ES ENGINEERING-SCIENCE

LETTER OF TRANSMITTAL

DATE 22 August 1994	JOB NO. 726104
ATTENTION Ms. Juliet Shin	
RE: Site Investigation at Redwood Regional Park Service Yard, Oakland California	

TO
Alameda County Health Care Services Agency
Division of Hazardous Materials
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

Dated _____

COPIES	DATE	NO.	DESCRIPTION
1	8/17/94		Workplan for Groundwater Characterization Program at Redwood Regional Park Service Yard, Oakland CA

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ For checking ☐ Resubmit _____ copies for approval

☒ For your use ☐ Approved as submitted ☐ Design only, not for construction

☐ As requested ☐ Approved as noted ☐ Return _____ corrected prints

☒ For review and comment ☐ Returned for corrections ☐ _____

☐ For Your Action

REMARKS: _____

COPY TO Warren Gee, EBRPD

SIGNED: Bruce M. Rucker

If enclosures are not as noted, please notify us at once. Bruce M. Rucker

ENGINEERING-SCIENCE, INC.

1301 Marina Village Parkway, Suite 200 • Alameda, California 94501 • (510) 769-0100 • Fax: (510) 769-9244

17 August 1994
Ref: 726104.02000

Alameda County Health Care Services Agency
Department of Environmental Health
Hazardous Materials Division
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Attention: Ms. Juliet Shin

Subject: Groundwater Characterization, Redwood Regional Park Service Yard, Oakland, California

Dear Ms. Shin:

Enclosed is the Engineering-Science, Inc. (ES) "Workplan for Groundwater Characterization at the Redwood Regional Park Service Yard in Oakland, California." This workplan discusses the objectives, tasks, investigative methods, and proposed schedule for soil and groundwater characterization activities associated with two former leaking underground fuel tanks (LUFTs) at the site.

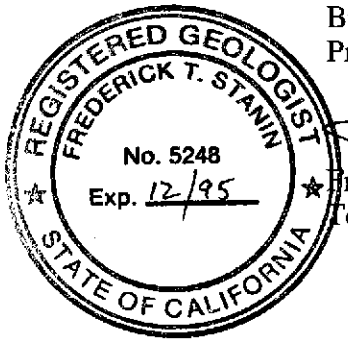
In accordance with your verbal guidance [18 May 1994 telephone conversation between Ms. Juliet Shin of Alameda County Health Care Services Agency, Department of Environmental Health - Hazardous Materials Division (ACHCSA-HMD) and Mr. Bruce Rucker of ES], the California Regional Water Quality Control Board - San Francisco Bay Region (RWQCB) will not be copied on this workplan or future project site deliverables, unless so directed by ACHCSA-HMD.

We trust that this submittal meets the needs of the ACHCSA-HMD. Please call if you have questions or require further information.

Very truly yours,

ENGINEERING-SCIENCE, INC.

Bruce M. Rucker
Project Manager



Frederick T. Stanin, R.G.
Technical Director

BMR/FTS/dka/69-14L.R0
Enclosure

cc: W. Gee, EBRPD

PARSONS

WORKPLAN FOR GROUNDWATER CHARACTERIZATION PROGRAM

at

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

Prepared for

EAST BAY REGIONAL PARKS DISTRICT
OAKLAND, CALIFORNIA

August 1994

Prepared by

ENGINEERING-SCIENCE, INC.
PLANNING • DESIGN • CONSTRUCTION MANAGEMENT
1301 MARINA VILLAGE PARKWAY, ALAMEDA, CA 94501 • 510/769-0100
OFFICES IN PRINCIPAL CITIES
726104/69-14

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SECTION 1

INTRODUCTION

PURPOSE AND SCOPE OF WORK

This workplan describes the objectives, tasks, investigative methods, and presents a schedule for conducting a groundwater characterization program at the Redwood Regional Park Service Yard site in Oakland, California (project site). This workplan follows previous remedial activities and site characterization activities, including closure of one diesel and one gasoline underground fuel storage tank (UFST) and excavation of contaminated soil (ES 1993c), aeration and confirmation sampling of excavated, stockpiled soil (ES 1993a), a preliminary site characterization (ES 1993c), and creek soil and surface water sampling and analysis (ES 1994a and 1994b).

Proposed groundwater characterization activities will include:

- Advancing exploratory soil borings in the vicinity of the former UFST excavation and surrounding areas
- Collecting soil and "grab" groundwater samples for laboratory analysis
- Installing six groundwater monitoring wells and performing monitoring on a quarterly basis
- Reporting of data

The format of this workplan generally follows published regulatory agency guidance documents (RWQCB 1990a and 1990b).

SECTION 2

SITE DESCRIPTION AND HISTORY

GENERAL

The project site is located at 7867 Redwood Road in Oakland, Alameda County, California. Figure A.1 (Appendix A) shows the location of the project site. The project site is the service yard for the Redwood Regional Park, and is located adjacent to and east of the park entrance road (Figure A.2). The service yard is essentially flat, gravel surfaced, and is located at the eastern foot of a hillside. The service yard is at an elevation approximately 10 - 13 feet above the park access road. Redwood Creek is located approximately 80 feet west of the former UFST excavation (Figure A.2).

The service yard formerly utilized two UFSTs (one 2,000-gallon diesel fuel and one 5,000-gallon unleaded gasoline) from the mid-1960's to 1993. Figure A.2 shows the location of the former UFSTs. Both UFSTs were reportedly installed between 1965 and 1968 (ES 1993c). The 5,000-gallon steel UFST contained unleaded gasoline and was reportedly a converted channel buoy purchased from the U.S. Navy (ES 1993c). The tanks and piping underwent integrity testing in 1984, 1986, 1988 and 1989. The unleaded gasoline UFST system failed the 1988 and 1989 tests (ES 1993c).

GEOLOGY AND HYDROLOGY

Geology

The site is located in the Berkeley Hills, approximately seven miles east of the southeastern shoreline of San Francisco Bay, within the Coast Ranges physiographic province of California. The San Francisco Bay Area is an elongate structural depression bounded by the Santa Cruz Mountains on the west and the Diablo Range on the east. The Berkeley Hills are encompassed by the Diablo Range. The bedrock in these mountain ranges is composed of sedimentary, metamorphic and volcanic rocks of Jurassic through Tertiary age (Borcherdt et. al. 1975).

The San Francisco Bay Area is a seismically active region. The area's main geologic structures are associated with two major faults: the San Andreas Fault in the Santa Cruz Mountains and the Hayward Fault which forms the western boundary of the Diablo Range. The Diablo Range has been uplifted and the bay has gradually subsided over the last three million years. The site is located approximately 2.5 miles east of the Hayward Fault (Norris and Webb 1990) (Nilsen et. al. 1979).

Overlying bedrock at the project site area is Quaternary alluvium consisting of silt, sand and gravel. Subsurface stratigraphy at the site is illustrated in hydrogeologic cross-section A-A' (Figure A.7) based on soil boring data acquired during the initial site characterization. Shallow soil stratigraphy consists of a surficial 3- to 10-foot thick clayey silt unit underlain by a 5- to 15-foot thick silty clay unit. All boreholes were terminated in a locally-occurring siltstone or a clay with variable amounts of silt and gravel.

Hydrology

Redwood Creek borders the site to the west (Figure A.2) and is a seasonal creek known for the occurrence of Rainbow Trout. This creek flows into Upper San Leandro Reservoir approximately one mile to the southeast of the site (USGS 1959). There is no comprehensive data on groundwater hydrology in the area of the project site (ACFCWCD 1988).

Groundwater at the site occurs under unconfined and confined conditions, as evidenced by the equilibration of static water levels relative to the first occurrence of groundwater encountered during drilling (ES 1993c). First occurrence of groundwater during drilling was encountered from 3 to 25 feet bgs, and equilibrated water levels ranged from 3 to 18 feet bgs (Figures A.3 and A.4). The difference between first occurrence of groundwater and equilibrated water level ranged from 0 to 13 feet. These differences were the greatest in areas east of the road and were much less west of the road. The spring observed on the east side of the excavation is indicative of the water table surface as evidenced by the position of static water levels relative to the east side of the former excavation (Figure A.3).

Figures A.3 and A.4 show the inferred water table surface, as evidenced by static water level measurements collected 4 October 1993 in the temporary well points, by the water level in the creek, and by the observation of water leaking into the excavation at the approximate depth where the correlated static water level surface intersects the former excavation. The inferred water table surface generally follows local topography and is encountered within the silty clay unit. Figure A.5 is a groundwater elevation map constructed from those temporary well point static water levels, and indicates local groundwater flow in the study area is from northeast to southwest.

As discussed above, the materials encountered in the water-bearing zone in boreholes in the vicinity of the former UFSTs are predominantly clayey silt and silty clay. A hydraulic conductivity value of approximately 0.05 ft/day and an effective porosity value of 35 percent are representative values of these parameters for this soil type (Fetter 1988). Given a groundwater gradient of 0.2 feet per foot as estimated from static water level measurements, the average linear groundwater velocity would be approximately 10 feet per year. These values are approximations only, and actual groundwater velocities could vary substantially.

BACKGROUND AND PREVIOUS FINDINGS

UFST Closure and Soil Remedial Activities

The two UFSTs were excavated and transported off-site for disposal in April 1993. Discolored soil was observed in the excavation pit below the gasoline UFST location. Laboratory analysis of initial confirmation soil samples collected from beneath each UFST indicated soil contamination by aromatic hydrocarbons (including benzene, toluene, ethylbenzene and total xylenes [BTEX]), and from beneath the gasoline UFST by total petroleum hydrocarbons as gasoline (TPH-G) (ES 1993c). No elevated levels of lead were detected in those soil samples. Analytical results of those samples are summarized in Table B.1 (Appendix B).

Approximately 600 cubic yards of contaminated soil in the vicinity of the UFSTs were excavated and stockpiled on site in June 1993 for aeration. The limits of the excavation had a surface area of approximately 2,500 square feet and a maximum depth of approximately 25 feet (below grade relative to the eastern edge of the excavation). Soil excavation activities were halted due to the potential for landslides, the presence of significant facility constraints (roads and buildings) and the infiltration of spring water into the excavation.

Five confirmation soil samples were collected by ES in June 1993 from the excavation base and walls (Figure A.6 and Table B.1). Discolored soil was noted only in the eastern wall of the excavation. However, confirmation soil samples from other areas contained up to 1,700 parts per million by volume (ppmv) total ionizable vapors as measured with a photoionization detector (PID) and a total hydrocarbon vapor analyzer (THVA). Up to 12,000 mg/Kg TPH-G was detected in excavation confirmation soil samples (Table B.1).

The excavation was backfilled between June and August 1993 with previously excavated clean overburden (estimated 270 cubic yards) and imported fill (estimated 330 cubic yards), and the surface was repaved.

Qua is it 330? (600-270)

The approximately 600 cubic yards of contaminated soil were stockpiled on plastic sheeting at an open area behind the Redwood Park Fire Station #2 located on Redwood Road approximately 500 feet east of the project site. Confirmation soil samples were collected from the stockpiled soil in July 1993, and aeration of the stockpiled, contaminated soil was begun in August 1993 (ES 1993a). The stockpiled soil continues to aerate at the site.

Initial Site Characterization

Following submittal of a technical workplan (ES 1993b), an initial site characterization was conducted in September and October 1993 in the vicinity of the former UFST excavation. Tasks conducted included: advancing 17 exploratory boreholes and converting 5 to temporary well points; collecting 27 soil and 5 "grab" groundwater samples for laboratory analysis; and measurement of static water levels (ES 1993c). Figure A.7 shows the locations and ground surface elevations of the exploratory boreholes.

Creek Soil and Surface Water Sampling

An area of discolored soil was observed in the bed of Redwood Creek southwest of the former UFSTs, and soil and "grab" surface water samples were collected for laboratory analysis in February and March 1994 (ES 1994a and 1994b). Figure A.8 shows the location of the soil and "grab" surface water samples. One soil sample was collected in February 1994 for laboratory analysis from the area of discolored soil. That sample contained minor concentrations (up to 3 mg/kg) of fuels (TPH); BTEX was not detected. Two "grab" surface water samples were collected in February and March 1994 immediately downstream of the discolored soil. Those water samples contained up to 130 µg/L TPH-G and BTEX; TPH-D/K was not detected. One "grab" surface water sample was also collected in March 1994 approximately 500 feet upstream of the area of discolored soil. That water sample contained 50 µg/L TPH-G; neither TPH-D/K nor BTEX were detected (Figure A.8) (ES 1994a and 1994b). It is inferred that this upstream surface water contamination results from runoff of vehicle-sourced fuel compounds from parking areas and/or roadways.

EXTENT AND MAGNITUDE OF CONTAMINATION

Soil Contamination

Figure A.9 and Table B.2 summarize the exploratory borehole soil sample analytical results. Figure A.3 is cross section A-A' showing the observed soil profile, groundwater conditions, and selected soil sample analytical results. No significant soil contamination was detected in boreholes immediately north, east or south of the excavation. Significant soil contamination (up to 1,900 mg/kg TPH-G, 1,300 mg/kg total petroleum hydrocarbons as kerosene [TPH-K] and 198 mg/kg total BTEX) was detected in boreholes southwest of the excavation (Figure A.3 and A.9 and Table B.2). Soil contamination was detected in exploratory boreholes up to 90 feet southwest of the excavation and in the eastern wall of Redwood Creek (130 feet southwest of the excavation). Soil contamination was not detected in an exploratory boring (B17) west of Redwood Creek (Figures A.3 and A.9 and Table B.2). These data indicate that UFST-sourced soil contamination extends primarily southwest from the former UFSTs to Redwood Creek. Soil contamination away from the former UFST location is inferred to result from lateral transport of dissolved fuel hydrocarbons with groundwater and subsequent vertical distribution of the fuel hydrocarbons into the soil by desorption during periods of groundwater fluctuation.

Groundwater Contamination

Figure A.10 and Table B.3 summarize the "grab" groundwater sample analytical results collected from temporary well points installed in five exploratory boreholes. Figure A.4 is cross section A-A' with selected "grab" groundwater sample analytical results. Groundwater contamination by TPH and BTEX was detected in all of the five temporary well points at the site, and in creek surface water samples collected downgradient of the former UFSTs. Maximum concentrations detected in groundwater were 810,000 µg/L TPH-G, 2,300,000 µg/L TPH-K, 570 µg/L TPH-D, and 125,000 µg/L total BTEX (12,000 µg/L benzene). Groundwater contamination extends laterally at least

100 feet southwest of the excavation (Figure A.4). The lateral and vertical extent of soil and groundwater contamination have not been fully characterized.

SECTION 3

PROPOSED SOIL AND GROUNDWATER CHARACTERIZATION ACTIVITIES

This section discusses the proposed soil and groundwater characterization activities which are designed to further evaluate the magnitude and extent of soil and groundwater contamination resulting from the former UFSTs at the project site. The objectives of the proposed characterization activities are as follows:

- Further evaluate the shallow stratigraphy and hydrogeology in the vicinity of the former UFSTs to assess potential pathways for contaminant migration
- Document the magnitude of residual, unsaturated zone soil contamination in the vicinity of the former UFSTs to facilitate evaluation of potential groundwater impacts
- Evaluate the impacts to groundwater associated with the leaking UFSTs

ES proposes to install six groundwater monitoring wells in the vicinity of the former UFSTs. The locations of the proposed wells are shown on Figure A.11. One monitoring well (MW-1) will be installed adjacent to and east (upgradient) of the former UFST excavation. The objectives of this well are to document that detected groundwater contamination results only from the former UFSTs, and to confirm the inferred southwestern groundwater flow direction.

One monitoring well (MW-2) will be installed within the footprint of the former UFST excavation. The objective of this well is to document inferred maximum groundwater contaminant levels in the UFST source area.

Three monitoring wells (MW-3, MW-4 and MW-5) will be installed along a north-south line approximately 60 feet west (downgradient) of the former UFST excavation. The objective of well MW-4 is to provide a hydrochemical and static water level monitoring point within the inferred groundwater contaminant plume. Wells MW-3 and MW-5 are background wells, and to confirm the northern and southern limits of the groundwater plume at those locations.

One monitoring well (MW-6) will be installed on the trail, immediately west of Redwood Creek. The objective of that well is to provide a "point of compliance" to confirm that UFST-sourced groundwater contamination does not extend beyond Redwood Creek.

Actual locations of the wells may vary depending on site conditions and facility constraints.

PERMITS AND NOTIFICATIONS

Prior to field activities, ES will submit to Alameda County Flood Control and Water Conservation District - Zone 7 Water Agency (Zone 7) a Drilling Permit Application, which includes the notification of estimated date to begin well installations. Following well installations, ES will submit to Zone 7, the California Department of Water Resources (DWR) and ACHCSA-DHM the appropriate well completion documentation, including the DWR Water Well Drillers Report and borehole geologic logs.

BOREHOLE ADVANCEMENT AND SAMPLING

The exploratory boreholes will be advanced using approximately 10-inch outside diameter (OD) truck-mounted, hollow-stem augers. Boreholes will be terminated approximately three feet into the lower permeability siltstone or clayey to gravelly silt unit (Figures A.3 and A.4). Soil samples will be collected in advance of the augers at least every five feet in 2-inch OD by 6-inch long brass tubes using a modified California split-spoon sampler. The boreholes will be geologically logged by visual observation using the Unified Soils Classification System (USCS).

Up to two soil samples will be collected for laboratory analysis from each exploratory borehole at a depth just above first occurrence of groundwater during borehole advancement and/or at the depth(s) within the unsaturated zone that exhibits the greatest contamination (based on visual observation and measurements with a photoionization detector [PID] and total hydrocarbon vapor analyzer [THVA]). Soil samples will be collected in pre-cleaned brass sampling sleeves, sealed with Teflon™ tape and non-reactive plastic caps, labeled, refrigerated and transported under chain-of-custody the same day to the analytical laboratory.

All exploratory borehole drilling and sampling equipment will be decontaminated prior to advancing each borehole by steam cleaning or by scrubbing with a trisodium phosphate (TSP) detergent solution followed by triple rinsing with deionized water.

MONITORING WELL INSTALLATIONS

Well Construction

The monitoring wells will be constructed in accordance with the following guidance documents:

- Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites (RWQCB 1990)
- California State Water Resources Control Board (SWRCB) Leaking Underground Fuel Tank Task Force, Leaking Underground Fuel Tank Manual: Guidelines for Site Assessment, Cleanup and Underground Storage Tank Closure (SWRCB 1989)

- State of California Department of Health Services - Toxic Substances Control Program - Program and Administrative Support Division - Technical Services Branch: Scientific and Technical Standards for Hazardous Waste Sites, Volume 1: Site Characterization, August 1990

The wells will be constructed of internally threaded, 10-foot lengths of 4-inch outside diameter (OD), Schedule 40 polyvinyl chloride (PVC) casing. No organic adhesives or solvents will be utilized in the construction of the wells. A threaded PVC bottom plug will be placed at the base of the casing, and the casing will be slotted (0.010-inch factory-milled slots) to extend several feet above and below the inferred water table (Figures A.3 and A.4). Filter pack sand (Monterey #2-12) will be placed around the annulus of the slotted casing, and will extend at least 2 feet above the top of the well screen. A 3-foot thick seal of bentonite pellets will be emplaced above the filter pack then hydrated. Bentonite-cement grout will be used to seal the annular space between the well casing and the borehole walls, from the top of the bentonite seal to the ground surface.

Surface completions will consist of either a traffic-proof, flush-mounted, locking box (for wells completed in pavement) or aboveground, iron locking "stovepipes" surrounded by three iron traffic posts (for wells completed in unpaved areas). All well casings will have air-tight PVC caps. Figures A.12 and A.13 are the proposed well construction schematics for the flush finish and aboveground completions, respectively.

Well Development

No sooner than 24 hours following completion, the monitoring wells will be developed by surging and bailing or surging and pumping until the water is free and clear of sediment, or until a maximum of ten casing volumes have been purged (estimated to be approximately 100 gallons, based on a 4-inch OD well with a 15-foot water column). During well development, aquifer stability parameters (including temperature [T], electrical conductivity, [EC], pH and turbidity) will be measured and recorded.

Well Survey

Following well completions, the elevations at top of casing and adjacent ground surface will be surveyed relative to the U.S. Geological Survey (USGS) benchmark number JHF-49. Surveying precision shall be to within 0.01 foot.

MONITORING AND HYDROCHEMICAL SAMPLING OF MONITORING WELLS

Monitoring well sampling procedures will be in accordance with the following guidance documents:

- Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites (RWQCB 1990)
- California State Water Resources Control Board (SWRCB) Leaking Underground Fuel Tank Task Force, Leaking Underground Fuel Tank Manual: Guidelines for Site Assessment, Cleanup and Underground Storage Tank Closure (SWRCB 1989).

Monitoring Frequency and Duration

The monitoring well(s) will be sampled and monitored on a quarterly basis for at least one year. Additional events may be warranted based on the analytical results of the first year of sampling. The initial groundwater monitoring event will be conducted no sooner than 24 hours following development of the wells.

Well Monitoring and Purging

Static water levels will be measured using an electric water level indicator. Water level measurements will be made initially upon removal of the airtight well casing cap. Water levels will then be remeasured after a period of no less than one-half hour to allow dissipation of potential air pressure and equilibration of water levels. For at least the first monitoring event, an oil/water interface probe will be used to inspect for potential floating fuel product. An electric submersible pump or Teflon™ bailer will be used to purge at least three casing volumes from the wells prior to sampling with a bailer. During well purging, aquifer stability parameters (T, EC, pH) will be measured and recorded. The well will be considered to be adequately purged when the following criteria are met for successive casing volumes:

- ph ±0.2 standard units
- temperature ±1° Celsius
- electrical conductivity ±10% (µmhos)

If the water-bearing zone is low yielding, care will be exercised to ensure that the well is not purged to dryness, to avoid the loss of volatile constituents. The purging technique shall also incorporate purging over the entire screened interval of the well. If groundwater infiltration rates are not adequate to allow the proposed volumes to be purged, then the well will be sampled after the water level has recovered to 80 percent of its pre-purging level.

Well Sampling

Water samples will be collected with a Teflon™ bailer and transferred to pre-cleaned, laboratory-supplied containers. Sample containers will be labeled at the time of the sample collection, and shall include: site name; sampler's name; sample collection date and time; and requested laboratory analysis. Sample containers will be placed in a cooler packed with "blue ice" and transported under chain of custody the same day to a State of California Environmental Protection Agency (Cal EPA) Environmental Laboratory Accreditation Program (ELAP)-certified laboratory.

SOIL AND GROUNDWATER SAMPLE ANALYTICAL PROCEDURES

The soil and groundwater samples will be analyzed for contaminants of concern previously detected in site soil and groundwater samples during the remedial and characterization activities. Analytical methods will be in accordance with the RWQCB Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites (10 August 1990). Those analyses include:

- Total petroleum hydrocarbons as gasoline (TPH-G), diesel (TPH-D) and kerosene (TPH-K) by the State of California Department of Toxic Substances Control/Leaking Underground Fuel Tank (DTSC/LUFT) Manual Method (equivalent to modified EPA Method 8015)
- Aromatic hydrocarbons (including benzene, toluene, ethylbenzene and total xylenes [BTEX]) by EPA Method 8020

Section 4 discusses analytical laboratory quality assurance/quality control (QA/QC) requirements, including analytical Method Reporting Limits (MRLs).

MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) generated during the proposed program includes: soil cuttings from borehole drilling; groundwater from monitoring well development and purging prior to quarterly sampling; and decontamination rinsates from drilling and well sampling activities. Based on previous investigative results, it is anticipated than no hazardous IDW will be generated in the proposed investigation.

Soil cuttings will be containerized on site in drums pending receipt of analytical results from the soil samples collected during drilling of the monitoring well boreholes. That soil will either be added to the existing stockpiled soil at the site, or transported off site for treatment or disposal, based on analytical results.

All purge water will be containerized in an on-site, approximately 1,000-gallon plastic tank. When the tank is full or at the conclusion of the four quarterly monitoring events (whichever is first), the purge water will be transported off site for recycling, treatment or disposal, based on analytical results.

Potentially contaminated personal protective equipment (PPE) (including disposal coveralls and gloves) will be decontaminated and disposed of as solid waste.

REPORTING OF DATA

The results of the groundwater characterization activities will be summarized in the chronologically appropriate quarterly progress report for the investigation. Each quarterly progress report will include the following elements:

- Brief history of previous site investigations
- Description of current quarter activities
- Tabular summary of current and previous analytical data
- Certified analytical laboratory reports and associated chain-of-custody documentation

At the conclusion of the first year of quarterly groundwater monitoring, an annual summary report will be produced. That summary report will summarize the year of groundwater monitoring activities, analyze hydrochemical trends, and evaluate regulatory agency criteria governing detected groundwater contaminants.

Each report will be signed by a California Registered Geologist (R.G.), Certified Engineering Geologist (C.E.G.) or Professional Engineer (P.E.).

SECTION 4

SITE SAFETY AND QUALITY ASSURANCE/ QUALITY CONTROL (QA/QC)

SITE SAFETY

In accordance with federal Occupational Safety and Health Administration (OSHA) and ES corporate policy, a project health and safety plan (HASP) has been developed for environmental investigations at the project site (ES 1992), and contains the following information:

- Site location and scope of work
- Safety and health risk analysis
- Field team organization and responsibilities
- Air monitoring
- Personal protective equipment (PPE)
- Site control measures
- Decontamination procedures
- Emergency response plan
- Employee training and medical monitoring

All ES employees will adhere to the requirements specified in the HASP. The well drilling subcontractor will be responsible for preparing and implementing a site safety plan, which will adhere to the requirements of the ES HASP, at a minimum. The ES HASP is available upon request, and will be in the possession of ES field personnel during groundwater characterization activities.

QUALITY ASSURANCE/QUALITY CONTROL

Field QA/QC Procedures

All field activities will be documented in a bound field logbook, including meter readings and calibration data. Those data will subsequently be transferred to appropriate field forms. Copies of this workplan, the HASP and well installation permits will be available on site during all field activities.

All field instruments (PID, THVA, pH meters, EC meters, dissolved oxygen, temperature meter) will be calibrated prior to the start of field activities each day, at a minimum. Calibrations will be performed more frequently if Standard Operating Procedures (SOPs) or instruction manuals so indicate. All calibration data will be entered in the field logbook.

Strict chain-of-custody and sample preservation procedures as required by the specific analytical methods will be adhered to by field personnel. Care will be taken to ensure that air bubbles (headspace) are not present in VOA vials, and that the samples are cooled to 4° Celsius. The following sample containers will be utilized for soil and groundwater samples collected during the proposed investigation:

Soil samples

- All analyses: precleaned 6-inch long by 2-inch OD stainless steel or brass sleeves with nonreactive plastic caps

Groundwater samples

- TPH-G and BTEX: precleaned 40 milliliter (ml) volatile organic analysis (VOA) vials with Teflon™ septa
- TPH-D/K: 500 or 1,000 ml amber glass jars with Teflon™-lined caps

All field activities will be conducted in accordance with the requirements specified in this workplan (and any agreed upon revisions), under the supervision of a California Registered Geologist (R.G.) or a Certified Engineering Geologist (C.E.G.).

Quality Control Samples

Two types of QC samples will be used to assess whether field or laboratory procedures affected analytical results during groundwater monitoring well sampling. One equipment rinsate blank will be collected per day from the groundwater sampling bailer and analyzed to monitor potential cross-contamination in the field due to inadequate decontamination of sampling equipment or sample contamination during transport. This procedure will be performed immediately after sampling the well with the most groundwater contamination. Field duplicate samples will be collected to assess whether field procedures produced reproducible analytical results. Field duplicate samples will include one soil sample collected during well installations and one groundwater sample per quarterly monitoring event. All QC samples will be analyzed for volatile constituents, including TPH-G and BTEX.

Analytical Laboratory QA/QC

All laboratory analyses will be conducted by a CalEPA ELAP-certified hazardous waste laboratory, which maintains current certifications for each analytical method required in the proposed investigation. Proposed method reporting limits (MRLs) for each analysis will be less than any applicable soil cleanup levels or water quality objectives for the site, but are subject to increase for samples requiring dilution. Table B.4 summarizes the MRLs and preserved sample holding times (prior to analysis) proposed for soil and groundwater samples collected during the proposed investigation.

Laboratory QC samples (e.g. method blanks, matrix spikes, surrogate spikes, etc.) will be analyzed by the laboratory in accordance with the requirements of each analytical method. All laboratory QC sample results and sample holding times will be evaluated in the context of their respective acceptance limits. Any deviations from the required analytical laboratory QA/QC procedures will be documented in a non-conformance memorandum and/or in the case narrative accompanying the certified laboratory report.

SECTION 5

PROPOSED SCHEDULE

East Bay Regional Parks District anticipates that the monitoring wells will be installed and the first quarterly groundwater monitoring event will be conducted in September 1994. Subsequent quarterly monitoring events will be conducted in December 1994 and March and June 1995. The results of the investigative activities proposed in this workplan will be summarized in the appropriate quarterly progress report(s) for the investigation (estimated to be published in November 1994 and February, May and August 1995.

SECTION 6

QUALIFICATIONS

Engineering-Science, Inc. (ES) is a California-based international multidisciplinary consulting firm providing a broad range of environmental engineering, planning and design services. ES has conducted environmental engineering and environmental science projects throughout the United States and abroad for over 45 years, including over 15 years of direct hazardous waste management experience. ES maintains all current licenses, certifications, training and insurance required for hazardous waste operations in the State of California, including:

- State of California Contractors State License Board General Engineering Contractor (A), General Building Contractor (B) and Hazardous Substances Removal and Remedial Actions (HAZ) Certifications
- Federal Occupational Safety and Health Administration (OSHA) 40-hour health and safety training for hazardous waste operations (29 CFR 1910.120) certification for all site workers
- Federal Occupational Safety and Health Administration (OSHA) 8-hour supervisory training for hazardous waste operations (29 CFR 1910.120) certification for site supervisors
- Workers compensation insurance

This workplan has been prepared, and the prepared scope of work will be conducted, under the supervision of Mr. Frederick T. Stanin. Mr. Stanin is a California Registered Geologist (No. 5428) and has over 10 years experience in the geological consulting field, including 4 years of directly applicable experience serving as principal investigator and/or technical director on hazardous waste site investigations. The ACHCSA-HMD will be notified in the event of any substitution for the principal scientist responsible for supervising technical issues on the project, and any substituted staff member will possess the required California professional registration (Registered Geologist, Certified Engineering Geologist or Professional Engineer), and will have an equivalent experience level.

The soil boring/sampling and well installation contractor selected by ES will have the following certifications and training:

- Class C-57 Contractors License

- Federal Occupational Safety and Health Administration (OSHA) 40-hour health and safety training for hazardous waste operations (29 CFR 1910.120) certification for all site workers
- Federal Occupational Safety and Health Administration (OSHA) 8-hour supervisory training for hazardous waste operations (29 CFR 1910.120) certification for site supervisors

SECTION 7

REFERENCES

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ES 1992, Health and Safety Plan for Underground Storage Tank Investigations, prepared for East Bay Regional Parks District, July.

ES 1993a, Sampling of Contaminated Soil Stockpile, Redwood Regional Park Site. 6 August

ES 1993b, Workplan for Site Characterization at East Bay Regional Park District, Redwood Regional Park Corporation Yard, Oakland, Alameda County, California. 3 September

ES 1993c, Closure of Underground Fuel Storage Tanks and Initial Site Characterization at Redwood Regional Park Service Yard, Oakland, California. 16 December

ES 1994a, Creek and Soil Sampling at Redwood Regional Park, Oakland, California. 2 March

ES 1994b, Creek Surface Water at Redwood Regional Park, Oakland, California. 13 May

Nilsen et. al. 1979, Relative Slope Stability and Land-Use Planning in the San Francisco Bay Region, California, USGS Professional Paper 944.

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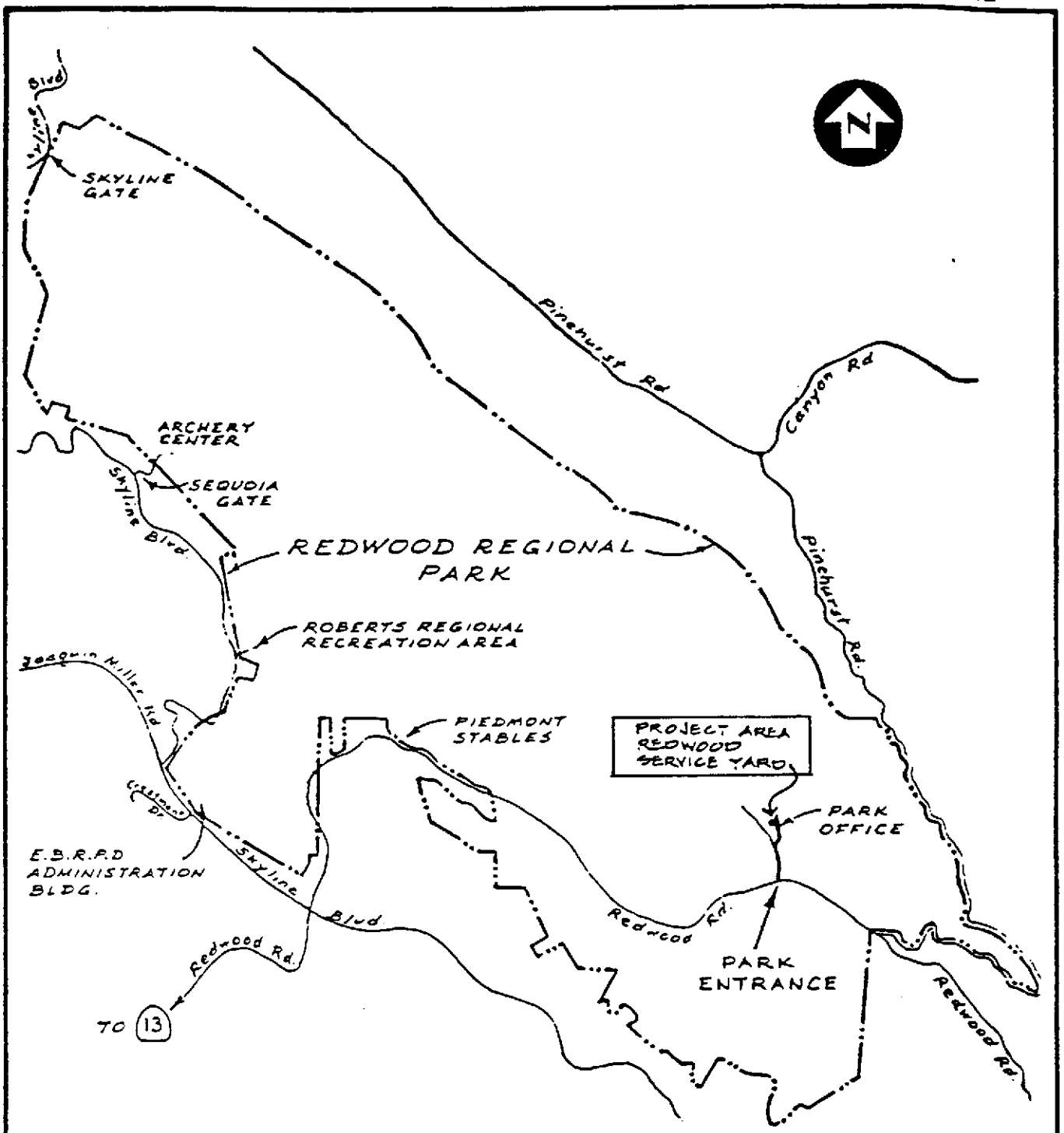
APPENDIX A

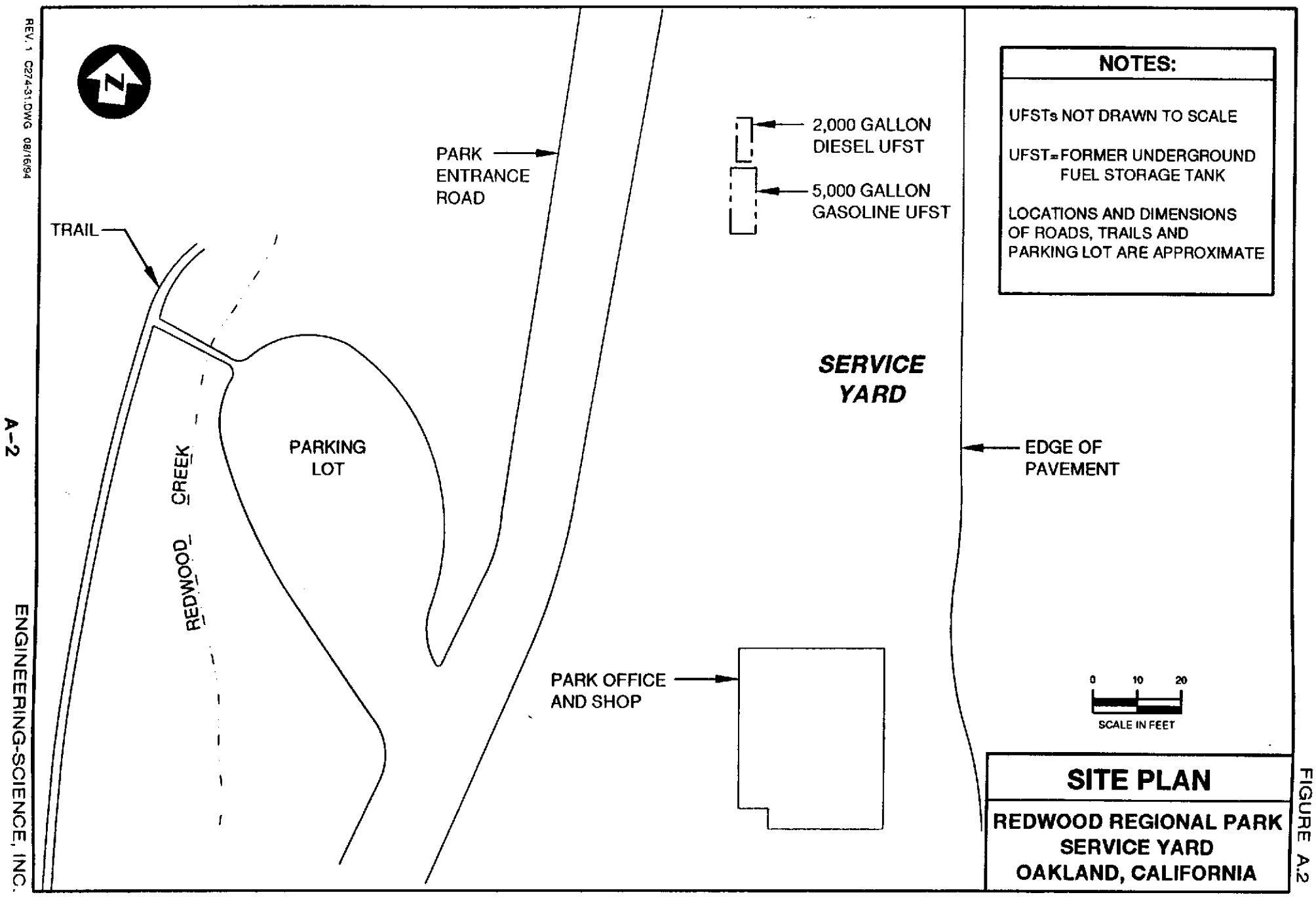
FIGURES



SITE LOCATION MAP

REDWOOD REGIONAL PARK
SERVICE YARD

OAKLAND, CALIFORNIA



REV. 1 C274-31.DWG 08/16/94

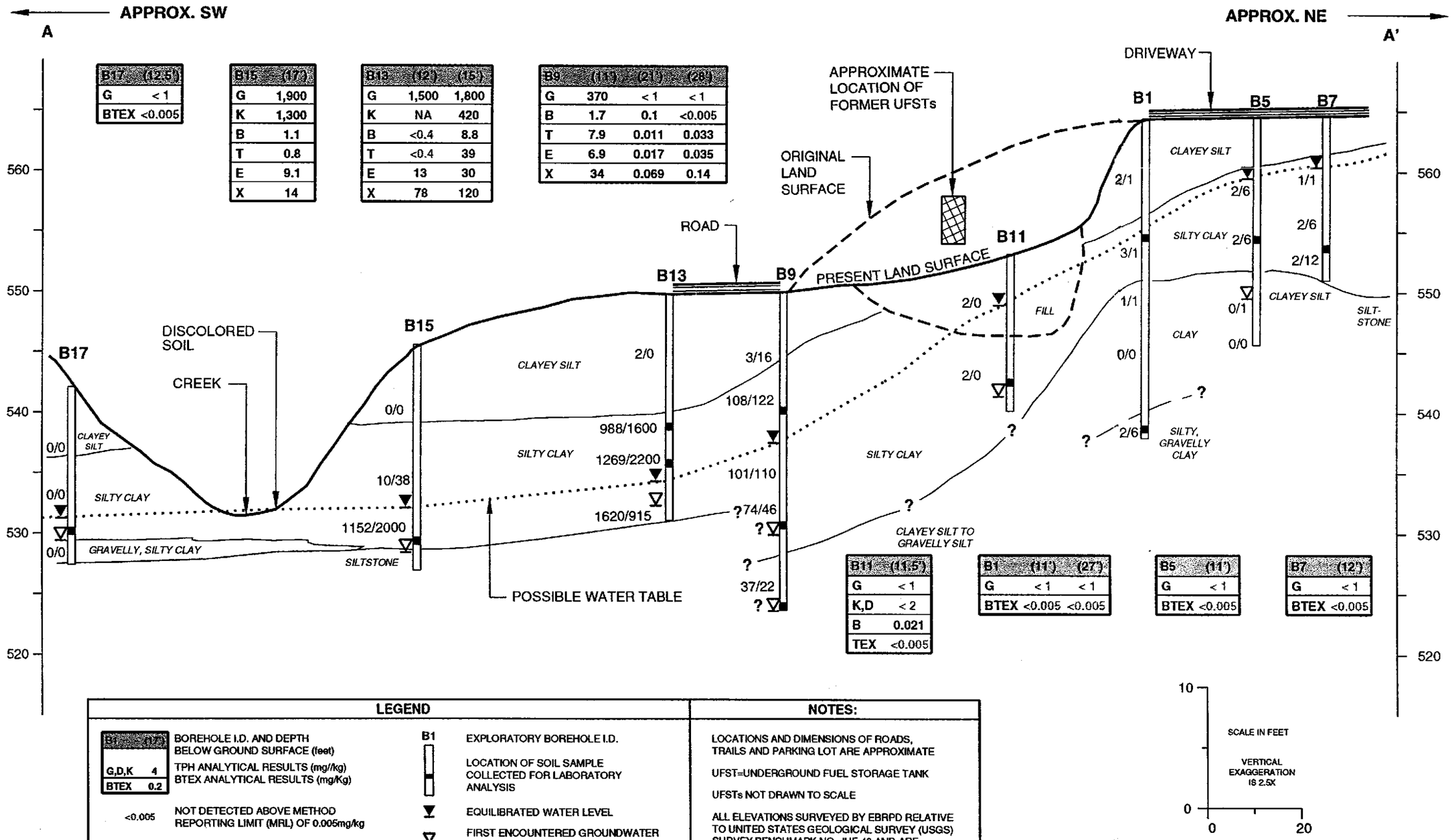
A-2

ENGINEERING-SCIENCE, INC.

SITE PLAN

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

FIGURE A-2



LEGEND

B1 (12') / G,D,K 4 / BTEX 0.2	BOREHOLE I.D. AND DEPTH BELOW GROUND SURFACE (feet); TPH ANALYTICAL RESULTS (mg//kg) BTEX ANALYTICAL RESULTS (mg/Kg)
<0.005	NOT DETECTED ABOVE METHOD REPORTING LIMIT (MRL) OF 0.005mg/kg
G	TOTAL PETROLEUM HYDROCARBONS (TPH) AS GASOLINE
K	TPH AS KEROSENE
D	TPH AS DIESEL
B	BENZENE
T	TOLUENE
E	ETHYLBENZENE
X	TOTAL XYLENES
B1	EXPLORATORY BOREHOLE I.D.
	LOCATION OF SOIL SAMPLE COLLECTED FOR LABORATORY ANALYSIS
▼	EQUILIBRATED WATER LEVEL
▽	FIRST ENCOUNTERED GROUNDWATER DURING DRILLING
10/40	PHOTOIONIZATION DETECTOR (PID)/ TOTAL HYDROCARBON VAPOR ANALYZER (THVA) READINGS IN PARTS PER MILLION BY VOLUME (ppmv)
NA	NOT ANALYZED

NOTES:

LOCATIONS AND DIMENSIONS OF ROADS, TRAILS AND PARKING LOT ARE APPROXIMATE

UFST=UNDERGROUND FUEL STORAGE TANK

UFSTs NOT DRAWN TO SCALE

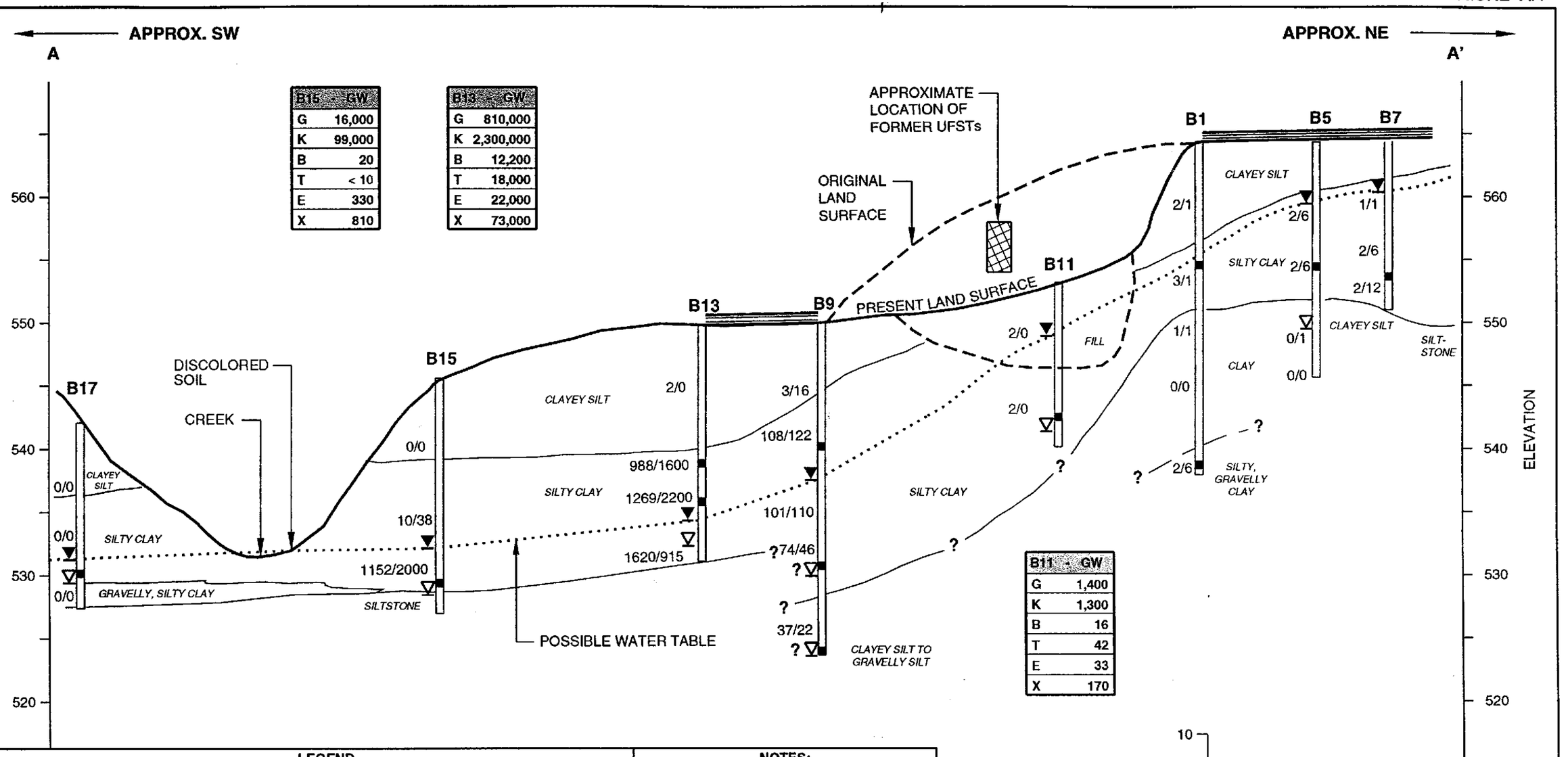
ALL ELEVATIONS SURVEYED BY EBRPD RELATIVE TO UNITED STATES GEOLOGICAL SURVEY (USGS) SURVEY BENCHMARK NO. JHF-49 AND ARE EXPRESSED AS FEET ABOVE MEAN SEA LEVEL (MSL)

10
SCALE IN FEET
VERTICAL EXAGGERATION IS 2.5X
0
0 20

CROSS SECTION A-A' WITH SOIL SAMPLE ANALYTICAL RESULTS

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

REV. 1 C274-36.DWG 08/16/94



LEGEND

B10 GW / G,D,K 4 / BTEX 0.2	SAMPLE I.D. TPH ANALYTICAL RESULTS (µg/L) BTEX ANALYTICAL RESULTS (µg/L)
< 10	NOT DETECTED ABOVE METHOD REPORTING LIMIT (MRL) OF 10 µg/L
G	TOTAL PETROLEUM HYDROCARBONS (TPH) AS GASOLINE
K	TPH AS KEROSENE
B	BENZENE
T	TOLUENE
E	ETHYLBENZENE
X	TOTAL XYLENES
B1	EXPLORATORY BOREHOLE I.D.
	LOCATION OF SOIL SAMPLE COLLECTED FOR LABORATORY ANALYSIS
▼	EQUILIBRATED WATER LEVEL
▽	FIRST ENCOUNTERED GROUNDWATER DURING DRILLING
10/40	PHOTOIONIZATION DETECTOR (PID)/ TOTAL HYDROCARBON VAPOR ANALYZER (THVA) READINGS IN PARTS PER MILLION BY VOLUME (ppmv)

NOTES:

LOCATIONS AND DIMENSIONS OF ROADS, TRAILS AND PARKING LOT ARE APPROXIMATE

UFST=UNDERGROUND FUEL STORAGE TANK

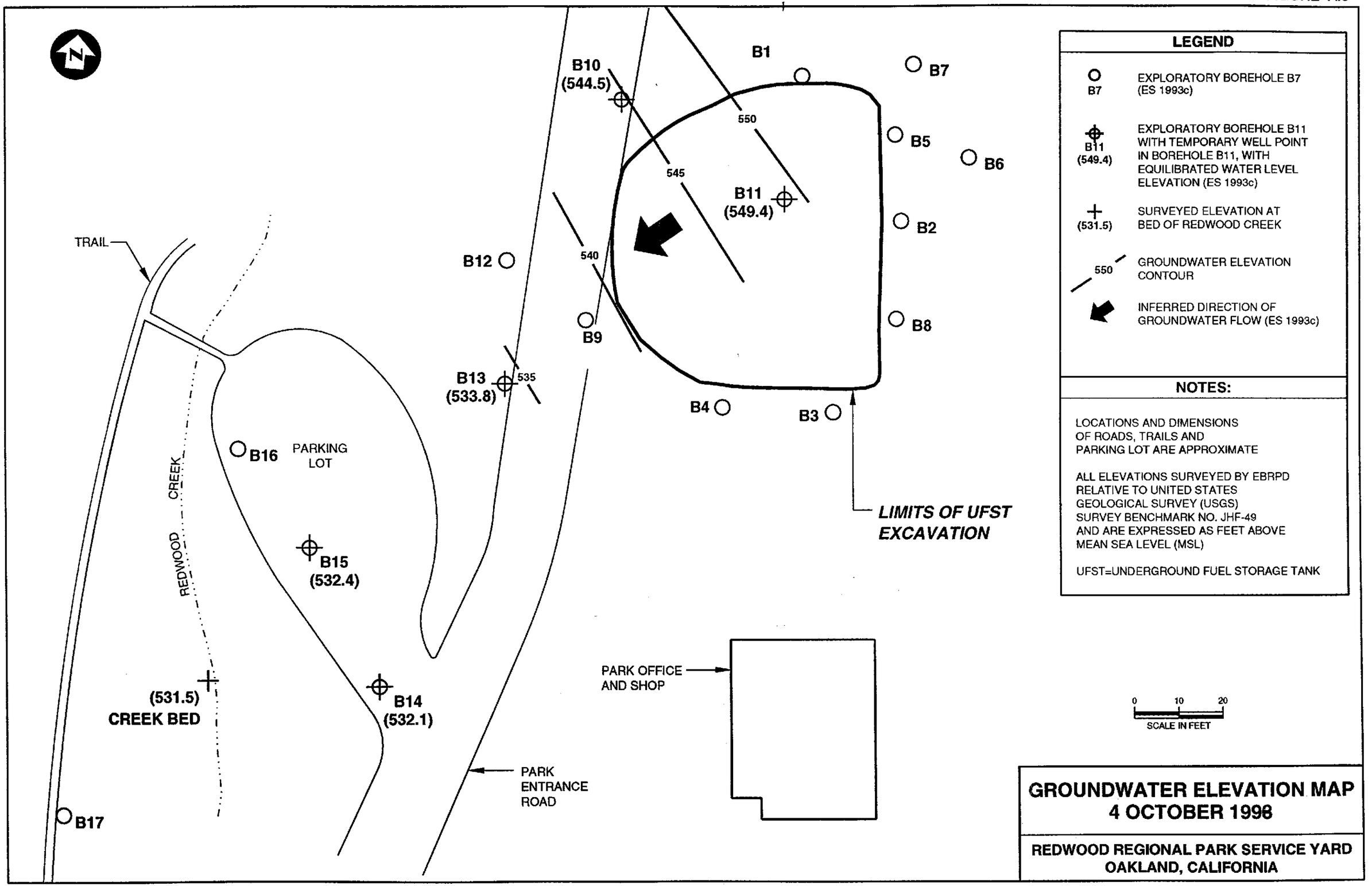
UFSTs NOT DRAWN TO SCALE

ALL ELEVATIONS SURVEYED BY EBRPD RELATIVE TO UNITED STATES GEOLOGICAL SURVEY (USGS) SURVEY BENCHMARK NO. JHF-49 AND ARE EXPRESSED AS FEET ABOVE MEAN SEA LEVEL (MSL)

CROSS SECTION A-A' WITH "GRAB" WATER SAMPLE ANALYTICAL RESULTS

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

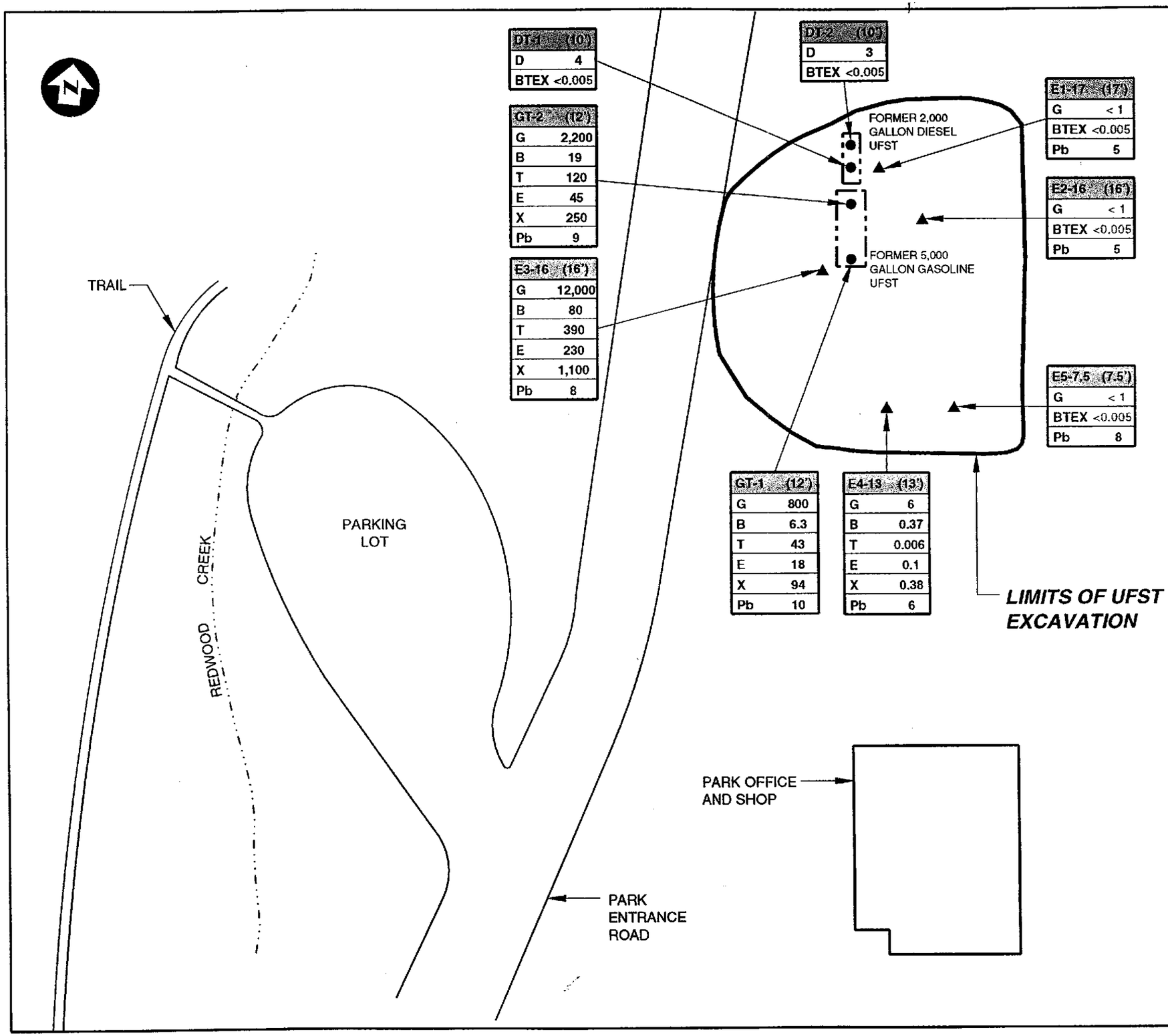
REV. 1 C274-38.DWG 06/16/94



GROUNDWATER ELEVATION MAP
4 OCTOBER 1998

REDWOOD REGIONAL PARK SERVICE YARD
OAKLAND, CALIFORNIA

REV. 1 C274-39.DWG 08/16/94



LEGEND

- ● — INITIAL SOIL SAMPLE COLLECTED 3 MAY 1993 FROM BENEATH UFST (ES 1993c)
- ▲ E4-13 — EXCAVATION CONFIRMATION SOIL SAMPLE COLLECTED AT DEPTH OF 13 FEET BELOW GRADE OF SERVICE YARD (ES 1993c)

E1-17 (17')	
G,D,K	4
BTEX	0.2
Pb	8

SOIL SAMPLE I.D. AND DEPTH BELOW GROUND SURFACE (feet)
TPH ANALYTICAL RESULTS (mg//kg)
BTEX ANALYTICAL RESULTS (mg/Kg)
TOTAL LEAD ANALYTICAL RESULTS (mg/Kg)

<0.005 — NOT DETECTED ABOVE METHOD REPORTING LIMIT (MRL) OF 0.005 mg/kg

- G — TOTAL PETROLEUM HYDROCARBONS (TPH) AS GASOLINE
- K — TPH AS KEROSENE
- D — TPH AS DIESEL
- B — BENZENE
- T — TOLUENE
- E — ETHYLBENZENE
- X — TOTAL XYLENES

NOTES:

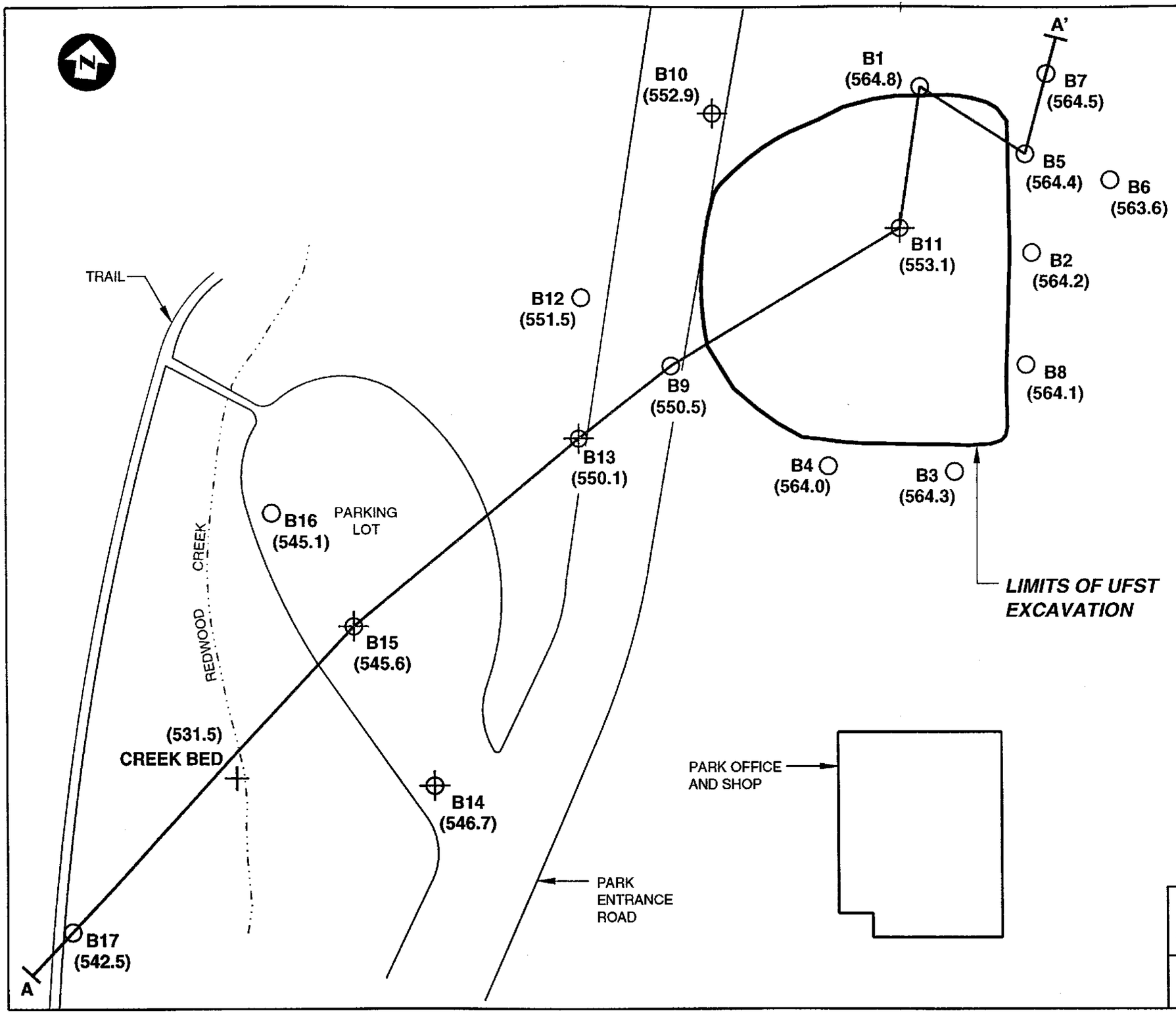
1. UFSTs NOT DRAWN TO SCALE
2. UFST=UNDERGROUND FUEL STORAGE TANK
3. LOCATIONS AND DIMENSIONS OF ROADS, TRAILS AND PARKING LOT ARE APPROXIMATE

0 10 20
SCALE IN FEET

UFST EXCAVATION PLAN AND CONFIRMATION SOIL SAMPLE ANALYTICAL RESULTS

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

REV. 1 C274-32.DWG 08/16/94



LEGEND

B7 (564.4)	EXPLORATORY BOREHOLE B7 AND ELEVATION OF ADJACENT GROUND SURFACE (ES 1993c)
B11 (553.1)	EXPLORATORY BOREHOLE B11 WITH TEMPORARY WELL POINT, AND ELEVATION OF ADJACENT GROUND SURFACE (ES 1993c)
(531.5)	SURVEYED ELEVATION AT BED OF REDWOOD CREEK
A — A'	CROSS SECTION A-A'

NOTES:

LOCATIONS AND DIMENSIONS OF ROADS, TRAILS AND PARKING LOT ARE APPROXIMATE

UFST=UNDERGROUND FUEL STORAGE TANK

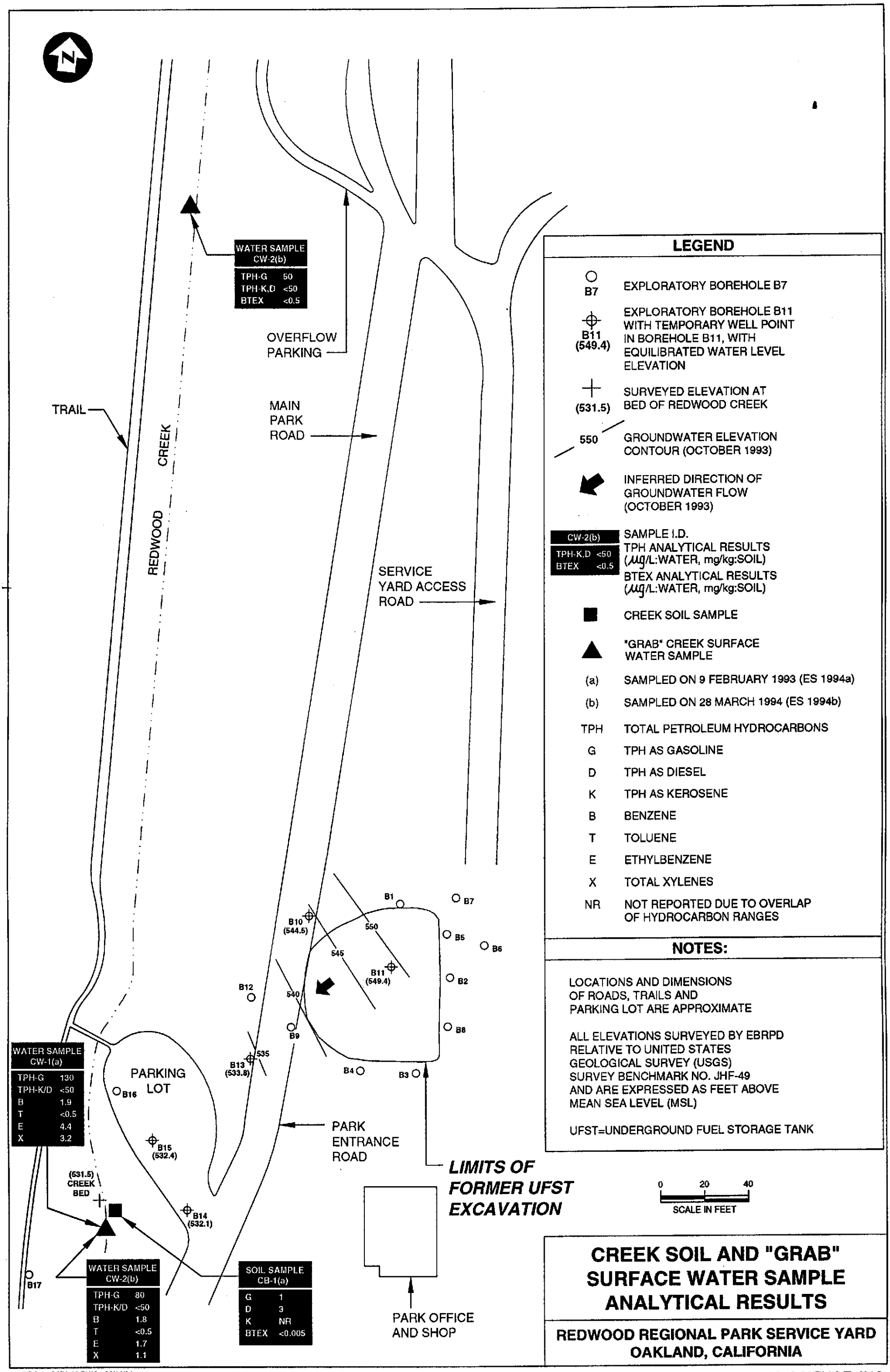
ALL ELEVATIONS SURVEYED BY EBRPD RELATIVE TO UNITED STATES GEOLOGICAL SURVEY (USGS) SURVEY BENCHMARK NO. JHF-49 AND ARE EXPRESSED AS FEET ABOVE MEAN SEA LEVEL (MSL)

0 10 20
SCALE IN FEET

EXPLORATORY BOREHOLE AND CROSS SECTION A-A' LOCATIONS

REDWOOD REGIONAL PARK SERVICE YARD
OAKLAND, CALIFORNIA

REV. 0 C274-33.DWG 08/16/94

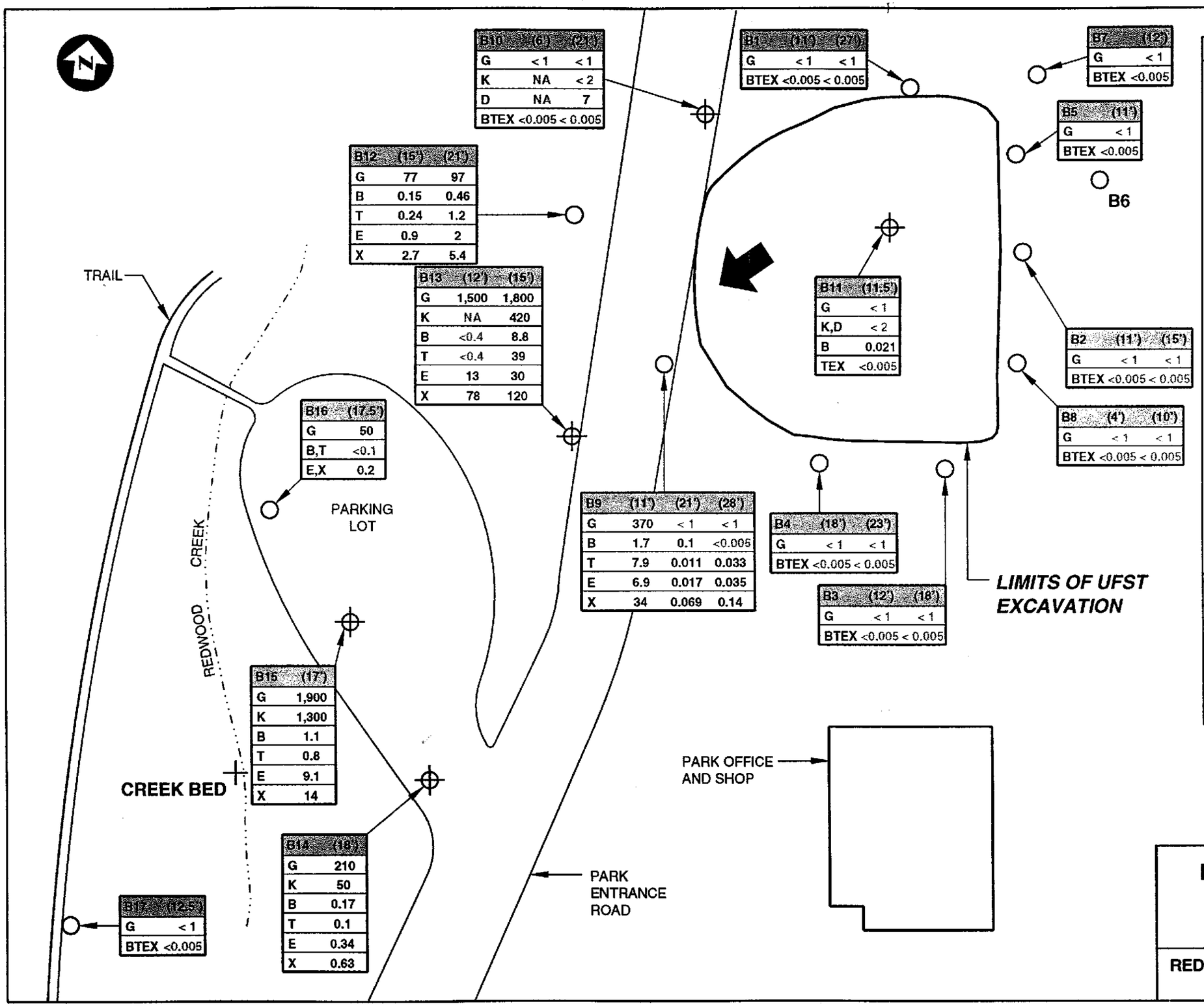


CREEK SOIL AND "GRAB" SURFACE WATER SAMPLE ANALYTICAL RESULTS

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

REV. 1 C276-12.DWG 08/16/94

ENGINEERING-SCIENCE, INC.



LEGEND

- B7 — EXPLORATORY BOREHOLE B7 (ES 1993c)
- B11 — EXPLORATORY BOREHOLE B11 WITH TEMPORARY WELL POINT (ES 1993c)
- INFERRED DIRECTION OF GROUNDWATER FLOW
- B10 (17') / G,D,K 4 / BTEX 0.2 / Pb 8 — SOIL SAMPLE I.D. AND DEPTH BELOW GROUND SURFACE (feet); TPH ANALYTICAL RESULTS (mg//kg) BTEX ANALYTICAL RESULTS (mg/Kg) TOTAL LEAD ANALYTICAL RESULTS (mg/Kg)
- <0.005 — NOT DETECTED ABOVE METHOD REPORTING LIMIT (MRL) OF 0.005 mg/kg
- G — TOTAL PETROLEUM HYDROCARBONS (TPH) AS GASOLINE
- K — TPH AS KEROSENE
- D — TPH AS DIESEL
- B — BENZENE
- T — TOLUENE
- E — ETHYLBENZENE
- X — TOTAL XYLENES
- NA — NOT ANALYZED

NOTES:

LOCATIONS AND DIMENSIONS OF ROADS, TRAILS AND PARKING LOT ARE APPROXIMATE

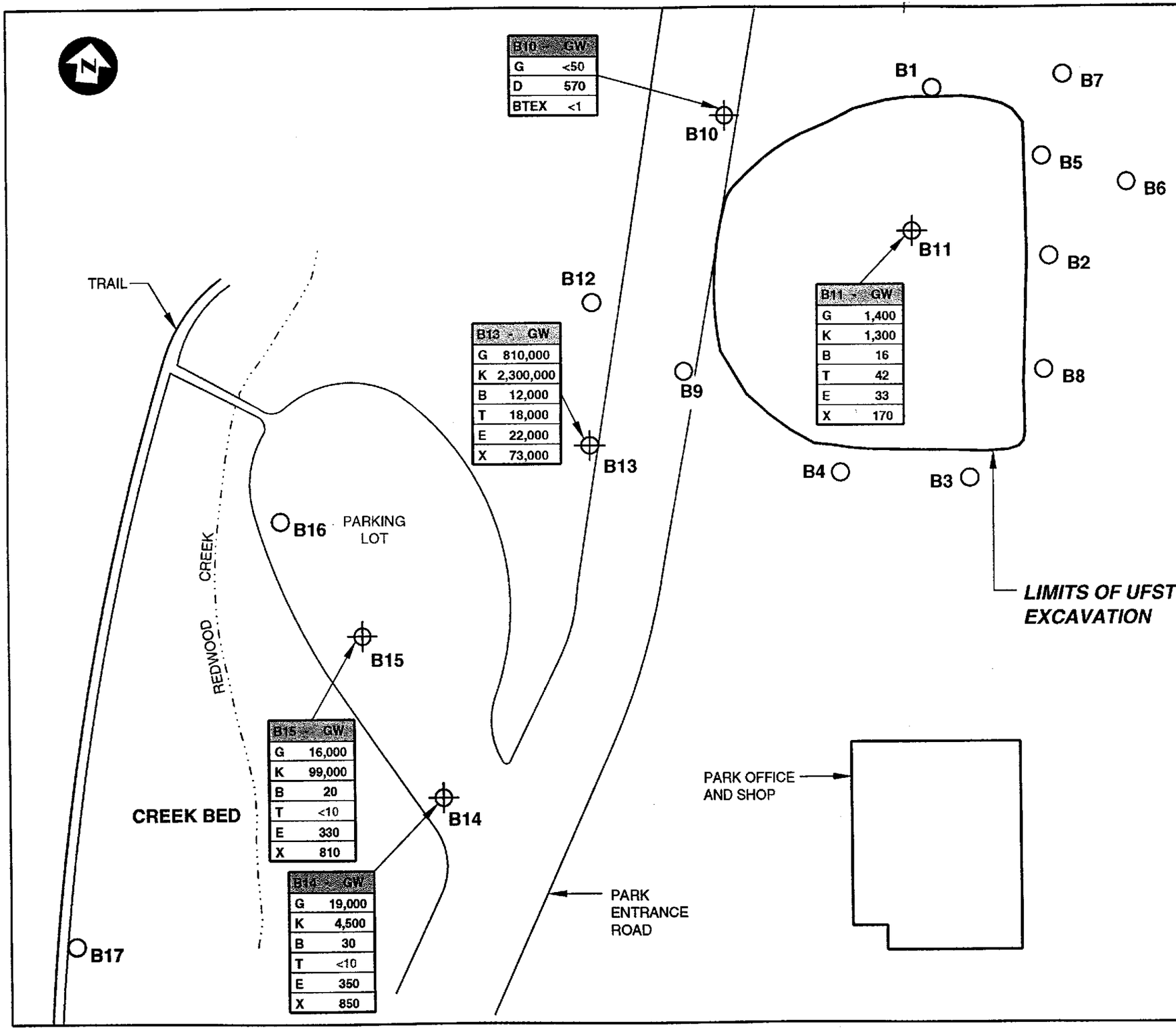
UFST=UNDERGROUND FUEL STORAGE TANK

0 10 20
SCALE IN FEET

EXPLORATORY BOREHOLE SOIL SAMPLE ANALYTICAL RESULTS

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

REV. 1 C274-35.DWG 08/16/94



LEGEND

- B7 — EXPLORATORY BOREHOLE B7 (ES 1993c)
- B11 — EXPLORATORY BOREHOLE B11 WITH TEMPORARY WELL POINT (ES 1993c)
- INFERRED DIRECTION OF GROUNDWATER FLOW
- B10 - GW / G,D,K <50 / BTEX <5 — SAMPLE I.D. TPH ANALYTICAL RESULTS (µg/L) BTEX ANALYTICAL RESULTS (µg/L)
- <50 — NOT DETECTED ABOVE METHOD REPORTING LIMIT (MRL) OF 0.005 µg/L

NOTES:

LOCATIONS AND DIMENSIONS OF ROADS, TRAILS AND PARKING LOT ARE APPROXIMATE

UFST=UNDERGROUND FUEL STORAGE TANK

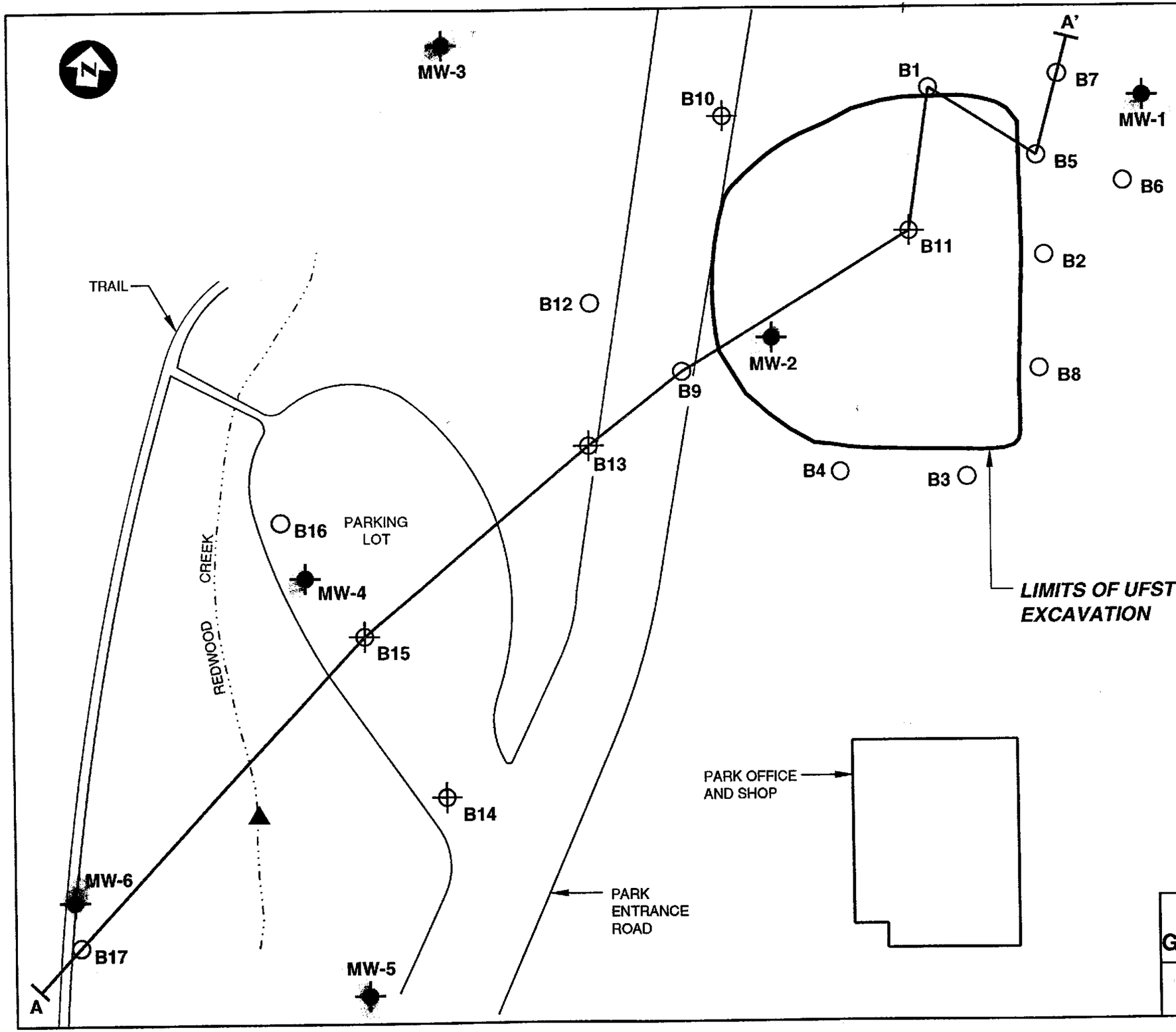
ALL ELEVATIONS SURVEYED BY EBRPD RELATIVE TO UNITED STATES GEOLOGICAL SURVEY (USGS) SURVEY BENCHMARK NO. JHF-49 AND ARE EXPRESSED AS FEET ABOVE MEAN SEA LEVEL (MSL)

0 10 20
SCALE IN FEET

TEMPORARY WELL POINT "GRAB" WATER SAMPLE ANALYTICAL RESULTS

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

REV. 2 C276-13.DWG 08/16/94



LEGEND

- B7 — EXPLORATORY BOREHOLE B7 (ES 1993c)
- B11 — EXPLORATORY BOREHOLE B11 WITH TEMPORARY WELL POINT (ES 1993c)
- A — A' — CROSS SECTION A-A'
- MW-1 — PROPOSED LOCATION OF OF GROUNDWATER MONITORING WELL MW-1
- AREA OF DISCOLORED SOIL AND CREEK SOIL AND "GRAB" SURFACE WATER SAMPLES (ES 1994a AND 1994b)
- INFERRED DIRECTION OF GROUNDWATER FLOW (OCTOBER 1993)

NOTES:

LOCATIONS AND DIMENSIONS OF ROADS, TRAILS AND PARKING LOT ARE APPROXIMATE

UFST=UNDERGROUND FUEL STORAGE TANK

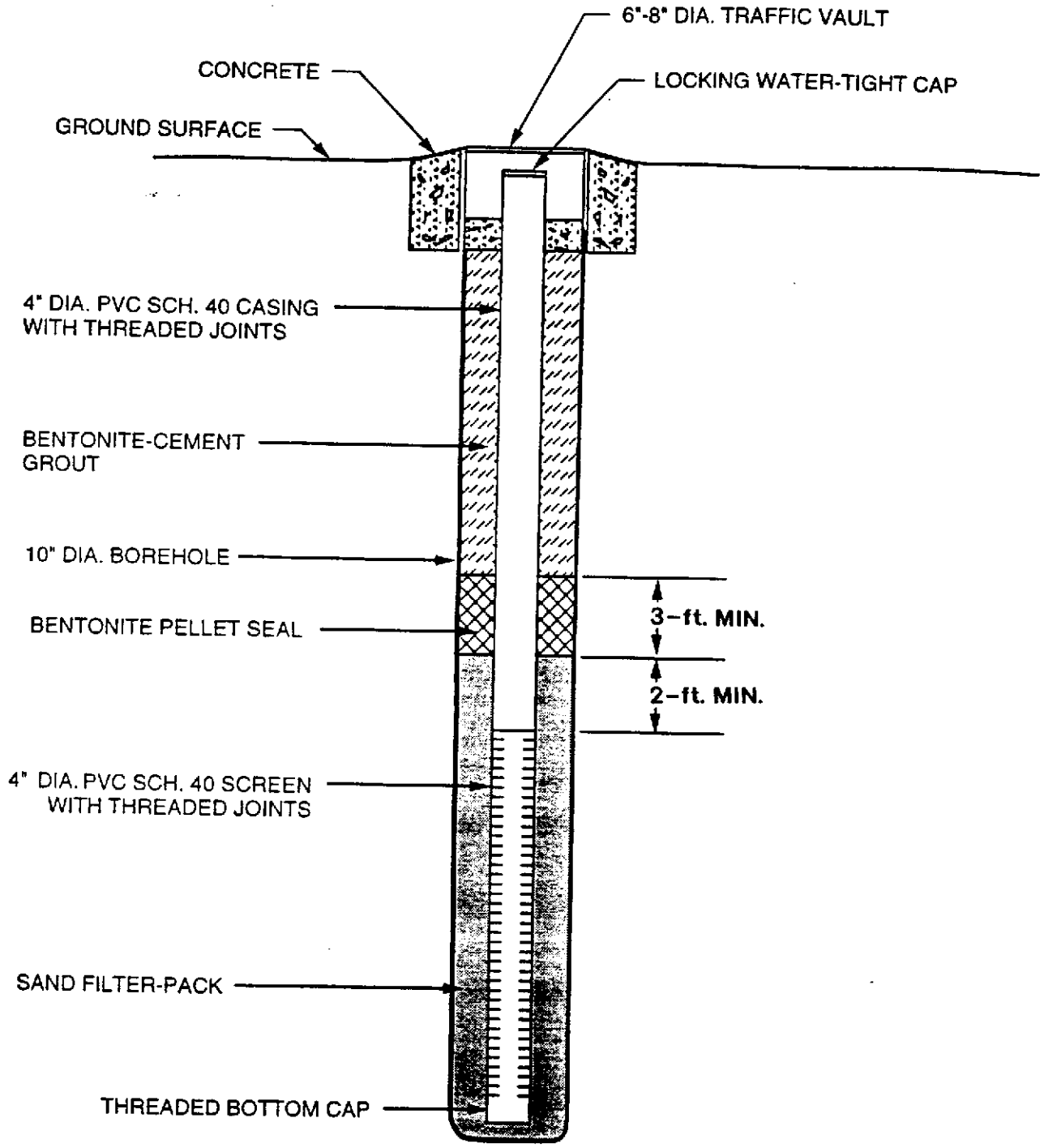
ALL ELEVATIONS SURVEYED BY EBRPD RELATIVE TO UNITED STATES GEOLOGICAL SURVEY (USGS) SURVEY BENCHMARK NO. JHF-49 AND ARE EXPRESSED AS FEET ABOVE MEAN SEA LEVEL (MSL)

0 10 20
SCALE IN FEET

PROPOSED LOCATIONS OF GROUNDWATER MONITORING WELLS

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

REV. 1 C274-34.DWG 08/16/94

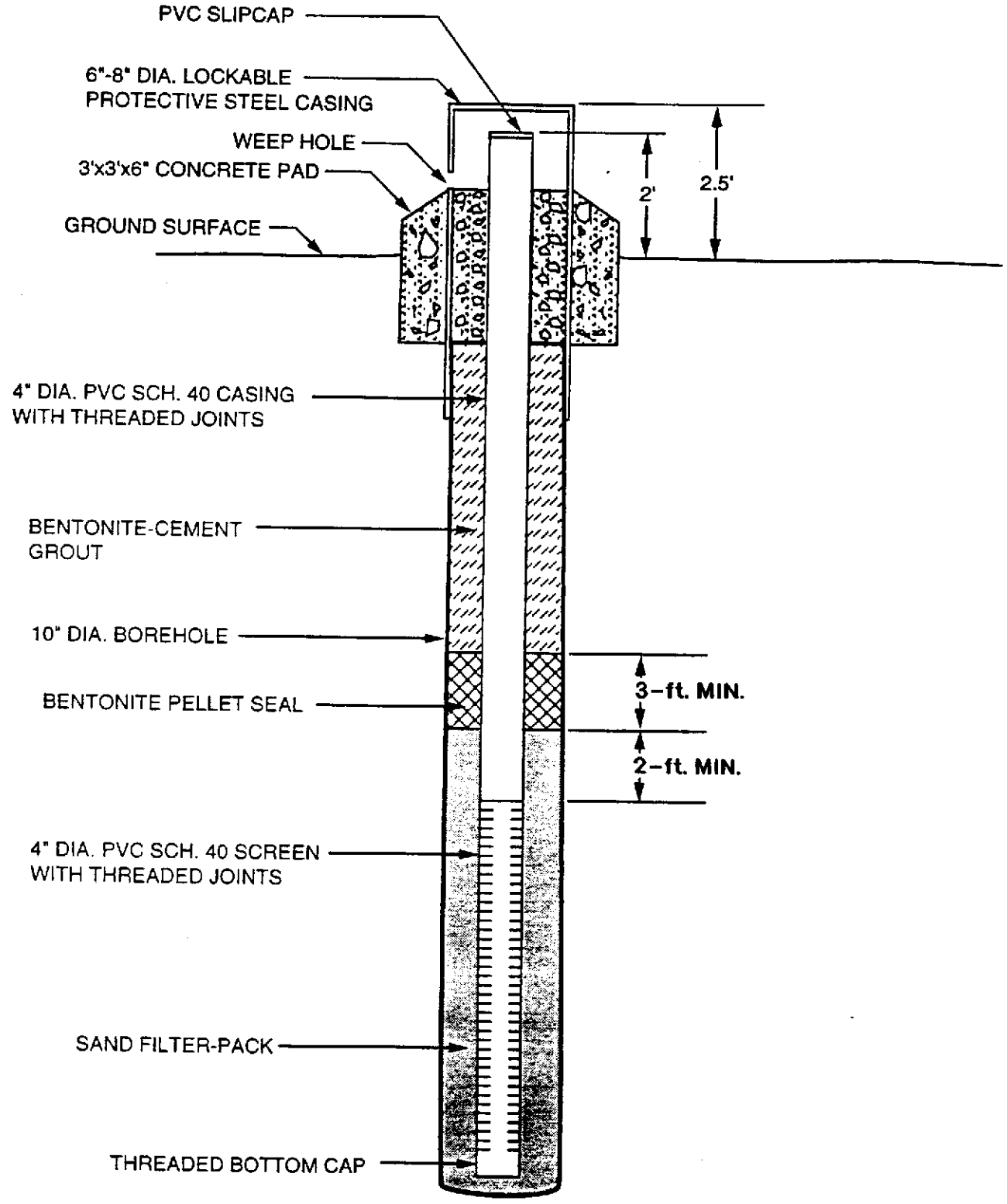


MONITORING WELL CONSTRUCTION SCHEMATIC FOR FLUSH FINISH

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

REV. 1 C343-01.DWG 07/29/94

ENGINEERING-SCIENCE, INC.



MONITORING WELL CONSTRUCTION SCHEMATIC FOR ABOVEGROUND COMPLETION

REDWOOD REGIONAL PARK SERVICE YARD OAKLAND, CALIFORNIA

REV. 1 C343-01.DWG 07/29/94

ENGINEERING-SCIENCE, INC.

APPENDIX B

TABLES

TABLE B.1
1993 TANK CLOSURE SOIL SAMPLE ANALYTICAL RESULTS
Redwood Regional Park Service Yard
Oakland, CA

Initial Samples (a)	Depth (feet below grade)	TPH–G	TPH–K	TPH–D	Benzene	Toluene	Total Xylenes	Ethyl–benzene	Lead (total)
		concentrations in mg/kg							
DT–1	10	NA	**	4	< 0.005	< 0.005	< 0.005	< 0.005	NA
DT–2	10	NA	< 1	3	< 0.005	< 0.005	< 0.005	< 0.005	NA
GT–1	12	800	NA	NA	6.3	43	94	18	10
GT–2	12	2,200	NA	NA	19	120	250	45	9
Excavation Confirmation Samples (b)									
E1–17	17	< 1	NA	NA	< 0.005	< 0.005	< 0.005	< 0.005	5
E2–16	16	< 1	NA	NA	< 0.005	< 0.005	< 0.005	< 0.005	5
E3–16	16	12,000	NA	NA	80	390	1,100	230	8
E4–13	13	6*	NA	NA	0.37	0.006***	0.38	0.1	6
E5–7.5	7.5	< 1	NA	NA	< 0.005	< 0.005	< 0.005	< 0.005	8

Notes:
TPH–G: Total Petroleum Hydrocarbons as Gasoline
TPH–D: Total Petroleum Hydrocarbons as Diesel Fuel
TPH–K: Total Petroleum Hydrocarbons as Kerosene

< 1 : Not detected above method reporting limit of 1 mg/kg
NA : Not Analyzed
* : Pattern does not match gasoline standard.
** : Kerosene Range not reported due to overlap of hydrocarbon range.
*** : Presence of this compound confirmed by second column;
however, the confirmation differed from the reported result by more than a factor of two.
(a) : Samples collected 3 May 1993 from directly beneath the tanks (Figure 1.3)
(b) : Samples collected 15 June 1993 from excavation base and sidewalls (Figure 1.3)

workgw11.wk1*
08/17/94

TABLE B.2
EXPLORATORY BOREHOLE SOIL SAMPLE ANALYTICAL RESULTS
Redwood Regional Park Service Yard
Oakland, CA

Sample I.D.	Depth (ft bgs)	TPH–G	TPH–K	TPH–D	Benzene	Toluene	Ethyl–benzene	Total Xylenes
		concentrations in mg/kg						
B1–11	11	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B1–27	27	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B2–11	11	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B2–15	15	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B3–12	12	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B3–18	18	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B4–18	18	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B4–23	23	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B5–11	11	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B7–12	12	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B8–4	4	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B8–10	10	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B9–11	11	370	NA	NA	1.7	7.9	6.9	34
B9–21	21	<1	NA	NA	0.1	0.011	0.017	0.069
B9–28	28	<1	NA	NA	<0.005	0.033 **	0.035	0.14
B10–6	6	<1	NA	NA	<0.005	<0.005	<0.005	<0.005
B10–21	21	<1	<2	7	<0.005	<0.005	<0.005	<0.005
B11–11.5	11.5	<1	<2	<2	0.021	<0.005	<0.005	<0.005
B12–14.5 *	14.5	150	NA	NA	0.24	0.44 **	1.7	4.6
B12–15	15	77	NA	NA	0.15 **	0.24 **	0.9	2.7 **
B12–21	21	97	NA	NA	0.46	1.2	2	5.4
B13–12	12	1,500	NA	NA	<0.4	<0.4	13	78
B13–15	15	1,800	420	(a)	8.8	39	30	120
B14–18	18	210	50	(a)	0.17 **	0.1 **	0.34 **	0.63 **
B15–17	17	1,900	1,300	(a)	1.1 **	0.8 **	9.1	14 **
B16–17.5	17.5	50	NA	NA	<0.1	<0.1	0.2 **	0.2 **
B17–12.5	12.5	<1	NA	NA	<0.005	<0.005	<0.005	<0.005

Notes:
TPH–G: Total Petroleum Hydrocarbons as Gasoline
TPH–D: Total Petroleum Hydrocarbons as Diesel Fuel
TPH–K: Total Petroleum Hydrocarbons as Kerosene
<1 : Not Detected above method reporting limit (MRL) of 1 mg/Kg
NA : Not Analyzed
(a) Diesel range not reported due to overlap of hydrocarbon ranges
* Field duplicate (quality control sample)
** Presence of this analyte confirmed by second column; however, the confirmation concentration differed from the reported result by more than a factor of two

workgw12.wk1
08/17/94

TABLE B.3
TEMPORARY WELL POINT "GRAB" WATER SAMPLE ANALYTICAL RESULTS
Redwood Regional Park Service Yard
Oakland, CA

Sample I.D.	TPH–G	TPH–K	TPH–D	Benzene	Toluene	Ethyl–benzene	Total Xylenes
	concentrations in μg/L						
B10–GW	<50	(a)	570	<1	<1	<1	<1
B11–GW	1,400	1,300	(b)	16	42	33	170
B13–GW	810,000	2,300,000	(b)	12,000	18,000	22,000 *	73,000 *
B14–GW	19,000	4,500	(b)	30 *	<10	350	850
B15–GW	16,000	99,000	(b)	20 *	<10	330 *	810 *

TPH–G: Total Petroleum Hydrocarbons as Gasoline
TPH–D: Total Petroleum Hydrocarbons as Diesel Fuel
TPH–K: Total Petroleum Hydrocarbons as Kerosene

<50	: Not Detected above method reporting limit (MRL) of 50 μg/l
(a)	Quantified as diesel due to overlap of hydrocarbon ranges
(b)	Quantified as kerosene due to overlap of hydrocarbon ranges
*	Presence of this analyte confirmed by second column; however, confirmation concentration differed from reported concentration by more than a factor of two.

workgw13.wk1
08/17/94

TABLE B.4
ANALYTICAL METHOD REPORTING LIMITS AND SAMPLE HOLDING TIMES
Groundwater Characterization Program

Contaminant	Analytical Method	Sample Matrix	MRL	Sample Holding Time (days) (a)
TPH–G	DTSC/LUFT	Soil	1 mg/kg	14
		Water	50 μg/L	14
TPH–D/K	DTSC/LUFT	Soil	1 mg/kg	40
		Water	50 μg/L	40
BTEX	EPA 8020	Soil	0.005 mg/kg	14
	EPA 602	Water	1 μg/L	14

Notes:

TPH–G: Total Petroleum Hydrocarbons as Gasoline

TPH–D: Total Petroleum Hydrocarbons as Diesel Fuel

TPH–K: Total Petroleum Hydrocarbons as Kerosene

DTSC/LUFT: California Department of Toxic Substances Control/Leaking Underground Fuel Tank Manual method

EPA: U.S. Environmental Protection Agency

(a) Holding time prior to analysis

workgw14.wk1"
08/19/94