET, GRADES TO STIFF, TRACE GRAVELS, MED PLASTICITY			NR
	BASE OF BORING			
	pH < 5.0			

Well Permit No.: _____
Date well drilled: 10/10/01
Date water level measured: 10/10/01
Well elevation: _____

Drilling Company: PROVISION
Driller: CHRIS/WAYNE ~~DUAL TUBE~~
Sampling Method: DUAL TUBE AUTO
Hammer Weight: _____

LF Geologist/Engineer: CHRISTY SWINDLING

Sketch of Well Location:

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-13

Project No. 7545.00.078

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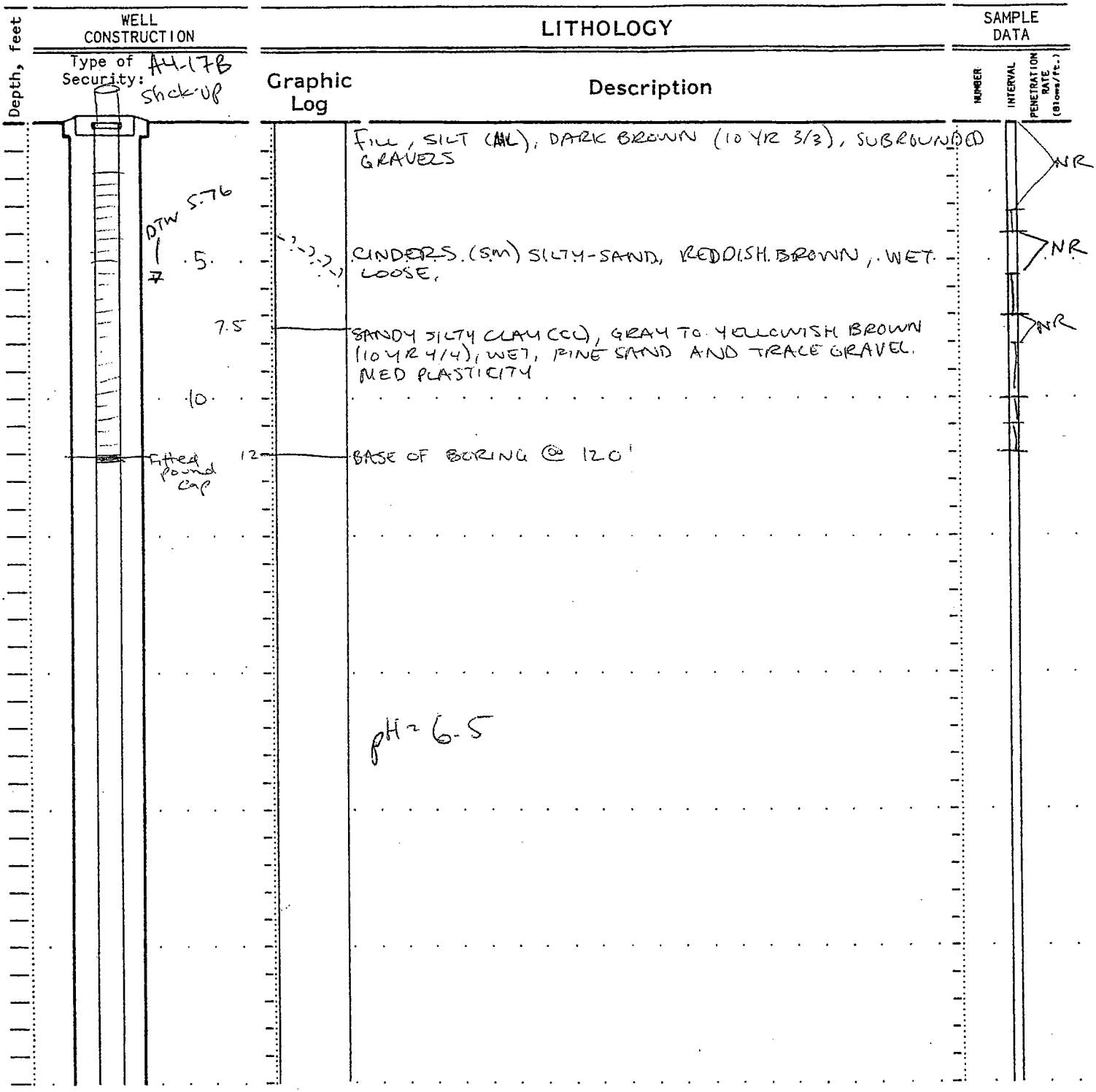
Page 1 of 1



Well Permit No.:
Date well drilled: 10/10/01
Date water level measured: 10/10/01
Well elevation:

Drilling Company: PRECISION
Driller: CHRIS/WAYNE
Sampling Method: DUALTUBE
Hammer Weight: AUTO

Sketch of Well Location:

LF Geologist/Engineer: CHRISTY SWINDLING

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR A4-17

Project No. 7545.00.078

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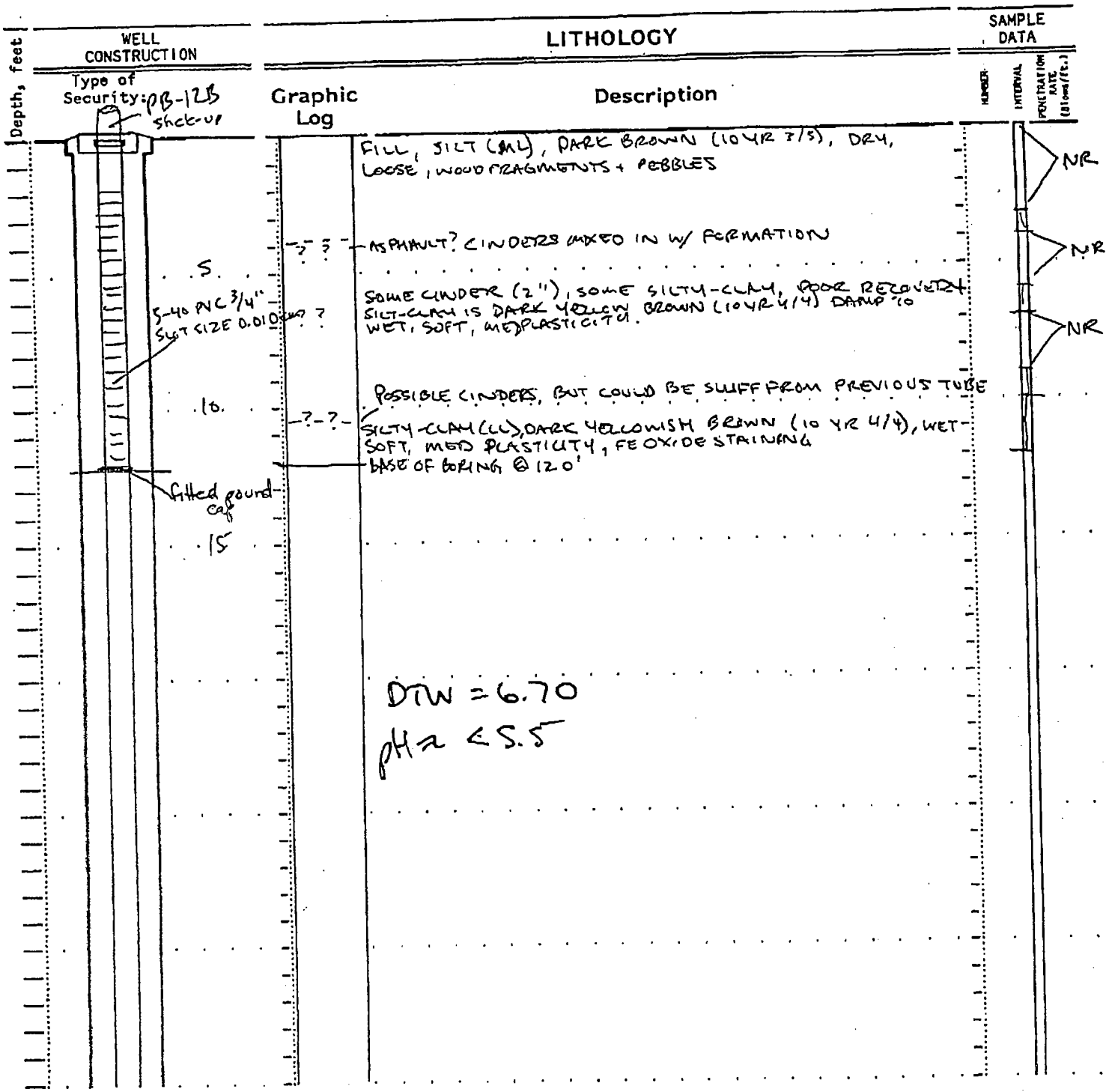

Well Permit No.:
Date well drilled: 10/10/01
Date water level measured: 10/10/01
Well elevation:

Drilling Company: PRECISION
Driller: CHRIS/WAYNE
Sampling Method: DUAL TUBE
Hammer Weight: AUTO

Sketch of Well Location:
PB-12
101

LF Geologist/Engineer: CHRISTY SWINDLING

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR PB-12

Project No. 7545.00-078

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