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SOIL AND GROUNDWATER INVESTIGATION REPORT
4701 Martin Luther King, Jr. Way
Oakland, California

August 2002

Prepared for

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All engineering information, conclusions, and recommendations contained in this report have been prepared by a California Professional Engineer. All hydrogeologic and geologic information, conclusions, and recommendations contained in this report have been prepared by a California Registered Geologist.

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1.0 INTRODUCTION

This *Soil and Groundwater Investigation Report* has been prepared by West Environmental Services and Technology, Inc. (WEST) on behalf of Children's Hospital of Oakland for the property located at 4701 Martin Luther King, Jr. Way in Oakland, California ("the Site," Figure 1-1).

Samples collected during the removal of three underground storage tanks (USTs) at the Site in 1990, and subsequent investigation on the Site and across 47th Street revealed the presence of petroleum hydrocarbons in soil and groundwater at and in the vicinity of the Site. Based on the soil and groundwater results, the Alameda County Environmental Health Services (ACEHS) requested in a letter dated July 27, 2001 the installation of groundwater monitoring wells at the Site to "confirm if the contamination has indeed impacted the Site across 47th Street."

WEST submitted a *Soil and Groundwater Investigation Work Plan* in August 2001 ("Work Plan," WEST, 2001a) on behalf of Children's Hospital of Oakland that described the methods and procedures to be used in the installation of the monitoring wells. The Work Plan was approved by ACEHS on March 8, 2002. This report presents the results of the soil and groundwater investigation conducted pursuant to the approved Work Plan.

1.1 BACKGROUND

The Site consists of a gated and fenced parking lot for Children's Hospital. Children's Hospital developed the Site into a parking lot in the 1990s (Figure 1-1). From the 1930s until conversion to a parking lot, a two-story commercial building was present on the Site. In October 1990, three USTs were removed from the beneath the sidewalk adjacent to the Site. Soil samples collected from the UST excavations revealed the presence of petroleum hydrocarbons.

Environmental investigations of the former USTs at 4629 Martin Luther King Jr. Way, located to the south of the Site, also revealed the presence of petroleum hydrocarbons in soil and

2.0 SITE DESCRIPTION

2.1 SITE DESCRIPTION AND FEATURES

The Site is located along 47th Street, approximately 50 feet northwest of the intersection with Martin Luther King, Jr., Way in Oakland, California (Figure 2-1). The approximately one-half acre Site is located on two adjoining parcels identified as Alameda County Assessor's Parcel Numbers 013-1163-007 and 013-1163-009. The northern boundary of these two parcels overlies Temescal Creek. In the 1930s, a two-story commercial building was built on the Site. In the 1990s, the Site was redeveloped as a gated and fenced parking lot for the Children's Hospital. Portions of the sidewalk adjacent to the Site along 47th Street appear to have been replaced. The former USTs were located beneath the sidewalk adjacent to 47th Street.

2.2 GEOLOGY AND HYDROGEOLOGY

2.2.1 Regional Geologic Setting

The Site is located within the Coast Ranges geomorphic province, which is characterized by a series of parallel, northwesterly-trending, folded and faulted mountain chains. In this part of the providence, the gentle low-lying topography is composed of reworked marine and non-marine sedimentary deposits derived from steeply inclined hills located to the east of the Site. Quaternary (2 to 3 million years ago to the present) uplift resulted in the geologically recent formation of Bay Area hills and valleys including the East Bay hills. The uplift has caused erosion of the mountains and hills with accompanying deposition in the valleys.

2.2.2 Site Geology

The geologic materials encountered at the Site and neighboring property consist of silty clays, clays, sandy silts and sandy clays from ground surface to approximately 10 feet below ground surface. Sandy and gravelly clays, and clayey sands and gravels are present between

groundwater. Based on the presence of the petroleum hydrocarbons in soil and groundwater both on and off-site, the ACHCSA requested further investigation to characterize impacts and evaluate remedial options. This report presents the results of the soil and groundwater investigations performed to characterize the extent of petroleum hydrocarbons in soil and groundwater at and in the vicinity of the former USTs and their relationship to the property across 47th Street in Oakland, California.

approximately 10 feet to 34 below ground surface. A geologic cross-section is depicted on Figure 2-2.

2.2.3 Site Hydrogeology

Groundwater was encountered between 20 feet and 25 feet below ground surface in the four soil borings installed by WEST and six soil borings advanced at 4629 Martin Luther King, Jr. Way (SCI, 1993). Advanced Assessment and Remediation Services of Concord, California, measured depth to groundwater in four monitoring wells installed at the 4629 Martin Luther King, Jr. Way as part of a groundwater quarterly monitoring program. On February 7, 2000, the depth to groundwater was measured to be approximately 15 feet below ground surface. A review of previous quarterly groundwater measurements showed that depth to groundwater fluctuated between approximately 15 to 22 feet below ground surface between December 1998 and February 2000. The groundwater gradient was reported to be to the south-southeast.

Based on the topography in the area, the groundwater gradient direction was inferred to be towards the west and San Francisco Bay. Temescal Creek is located approximately 100 feet north of 47th Street and carries surface water to the San Francisco Bay. On May 16, 2002, depth to groundwater was measured to be between 17.52 feet below ground surface to 18.75 feet below ground surface in the three monitoring wells M-1, M-2 and M-3. The groundwater flow direction is towards the northwest at a gradient of 0.009 feet per foot (Table 2-1 and Figure 2-3).

3.0 SUMMARY OF INVESTIGATIONS

Consistent with the requirements of California Code of Regulations, Title 23 Waters, Division 3, Water Resources Control Board, Chapter 16 Underground Storage Tank Regulations, a series of site investigations have been performed to assess the nature and extent of the release and to evaluate cleanup requirements.

3.1 PREVIOUS INVESTIGATIONS

Investigations conducted at the Site between 1989 and 1990 included a site assessment, collection of soil samples and the removal of underground storage tanks and associated piping. Additional investigations conducted on the property across 47th Street at 4629 Martin Luther King Way, between 1993 and 2000 included soil and groundwater sampling, groundwater monitoring well installation, and quarterly monitoring. A discussion of these investigations and their findings is presented below. A summary of analytical results from the previous investigations is included in Tables 3-1 and 3-2.

3.1.1 Site Assessment

Robert Gils Associates, Inc. (RGA), of Emeryville, California, conducted an initial site assessment of the Site on November 27, 1989. The results of the site assessment identified asbestos containing materials within the existing building at the Site. In addition, underground storage tanks were identified as being located beneath the sidewalk along 47th Street adjacent to the Site as well as a hydraulic lift within the building that was used by a current occupant for auto repair operations.

3.1.2 Soil Sampling

In December 1989, RGA advanced three soil borings at the Site to evaluate soil contamination associated with the underground fuel tanks. RGA collected seven soil samples from the three

borings at approximately 5 feet and 12 feet below ground surface. One soil boring was located east and two soil borings were located west of the approximate location of an UST. One soil sample (3194), collected from stained soil observed in one of the borings was submitted for chemical analysis of total petroleum hydrocarbons as gasoline (TPHg) and diesel (TPHd), and benzene, toluene, ethyl benzene, and xylenes (BTEX). Analytical results did not reveal concentrations of TPHg, TPHd or BTEX above their respective reporting limits of 5 milligrams per kilogram (mg/kg), 10 mg/kg and 0.1 mg/kg (Table 3-1).

3.1.3 UST Removal

On October 9, 1990, three USTs were removed from the Site by Tom Daniels Excavating, Inc., of Danville, California, under the supervision of Aqua Terra Technologies of Walnut Creek, California. A 2000-gasoline UST, 2000-gallon heating oil UST and a 500-gallon heating oil UST were removed from the Site. One excavation was advanced to remove the gasoline UST and a separate excavation was advanced to remove both heating oil USTs (Figure 2-1). The USTs were transported off-site by H&H Environmental Services for recycling by Schnitzer Steel of Oakland, California.

Four soil samples were collected from the sidewalls of the UST excavations. Two soil samples (TSA1 and TSA2) were collected from the gasoline UST excavation and two soil samples (TSB and TSC) were collected from the heating oil UST and analyzed for TPHg, TPHd, and benzene, toluene, ethyl benzene, and xylenes. TPHg and TPHd were detected up to 590 mg/kg and 1,100 mg/kg, respectively, from the soil samples collected from the UST excavations. Toluene, ethyl benzene, and xylenes were detected in soil samples up to 1.5 mg/kg, 7.8 mg/kg and 9.3 mg/kg, respectively. Benzene was not detected above laboratory reporting limits (Table 3-1).

On October 17, 1990, additional sidewall samples were collected from the sidewalls of the two UST excavations following over-excavation to approximately 19 feet below ground surface. Analytical results of the additional sidewall soil samples revealed concentrations of TPHg up to 2,700 mg/kg, toluene up to 0.05 mg/kg, ethyl benzene up to 15 mg/kg and xylenes up to 55

mg/kg (Table 3-1). Benzene was not reported above the laboratory detection limit in the additional soil samples collected from the excavations (Table 3-1).

3.1.4 Investigations of Properties in the Vicinity of the Site

3.1.4.1 PRELIMINARY FUEL OIL CONTAMINATION ASSESSMENT

Subsurface Consultants, Inc., of Oakland, California (SCI) conducted a soil investigation in the vicinity of the USTs associated with the property located at 4629 Martin Luther King, Jr. Way in May 1993 (Figure 2-1). Three former heating oil USTs were located beneath the sidewalk along 47th Street adjacent to 4629 Martin Luther King, Jr. Way. Two former gasoline USTs were also located at 4629 Martin Luther King, Jr. Way, approximately 40 feet east of the former heating USTs (Figure 2-1). SCI advanced nine soil borings in the vicinity of the USTs. Results of soil field screening using a photo-ionization detector for organic compounds revealed total organic compound concentrations up to 10,000 parts per million at a depth of approximately 20 feet below ground surface. Twenty soil samples were collected between 11.5 feet and 30.5 feet below ground surface from the nine soil borings and submitted for chemical analysis for total extractable hydrocarbons as diesel and total oil and grease (SCI, 1993).

Analytical results revealed concentrations of oil and grease up to 760 mg/kg and total extractable hydrocarbons as diesel up to 1,700 mg/kg in soil boring 3 at 21 feet below ground surface (Table 3-1). Groundwater was encountered within the soil borings between approximately 23 feet and 27 feet below ground surface.

3.1.4.2 GROUNDWATER MONITORING

Quarterly groundwater monitoring was conducted five times at 4629 Martin Luther King, Jr. Way beginning in December 1998. On February 7, 2000, Advanced Assessment and Remediation Services of Concord, California (AARS) performed quarterly groundwater monitoring of four monitoring wells (MW-1 through MW-4) located at 4629 Martin Luther

King, Jr. Way (AARS, 2000). The groundwater samples were analyzed for BTEX, TPHg, TPHd, and TPH as motor oil (TPHmo) by Priority Environmental Labs of Milpitas, California.

Petroleum odors and sheen was observed during well purging activities in groundwater from monitoring wells MW-1, MW-3, and MW-4 (Figure 2-1). Analytical results of the groundwater samples collected in February 2000 revealed concentrations of TPHg, TPHd, and TPHmo up to 2,100 micrograms per liter (µg/l), 920 µg/l, and 3,800 µg/l, respectively. Analytical results from the groundwater sample collected from MW-4 revealed concentrations of benzene, toluene, ethyl benzene, and xylenes up to 3.4 µg/l, 2.2 µg/l, 8.9 µg/l, and 29 µg/l, respectively (Table 3-2).

3.1.5 Preliminary Site Assessment

In June 2000, a preliminary site assessment (PSA) was conducted for the USTs associated with 4701 Martin Luther King, Jr. Way. The PSA included the review of available records regarding soil and groundwater characterization at the Site and neighboring properties, discussions with property owner representatives, a review of available historical aerial photographs and collection of soil and groundwater samples.

A review of historical aerial photographs was conducted to identify historical Site conditions. Interviews with Children's Hospital personnel were conducted to obtain additional information regarding the location of the three former USTs at the Site and conditions at 4629 Martin Luther King, Jr. Way. Children's Hospital personnel identified areas where the sidewalk had been repaired in the vicinity of the former USTs along 47th Street.

Additional information provided by Children's Hospital personnel included soil boring logs from investigations performed by SCI at the 4629 Martin Luther King, Jr. Way property. A review of the soil boring logs indicated the presence of petroleum hydrocarbon odors and the presence of oil in soil samples collected during installation of these borings. Based on the records review, four soil borings (SB-1 through SB-4) were advanced at and in the vicinity of the Site for collection of grab groundwater samples (Figure 2-1).

3.1.5.1 GROUNDWATER SAMPLING

On June 27, 2000, four soil borings (SB-1 through SB-4) were installed in the vicinity of the three former underground storage tanks located at the Site (Figure 2-1). The soil borings were advanced by Gregg Drilling of Martinez, California a C-57 licensed contractor using hydraulic direct push equipment. Soil samples were collected at 5-foot intervals between 5 feet and 25 feet below ground surface. The soil core samples were also field screened using a photo-ionization detector (PID) to monitor for total organic compounds as vapor.

Four grab groundwater samples were collected from the four soil borings installed at the Site (Figure 2-1). The four grab groundwater samples were collected from the soil borings through a polyvinyl chloride (PVC) ¾-inch diameter casing with slotted screen placed within the boring. A stainless steel bailer was lowered within the PVC casing to collect the grab groundwater samples.

Field observations of the groundwater indicated a petroleum odor and sheen were present in the groundwater collected from SB-1, SB-2, and SB-4. No sheen or odor was observed in grab groundwater samples collected from SB-3.

3.1.5.2 GRAB GROUNDWATER ANALYTICAL RESULTS

Laboratory analytical results revealed concentrations of TPHg up to 24,000 µg/l and TPHd up to 150,000 µg/l in the groundwater sample collected from SB-4 (Table 3-2). The analytical result also revealed that TPHmo was detected in one sample, SB-2, at a concentration of 5,900 µg/l. The presence of suspended sediment was interpreted to have biased the groundwater sample results higher due to adsorption of petroleum hydrocarbons in sediment present in the grab groundwater samples.

Concentrations of toluene, ethyl benzene, and xylenes were also detected above laboratory reporting limits in the grab groundwater ample collected from SB-2 at 1.3 µg/l, 0.52 µg/l, and

6.7 µg/l, respectively (Table 3-2). Concentrations of TPHg, TPHd, TPHmo, MTBE and BTEX compounds were not reported above laboratory reporting limits from the grab groundwater sample collected from SB-3 (Table 3-2).

3.2 RECENT INVESTIGATIONS AT THE SITE

3.2.1 Soil Sampling

Three borings were advanced at the Site on April 26, 2002, for collection of soil and groundwater samples at the locations shown on Figure 2-1. The borings were advanced utilizing hydraulic direct push equipment. Soil samples were collected in 5-foot long disposable acetate liners within a hydraulic driven 5-foot long 3-inch diameter stainless steel core barrel.

Twelve soil samples were collected from the three soil borings. The soil samples were collected at approximately five-foot intervals commencing at approximately 10 feet below ground surface. The borings were terminated at approximately 30 to 34 feet below ground surface and completed as monitoring wells (M-1 through M-3). The monitoring well construction details are summarized in Table 3-3 and copies of the boring/well construction logs are included in Appendix A.

Soil samples for volatile chemical analyses were collected in accordance with USEPA Method 5035 using EnCore™ sample containers. Three disposable 5-milligram (5-mg) sample plugs were collected from each soil sample tube. The 5-mg sample plugs were pushed into the ends of the sample tube. After collection, the sample plugs were capped and placed in separate sealing foil pouches for transport to the analytical laboratory. Down-hole re-usable sampling equipment was decontaminated prior to reuse at each sampling location.

The samples for laboratory analysis were collected in appropriate sample containers, labeled and then placed in an insulated chilled cooler for transport to the laboratory. The samples were transported using USEPA chain-of-custody protocols to STL San Francisco of Pleasanton,

California, certified by the California Department of Health Services (DHS) Environmental Accreditation Laboratory Program (ELAP). A copy of the chain-of-custody forms is included in Appendix B.

The 12 soil samples were submitted for analysis of total petroleum hydrocarbons as diesel (TPHd) and gasoline (TPHg) by USEPA Method 8015 and petroleum related volatile organic compounds (VOCs) including benzene, toluene, ethyl benzene, total xylenes and MTBE by USEPA Method 8021 with confirmation of MTBE by USEPA Method 8260B.

3.2.1.1 SOIL SAMPLE ANALYTICAL RESULTS

Soil samples were collected from boring M-1 between 10 feet and 25 feet below ground surface located in the vicinity of the former heating oil USTs at 4629 Martin Luther King, Jr. Way. Laboratory analysis revealed TPHd between 1.1 mg/kg at 15 feet below ground surface to 2.8 mg/kg at 25 feet below ground surface. The laboratory analyses did not reveal the presence of TPHg, BTEX or MTBE in the four soil samples collected from boring M-1 above their respective laboratory reporting limits of 1.0 mg/kg and 0.0050 mg/kg (Table 3-1).

Laboratory analysis of the soil samples collected from boring M-2, advanced in the vicinity of the former USTs at 4701 Martin Luther King, Jr. Way, revealed TPHd and TPHg at 7.5 mg/kg and 2.4 mg/kg, respectively in the sample collected from 20 feet below ground surface. The other three samples did not reveal the presence of TPHd or TPHg above the laboratory reporting limits. Laboratory analysis of the four samples from boring M-2 also did not reveal the presence of the petroleum related VOCs (BTEX and MTBE) above the laboratory reporting limit of 0.0050 mg/kg.

The soil samples from boring M-3, advanced in the vicinity of the former gasoline UST at 4629 Martin Luther King, Jr. Way revealed the maximum TPHd and TPHg concentration during this investigation at 8.5 mg/kg and 110 mg/kg, respectively in the soil sample collected from 20 feet below ground surface. Laboratory analysis also revealed the presence of TPHd at 2.4 mg/kg and

4.7 mg/kg in the samples collected from 10 and 15 feet below ground surface, respectively, in boring M-3. Laboratory analysis of the four samples from boring M-3 did not reveal the presence of the petroleum related VOCs (BTEX and MTBE) above the laboratory reporting limit of 0.0050 mg/kg. The results of the laboratory analyses are summarized in Table 3-1 and presented on Figure 3-1. A copy of the laboratory certificates is included in Appendix B.

3.2.2 Groundwater Monitoring Well Installation

Following collection of soil samples, the soil borings were converted to groundwater monitoring wells. The groundwater monitoring wells were constructed of 1.5-inch diameter schedule 40 polyvinyl chloride (PVC) slotted screen with 0.010-inch factory machined slots. The slotted screen portion was pre-packed with a sand filter pack consisting of #2/16 graded sand, and was placed within the borehole across the groundwater table encountered during the soil sampling activities to allow for seasonal fluctuation of the water table. Blank 1.5-inch diameter schedule 40 PVC was used to complete the wells to the ground surface. A 2-foot seal consisting of bentonite pellets was placed above the sand filter pack. A Portland cement grout sanitary seal was placed above the bentonite seal to the ground surface. A flush mounted traffic rated steel protective box was placed over the top of the well casing. The well casings were installed with locking well caps for security.

3.2.3 Groundwater Monitoring Well Elevation and Location Survey

Following groundwater monitoring well installation, the elevations of the top of the well casings were surveyed by a California State licensed land surveyor to the nearest 0.01-foot above mean sea level (MSL). The well elevation survey was used to calculate the groundwater elevation at each monitoring well location for determination of groundwater flow direction and gradient. The monitoring wells were also surveyed to generate monitoring well location and elevation data for electronic data delivery (EDD) as required by Assembly Bill 2886 (Water Code Sections 13195-13198). As outlined in the requirements by the California State Water Resources Control Board (Article 12, Chapter 16, Division 3, Title 23 of the California Code of Regulations), data

generated from this investigation will be submitted in both hard copy and electronic format. A copy of the surveying documentation is included in Appendix C.

3.2.4 Groundwater Sampling

Groundwater samples were collected on May 15, 2002 from the groundwater monitoring wells using a low-flow purge and sample technique. Depth to groundwater measurements were made on May 16, 2002 (Table 2-1 and Figure 2-3). The groundwater samples were collected by lowering a stainless steel weight attached to ¼-inch diameter polyethylene disposable tubing attached to a peristaltic pump outfitted with an electronic flow controller. Groundwater parameters including pH, dissolved oxygen, temperature, and electrical conductivity were measured every 3 minutes for a minimum of 15 minutes to monitor groundwater stability. Once groundwater parameters stabilized to within 10 percent of subsequent measurements, the groundwater sample was collected. A copy of the groundwater sample field data sheets is included in Appendix C.

Groundwater from the monitoring wells was transferred to a laboratory supplied sample container. Groundwater samples for TPHg, BTEX, and MTBE chemical analyses were collected using zero headspace 40-milliliter glass volatile organic analysis (VOA) vials preserved with hydrochloric acid. Groundwater samples for TPHd were collected in 1-liter amber jars.

The samples for laboratory analysis were collected in appropriate sample containers, labeled and then placed in an insulated chilled cooler for transport to the laboratory. The samples were transported using USEPA chain-of-custody protocols to K Prime Analytical Laboratories of Santa Rosa, California, certified by the California Department of Health Services (DHS) Environmental Accreditation Laboratory Program (ELAP). A copy of the chain-of-custody forms is included in Appendix B.

3.2.4.1 GROUNDWATER SAMPLE ANALYTICAL RESULTS - TPH

The laboratory analysis of the groundwater sample from monitoring well M-1, located in the vicinity of the former heating oil USTs revealed 136 µg/l of TPHd. The laboratory analysis of the groundwater sample from M-1 did not reveal the presence of TPHg above the reporting limit of 50 µg/l.

The groundwater sample collected from groundwater water monitoring well M-2, downgradient of M-3, revealed 148 µg/l of TPHd and 113 µg/l of TPHg. The highest reported concentrations of TPHd and TPHg were in the groundwater samples collected from monitoring well M-3 at 231 µg/l and 298 µg/l, respectively. A summary of the groundwater laboratory analytical results is presented in Table 3-2 and on Figure 3-2. A copy of the laboratory certificates is included in Appendix B.

3.2.4.2 GROUNDWATER SAMPLE ANALYTICAL RESULTS - VOCS

The petroleum hydrocarbon related VOCs, benzene, toluene and ethyl benzene were not reported to be present in the groundwater samples from M-1, M-2 or M-3 above the reporting limit of 0.500 µg/l. MTBE was reported to be present in the groundwater sample from M-1 at 2.04 µg/l using USEPA Method 8021. Confirmation analysis of the groundwater sampling for MTBE using USEPA Method 8260B revealed MTBE at 3.73 µg/l.

Total xylenes were reported at 2.95 µg/l in the sample from groundwater monitoring well M-2. Laboratory analysis of the groundwater sample from monitoring well M-2 did not reveal MTBE above the reporting limit of 2.0 µg/l. Total xylenes were reported in groundwater at 5.11 µg/l in the primary sample and 4.46 µg/l in the duplicate sample from M-3. MTBE was not detected above the laboratory reporting limit of 2.0 µg/l in the sample collected from monitoring well M-3.

A summary of the groundwater laboratory analytical results is presented in Table 3-2 and on Figure 3-2. A copy of the laboratory certificates is included in Appendix B.

4.0 APPLICABLE REGULATORY SCREENING CRITERIA

Investigations at and in the vicinity of the Site revealed measurable concentrations of petroleum hydrocarbons and petroleum related VOCs in soil and groundwater. Recent investigations revealed TPHd and TPHg in soil and groundwater and the petroleum related VOCs MTBE and xylenes in groundwater. The assessment of the potential impacts associated with existing conditions requires an accurate conceptual model and comparison with appropriate evaluation criteria.

An accurate Conceptual Site Model (CSM) incorporates all of the Site data and describes the fate and distribution of chemicals of concern, as well as potential receptors to aid in identifying appropriate evaluation criteria. Through a comparison of the data to applicable criteria, the CSM has been used to assess the adequacy of the Site characterization and aid in making decisions regarding conditions at the Site.

4.1 CONCEPTUAL SITE MODEL

The CSM for the Site incorporates known historical operation at and in the vicinity of the Site, geology and hydrogeology, properties of the chemicals at the Site, suspected transport mechanism, and potential exposure scenarios. Investigations have revealed petroleum hydrocarbons in soil and groundwater.

A Conceptual Site Model (CSM) has been developed to assist in the evaluation of potential impacts associated with residual chemicals at the Site through the progressive assemblage of information regarding the distribution of chemicals the Site and its setting (SWRCB, 2000). The CSM has been used to streamline evaluations of potential links between contamination sources and potential receptors through potential contaminant release mechanisms, potential pathways, and exposure routes. In addition, by comparing Site data to applicable criteria, the CSM has been used to assess the adequacy of the site characterization and identify whether more information is required, and to make decisions regarding remediation (Figure 4-1).

4.2 SCREENING LEVEL ASSESSMENT

A screening level assessment was prepared to evaluate potential risks to human health and the environment posed by the chemicals at the Site. The screening level assessment consisted of three components: (1) identification of potential exposure pathways, (2) identification of appropriate screening levels for each media, and (3) a comparative analysis.

4.2.1 Exposure Pathways Evaluation

Exposure pathways for petroleum hydrocarbons and VOCs at the Site have been evaluated to assess the potential impacts to human health and the environment. Potential human exposure to VOCs is limited to ingestion of groundwater to inhalation of VOCs that have migrated from groundwater. Direct exposure to groundwater at the Site was not identified as a complete exposure pathway because institutional controls limit use of groundwater in the upper 50 feet. The groundwater at the Site has the potential to migrate to the surface water of Temescal Creek. Based on the distance and the nature of the petroleum hydrocarbons at the Site, it is anticipated that natural attenuation processes would reduce concentrations prior to impacting surface water.

4.2.2 Identification of Screening Levels

Based on the identified exposure pathways, applicable screening criteria were selected for soil and groundwater. The screening levels combine current default California Environmental Protection Agency (CalEPA) toxicity values with standard exposure factors to estimate acceptable concentrations in the environmental media that are protective of humans and the environment. The screening levels are designed to identify concentrations in environmental media that require further evaluation, trigger further investigation, and provide an initial cleanup goal, as applicable. Concentrations above these levels should not automatically trigger a response action. However, exceeding a screening level suggests that further evaluation of the risks potentially posed by site contaminants is appropriate.

4.2.2.1 RISK-BASED SCREENING CRITERIA

The California Regional Water Quality Control Board – San Francisco Region (Regional Board) has identified Tier 1 risk-based screening levels (RBSLs) for TPHd, TPHg, xylenes and MTBE (Regional Board, 2001). The Regional Board RBSLs "are considered to be very conservative [and] the presence of a chemical at concentrations below the corresponding RBSL can be assumed to not pose a significant threat to human health and the environment." While a chemical may be measured at concentrations above the Regional Board RBSL, it "does not necessarily indicate that adverse impact to human health or the environment are occurring, [it] simply indicates that potential for adverse impacts may exist and that additional evaluation is warranted."

In developing the RBSLs, the Regional Board has considered exposure pathways to humans, such as dermal contact and inhalation, migration of soil leachate to groundwater, and urban area eco-toxicity criteria. The Regional Board RBSLs for surface soil and groundwater screening criteria for the protection of indoor air in residential land use areas where groundwater is a potential drinking water resource have been used to evaluate the concentrations of chemicals measured at the Site (Regional Board, 2001).

4.2.3 Soil Screening Levels

In lieu of site-specific regulatory guidance or risk evaluations, soil remedial cleanup levels have been developed based on the Regional Board RBSLs (Regional Board, 2001). The Regional Board has identified Tier 1 risk-based screening levels (RBSLs) for total petroleum hydrocarbons, BTEX and MTBE.

The RBSLs for petroleum hydrocarbons have been developed based on protection of groundwater at 100 mg/kg. Screening levels for soil are summarized in Table 3-1.

4.2.4 Groundwater Screening Levels

In general, target cleanup levels for groundwater are based on the numerical water quality objectives designated in the Water Quality Control Plan for the San Francisco Bay Region or Basin Plan (Regional Board, 1995). The groundwater beneath the Site lies within the groundwater basin of the East Bay Plain and has been designated to have the potential beneficial use of municipal and domestic water supply (MUN). The Basin Plan for the California Regional Water Quality Control Board – San Francisco Region has identified that maximum contaminant levels (MCLs) as numerical water quality objectives. The State Department of Health Services (DHS) has set MCLs for xylenes in drinking water at 1,750 ppb (Cal. Code of Regs., tit. 22, § 64444). The State of California has set the MCL for MTBE at 5.0 µg/l.

The Basin Plan also includes narrative water quality objectives that require that waters "shall not contain taste- or odor-producing substances in concentrations that...adversely affect beneficial uses." Based on the taste and odor threshold, the groundwater remedial goal for TPHg and TPHd is 100 µg/l, equivalent to three threshold odor numbers (TON), the United States Environmental Protection Agency secondary MCL for nuisance odor. Similarly, the screening level for total xylenes was selected based on the organoleptic standards of 13 µg/l.

5.0 EVALUATION OF FINDINGS

The following presents a discussion of the results of the April and May 2002 soil and groundwater investigations relative to the identified potentially relevant screening level criteria.

5.1 SOIL EVALUATION

The soil samples from M-1, M-2 and M-3 did not reveal the presence of TPHd, BTEX and MTBE above their respective screening levels. The soil sample from M-3 at 20 feet below ground surface revealed the highest TPHd in soil at 8.5 mg/kg, less than the 100 mg/kg RBSL. TPHd was detected above the laboratory reporting limit only in the soil sample from 20 feet below surface (the approximate depth of the groundwater surface) in boring M-2 at 7.5 mg/kg.

Soil samples from boring M-1 revealed TPHd at 2.7 mg/kg, 1.1 mg/kg, 2.9 mg/kg and 2.8 mg/kg at 10, 15, 20 and 25 feet below ground surface, respectively. The TPHd in soil samples from boring M-1, while not above the RBSL is more indicative of residual petroleum hydrocarbons originating above the groundwater surface, e.g., a release from one of the former heating oil USTs within 10 feet of the boring located along the south side of 47th Street. Similar distributions of TPHd concentrations in soil were found in samples from boring M-3, with detections of TPHd at 10 feet (2.4 mg/kg), 15 feet (4.7 mg/kg) and 20 feet (8.5 mg/kg) below ground surface.

The soil sample from 20 feet below ground surface at M-3 revealed the highest concentration of TPHg at 110 mg/kg, greater than the 100 mg/kg screening level. Boring M-3 was advanced within approximately 10 feet of a former gasoline UST at 4629 Martin Luther King, Jr. Way. The highest TPHg soil samples from borings M-1 (less than 1.0 mg/kg) and M-2 (2.4 mg/kg) were over 45 times lower than the concentrations in samples from M-3. The presence of TPHg in the saturated zone at concentrations above the RBSL and attenuation in the downgradient groundwater direction is suggestive of a source of TPHg to groundwater in the vicinity of M-3.

Based on the comparison of the concentrations of petroleum hydrocarbons in soil from the April 2002 investigation with the RBSLs, with the exception of the soil sample from M-3 at 20 feet below ground surface, it does not appear that petroleum hydrocarbons in soil are contributing to groundwater degradation.

5.2 GROUNDWATER EVALUATION

Groundwater samples from M-1, M-2 and M-3 in May 2002 revealed TPHd and TPHg above their RBSL of 100 µg/l. Benzene, toluene, and ethyl benzene were not reported to be present in groundwater above laboratory reporting limits or RBSLs in the samples from the three monitoring wells installed during this investigation. MTBE was reported to be present in only the samples collected from M-1, up to 3.73 µg/l, less than the RBSL of 5.0 µg/l.

Laboratory analysis of the samples for TPHd revealed 136 µg/l in M-1, 148 µg/l in M-2 and 298 µg/l and 254 µg/l (duplicate sample) in M-3, above the screening levels for TPHd of 100 µg/l. The highest concentrations were reported in upgradient monitoring well M-3, in the vicinity of the former USTs at 4629 Martin Luther King, Jr. Way. The concentrations of TPHd in groundwater from M-1 and in M-2 were approximately one-half of those detected in M-3. The distribution of TPHd in the samples from the monitoring wells indicates that concentrations attenuate in the downgradient direction from M-3. The relative attenuation in the downgradient direction suggest that the concentrations of TPHd in groundwater likely attenuate to below the RBSL of 100 µg/l within 50 feet of M-2, and before impacting surface water of Temescal Creek.

The laboratory analysis for TPHg in the samples from the monitoring wells revealed a similar pattern to TPHd with concentrations above the groundwater RBSL of 100 µg/l in M-2 and M-3. The highest concentrations of TPHg in groundwater were in the samples from M-3 at 231 µg/l and 217 µg/l (duplicate sample). The concentration of TPHg in groundwater in the sample from M-2 at 113 µg/l was reported at approximately one-half of the concentration in M-3. The

groundwater sample from M-1 did not reveal the presence of TPHg above the laboratory limit or the RBSL.

The groundwater sample from upgradient monitoring well M-3 revealed the highest concentrations of total xylenes at 5.11 µg/l and 4.46 µg/l (duplicate sample), less than the RBSL of 13 µg/l. The groundwater sample from M-2, approximately 100 feet downgradient, revealed total xylenes at 2.95 µg/l, approximately one-half (57 percent) of the concentration reported in the sample from upgradient monitoring well M-3. Xylenes are associated with TPHg and typically are found at higher concentrations near the source area.

The groundwater sample from monitoring well M-1 revealed MTBE at 2.04 µg/l (USEPA Method 8021) and 3.73 µg/l (confirmation by USEPA Method 8260B) below the RBSL of 5.0 µg/l. The presence of MTBE at this location does not appear associated with releases from the heating oil USTs at 4629 Martin Luther King, Jr. Way. The presence of the MTBE in groundwater at M-1 may be associated with upgradient offsite releases that have migrated to this location.

Based on the groundwater flow direction and the relative concentrations of petroleum hydrocarbons in soil and groundwater, it appears that the presence of TPHd, TPHd and xylenes present in M-2 groundwater may be attributable to releases in the vicinity of M-3. It also appears that based on the groundwater flow direction, lack of detection of MTBE in samples from M-2 and M-3, and the lack of detection of either TPHg or BTEX in the groundwater sample from M-1, the MTBE in groundwater from M-1 appears to originate from an upgradient source.

6.0 SUMMARY

Samples collected during the removal of the three underground storage tanks (USTs) at the Site in 1990, and during subsequent investigations conducted at the Site and to the south across 47th Street revealed the presence of petroleum hydrocarbons in soil and groundwater. Soil samples from the UST excavation at the Site in 1990 revealed TPHg up to 2,700 mg/kg and TPHd up to 1,100 mg/kg. Soil samples collected in 1993 from 47th Street and at 4629 Martin Luther King, Jr. Way revealed TPHd up to 1,700 mg/kg from the saturated zone.

Groundwater sample collected from monitoring wells installed at 4629 Martin Luther King, Jr. Way revealed the presence of TPHg up to 2,100 µg/l, TPHd up to 920 µg/l and TPHmo up to 3,800 µg/l. Groundwater samples from the wells at 4629 Martin Luther King, Jr. Way also revealed benzene up to 3.4 µg/l, toluene up to 2.2 µg/l, ethyl benzene up to 8.9 µg/l and total xylenes up to 2.9 µg/l.

Grab groundwater samples collected from the vicinity of the USTs at the Site in 2000 revealed TPHg up to 24,000 µg/l and TPHd up to 150,000 µg/l. The presence of suspended sediment was interpreted to have biased the groundwater sample results higher. Groundwater flow direction was reported to be to the south-southeast at the time of the sampling. Based on the soil and groundwater results, the Alameda County Environmental Health Services (ACEHS) requested in a letter dated July 27, 2001 the installation of groundwater monitoring wells at the Site to "confirm if the contamination has indeed impacted the Site across 47th Street."

6.1 SUMMARY OF RECENT INVESTIGATION

In April 2002, three borings were advanced, 12 soil samples collected and the borings were completed as monitoring wells. Groundwater elevation data generated during this investigation identified that groundwater flow direction was to the northwest.

The findings of the soil and groundwater investigation include:

- Groundwater elevation data revealed that the gradient was 0.009 feet per foot in the north-northwest direction.

- TPHd, BTEX and MTBE were not detected in soil samples from borings M-1, M-2 and M-3 above their respective RBSLs.

- Only one of the 12 soil samples collected during the investigation, the sample from boring M-3 at 20 feet below ground surface, contained TPHg at 110 mg/kg above the RBSL of 100 mg/kg.

- The highest TPHg soil samples from borings M-1 (less than 1.0 mg/kg) and M-2 (2.4 mg/kg) were over 45 times lower than the concentrations in samples from boring M-3 and less than the RBSL of 100 mg/kg.

- The reported concentrations of TPHd in groundwater samples from M-1 at 136 µg/l, M-2 at 148 µg/l), and M-3 at 298 µg/l exceed the RBSL of 100 µg/l. The concentrations of TPHd in samples from groundwater monitoring wells M-1 and M-2, located in the cross- and downgradient directions, were approximately one-half of those detected in M-3.

- The concentrations of TPHg reporting in groundwater samples from M-2 at 113 µg/l and M-3 at 231 µg/l (217 µg/l in the duplicate sample) exceed the RBSL of 100 µg/l. The concentration of TPHg in the downgradient monitoring well M-2, is approximately one-half of the concentration reported in M-3. Monitoring well M-3 was installed within approximately 10 feet of a former gasoline UST.

- Total xylenes were detected in groundwater above the laboratory reporting limit at 2.95 µg/l in the sample from M-2 and 5.11 µg/l (4.46 µg/l in the duplicate sample) in the groundwater samples from M-3, less than the RBSL of 13 µg/l. The concentration of

total xylenes in M-2 was reported at approximately one-half the concentration in the upgradient monitoring well M-3.

- MTBE was detected above the laboratory reporting limit of 2.0 µg/l only in M-1 during this investigation at 3.73 µg/l (based on the USEPA 8260B confirmation).

- The groundwater samples from M-1, M-2, and M-3 were not reported to contain concentrations of benzene, toluene, or ethyl benzene above their respective laboratory detection limits or their RBSLs.

Based on the groundwater flow direction and the relative concentrations of petroleum hydrocarbons in soil and groundwater, it appears that the presence of TPHd, TPHd and xylenes present in M-2 groundwater may be attributable to releases in the vicinity of M-3. In also appears that based on the groundwater flow direction, lack of detection of MTBE in samples from M-2 and M-3, and the lack of detection of either TPHg or BTEX in the groundwater sample from M-1, the MTBE in groundwater from M-1 appears to originate from an upgradient source.

The comparison of the soil and groundwater data from the April 2002 investigation, with the exception of the soil sample from M-3 at 20 feet below ground surface, indicates that petroleum hydrocarbons in soil are not contributing to groundwater degradation. The groundwater samples also did not reveal the presence of petroleum related VOCs at concentration greater than their RBSLs. The concentrations of TPHd, TPHg and xylenes in groundwater appear to attenuate in the downgradient direction.

6.2 RECOMMENDATION FOR NO FURTHER ACTION

Based on the distribution of petroleum hydrocarbons, the measured groundwater flow direction, and the concentrations of petroleum hydrocarbons in soil and groundwater, there does not appear to be a threat to current beneficial uses of groundwater from the historical releases at the Site.

Therefore, no further action to address the petroleum hydrocarbon releases at the Site appears warranted. This recommendation is supported by the following:

- Only one soil sample was reported to contain concentrations of petroleum hydrocarbons (TPHg) in excess of screening levels to protect groundwater.

- It is anticipated that natural attenuation processes will reduce the groundwater concentrations of TPHd and TPHg to achieve water quality goals within a reasonable time.

- The existing prohibitions on well construction in the upper 50 feet should preclude the groundwater in the vicinity of the Site from being developed as a potable water source during the time that the natural attenuation processes reduce the TPHd and TPHg concentrations.

- It is also anticipated natural attenuation process will reduce the TPHd and TPHg concentrations in groundwater to below applicable surface water quality protection standards before impacting Temescal Creek.

7.0 REFERENCES

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8.0 DISTRIBUTION LIST

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TABLE 2-1
SUMMARY OF GROUNDWATER ELEVATION DATA
4701 Martin Luther King, Jr. Way
Oakland, California

Location	Date	Top-of Casing Elevation	Depth to Groundwater	Groundwater Elevation	Change in Elevation
		(feet above msl)	(ft)	(ft)	(ft)
M-1	5/16/02	88.88	17.52	71.36	--
M-2	5/16/02	90.06	18.75	71.31	--
M-3	5/16/02	90.86	18.68	72.18	--

Notes:
msl - mean seal level

TABLE 3-1
SUMMARY OF SOIL ANALYTICAL RESULTS
4701 Martin Luther King, Jr., Way
Oakland, California

Sample I.D.	Location/Depth (feet)	Date Sampled	TPHd	TPHg	Benzene	Toluene	Ethyl Benzene	Xylenes	MTBE
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
3194	Adjacent to USTs	12/7/89	<5.0	<10	<0.1	<0.1	<0.1	<0.1	--
TSA1	Gasoline UST pit	10/9/90	5.0	--	<0.005	0.017	0.039	0.061	--
TSA2	Gasoline UST pit	10/9/90	590	--	<0.005	1.5	7.8	9.3	--
TSB	Heating Oil UST pit	10/9/90	38	1,100	<0.005	<0.005	0.13	1.0	--
TSC	Heating Oil UST pit	10/9/90	<0.05	<10.0	<0.005	<0.005	<0.005	<0.005	--
TSA	Gasoline UST pit	10/17/90	530	--	<0.05	<0.05	5.0	9.0	--
TSB	Gasoline UST pit	10/17/90	2,700	--	<0.1	<0.1	15	55	--
TSC	Gasoline UST pit	10/17/90	1,300	--	<0.05	0.05	10	22	--
TSD	Gasoline UST pit	10/17/90	770	--	<0.025	<0.025	5.0	10	--
1	11.5	1993	--	<1.0	--	--	--	--	--
	20		--	6.0	--	--	--	--	--
2	15	1993	--	14	--	--	--	--	--
	23		--	570	--	--	--	--	--
3	18	1993	--	310	--	--	--	--	--
	21		--	1,700	--	--	--	--	--
	25		--	190	--	--	--	--	--
4	21	1993	--	80	--	--	--	--	--
	31		--	<1.0	--	--	--	--	--
5	21	1993	--	<1.0	--	--	--	--	--
	27.5		--	<1.0	--	--	--	--	--
	30.5		--	<1.0	--	--	--	--	--
6	21	1993	--	16	--	--	--	--	--
	27.5		--	<1.0	--	--	--	--	--
7	21.5	1993	--	170	--	--	--	--	--
	25		--	<1.0	--	--	--	--	--
8	19	1993	--	750	--	--	--	--	--
	24.5		--	<1.0	--	--	--	--	--
9	22	1993	--	2.0	--	--	--	--	--
	25		--	<1.0	--	--	--	--	--
M-1	10	4/26/02	2.7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	15		1.1	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	20		2.9	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	25		2.8	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
M-2	10	4/26/02	<1.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	15		<1.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	20		7.5	2.4	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	25		<1.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
M-3	10	4/26/02	2.4	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	15		4.7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	20		8.5	110	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	25		<1.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
RBSLs			100	100	0.045	2.6	2.5	1	1

TABLE 3-2
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
Children's Hospital
4701 Martin Luther King, Jr., Way
Oakland, California

Sample Location	Date Sampled	TPHmo	TPHd	TPHg	Benzene	Toluene	Ethyl Benzene	Xylenes	MTBE	Iron		Field Observations
										Total	Soluble	
		(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(mg/l)		
MW-1	2/7/2000	900	76	89	ND	ND	0.9	2.8	ND	--	--	Sheen and odor observed
MW-2	2/7/2000	ND	ND	ND	ND	ND	ND	ND	ND	--	--	No sheen or odor observed
MW-3	2/7/2000	1,400	180	910	2.6	1.4	5.5	14	ND	--	--	Sheen and odor observed
MW-4	2/7/2000	3,800	920	2,100	3.4	2.2	8.9	29	ND	--	--	Sheen and odor observed
SB-1	6/27/2000	<610	5,500	8,500	<10	<10	<10	<10	<100	--	--	Sheen and odor observed
SB-2	6/27/2000	5,900	15,000	340	<0.5	1.3	0.52	6.7	<5.0	--	--	Sheen and odor observed
SB-3	6/27/2000	<690	<69	<50	<0.5	<0.5	<0.5	<0.5	<5.0	1100	<0.1	No sheen or odor observed
SB-4	6/27/2000	<50,000	150,000	24,000	<5.0	<5.0	<5.0	<5.0	<50	370	<0.1	Sheen and odor observed
M-1	5/16/02	--	136	<50.0	<0.500	<0.500	<0.500	<0.500	3.73	--	--	--
M-2	5/16/02	--	148	113	<0.500	<0.500	<0.500	2.95	<2.00	--	--	--
M-3	5/16/02	--	298	231	<0.500	<0.500	<0.500	5.11	<2.00	--	--	--
		--	254	217	<0.500	<0.500	<0.500	4.46	<2.00	--	--	--
RBSLs		100	100	100	1	40	30	13	5	--	--	--

Note:
µg/l -micrograms per liter
mg/l -milligrams per liter
TPHmo -total petroleum hydrocarbons as motor oil
TPHd -total petroleum hydrocarbons as diesel
TPHg -total petroleum hydrocarbons as gasoline
MTBE -methyl tert butyl ether
ND- Not detected above laboratory reporting limits

TABLE 3-3
SUMMARY OF WELL CONSTRUCTION DETAILS
4701 Martin Luther King, Jr. Way
Oakland, California

Well ID	Monitoring Well Construction Details						
	Date Installed	Well Diameter	Total Depth	Screen Interval	Sand Pack Interval	Bentonite Seal	Grout Seal
		(inches)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)
M-1	4/26/02	1.5	30	15 to 30	15 to 30	13 to 15	0 to 13
M-2	4/26/02	1.5	30	15 to 30	15 to 30	13 to 15	0 to 13
M-3	4/26/02	1.5	34	19 to 34	14 to 34	12 to 14	0 to 12

Notes:
ft bgs -Feet below ground surface

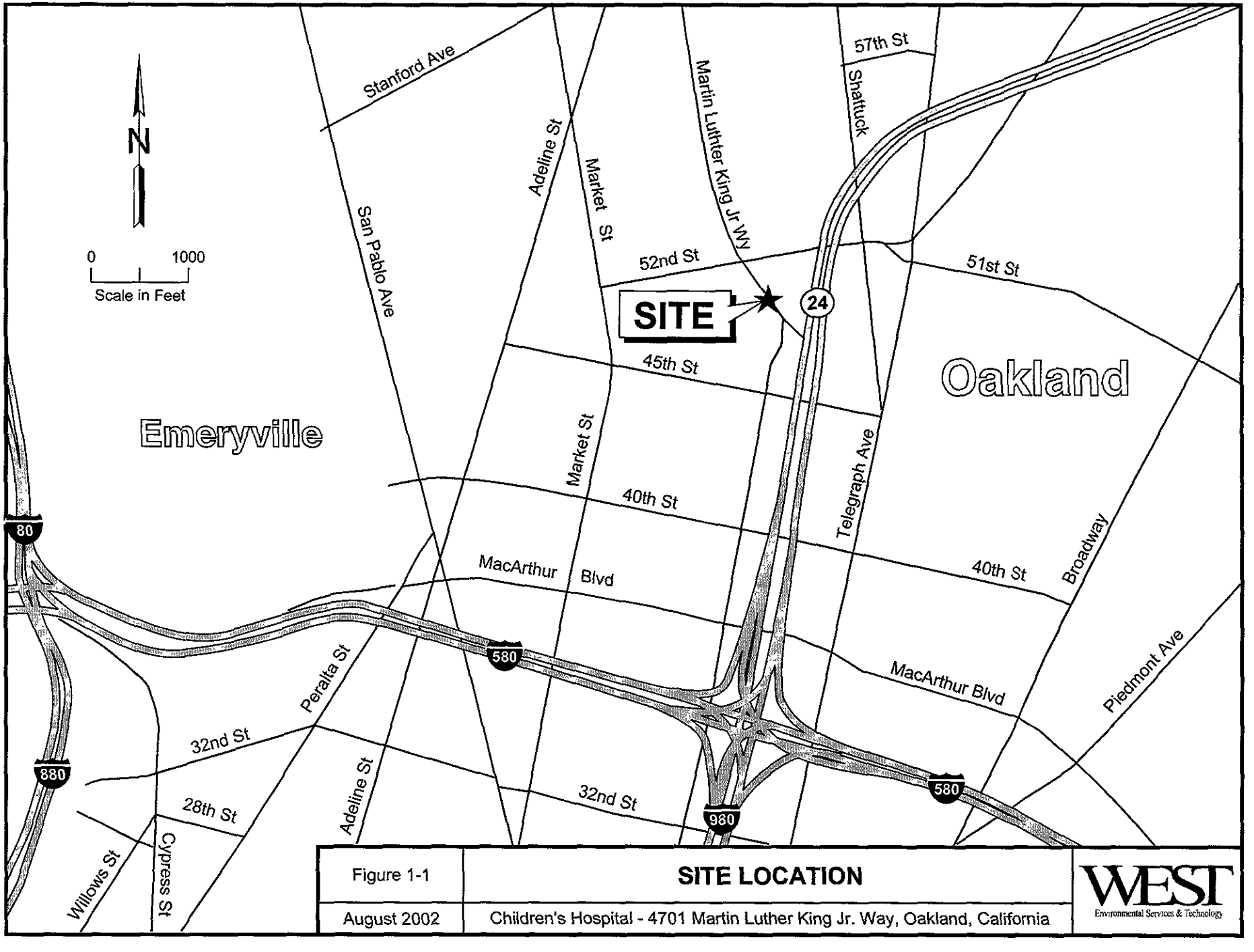


Figure 1-1	SITE LOCATION
August 2002	Children's Hospital - 4701 Martin Luther King Jr. Way, Oakland, California

WEST
Environmental Services & Technology

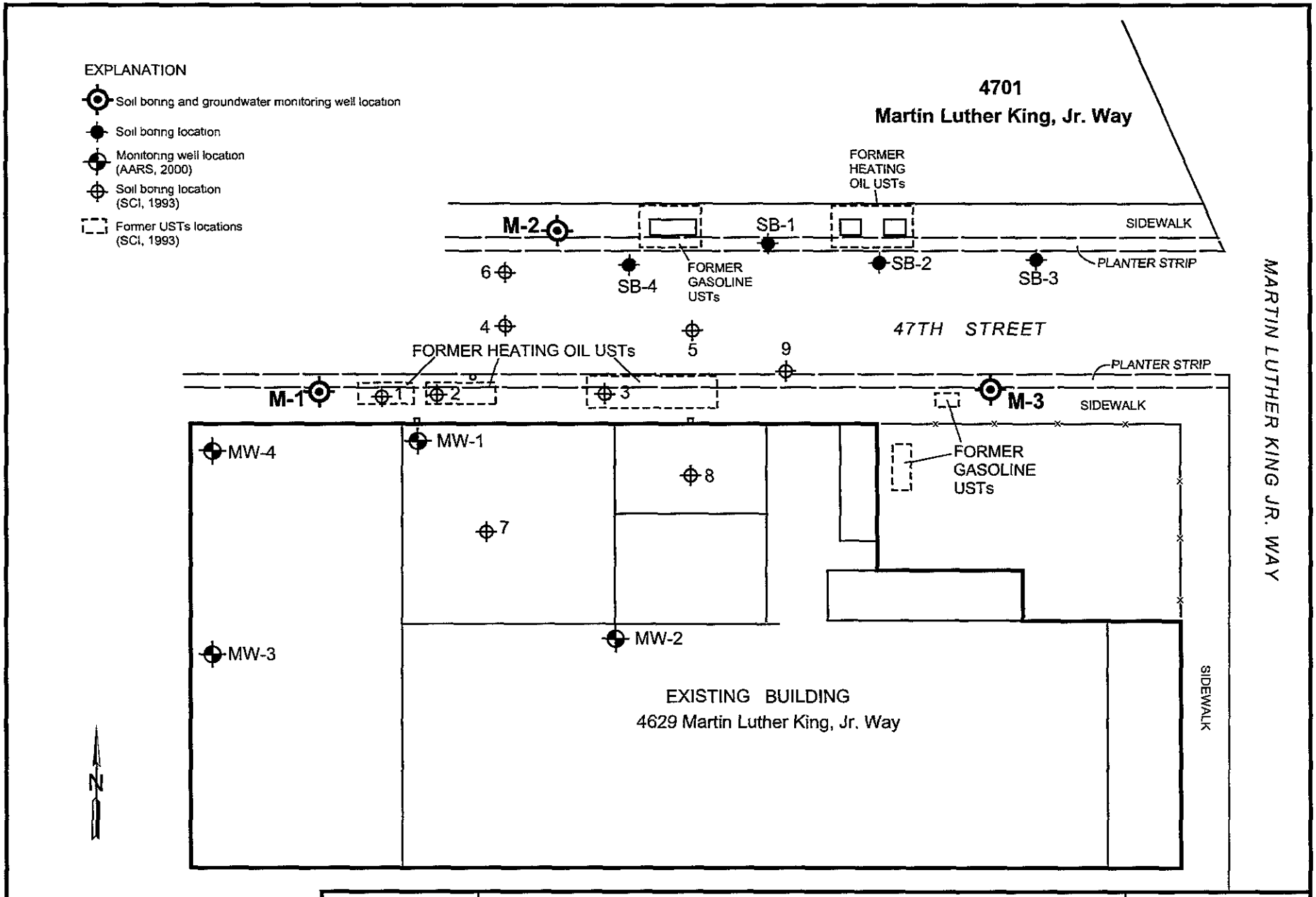


Figure 2-1	**SITE PLAN**	WEST Environmental Services & Technology
August 2002	Children's Hospital - 4701 Martin Luther King Jr. Way, Oakland, California	

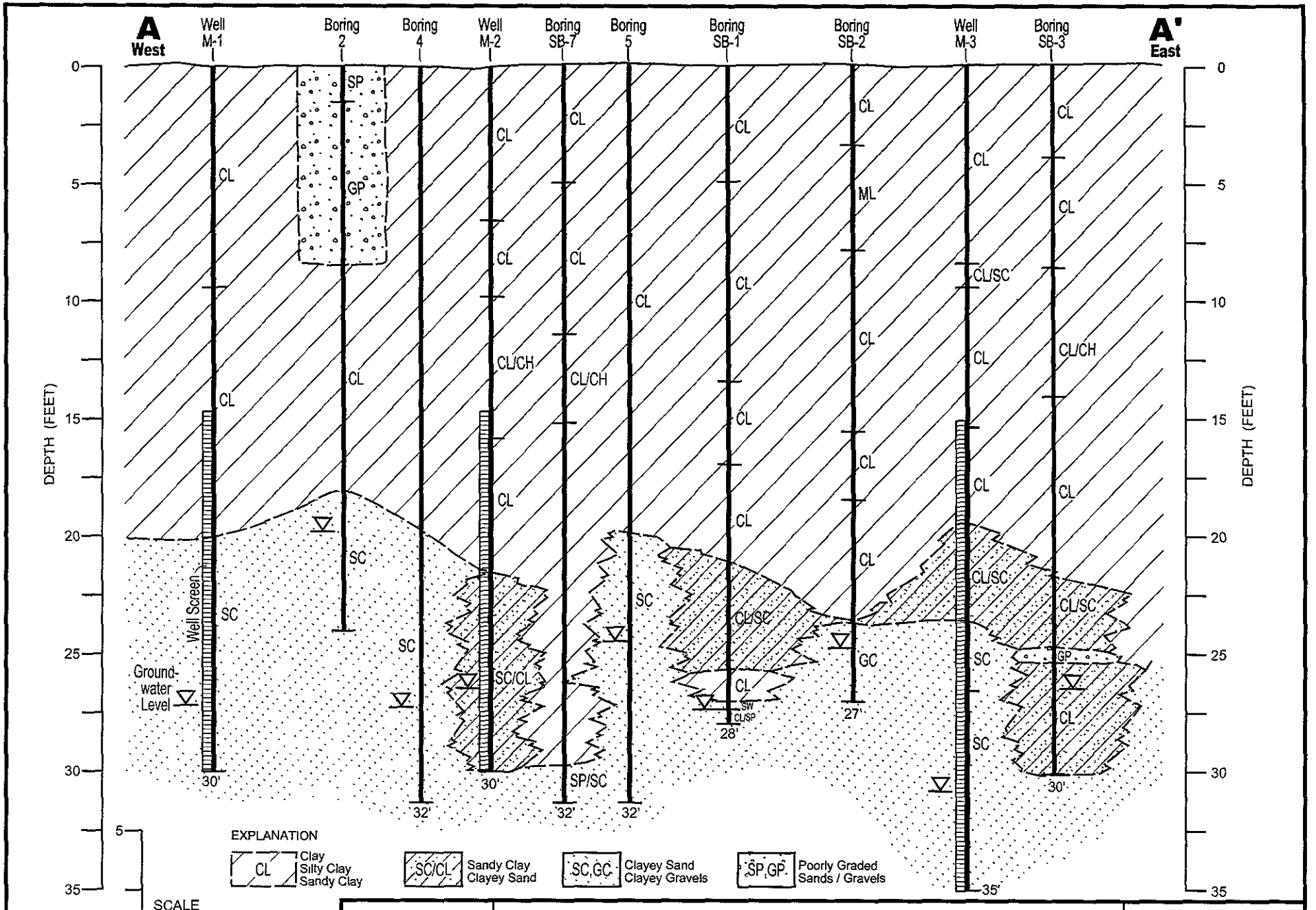


Figure 2-2	**GEOLOGIC CROSS-SECTION A-A'**	WEST Environmental Services & Technology
August 2002	Children's Hospital - 4701 Martin Luther King Jr. Way, Oakland, California	

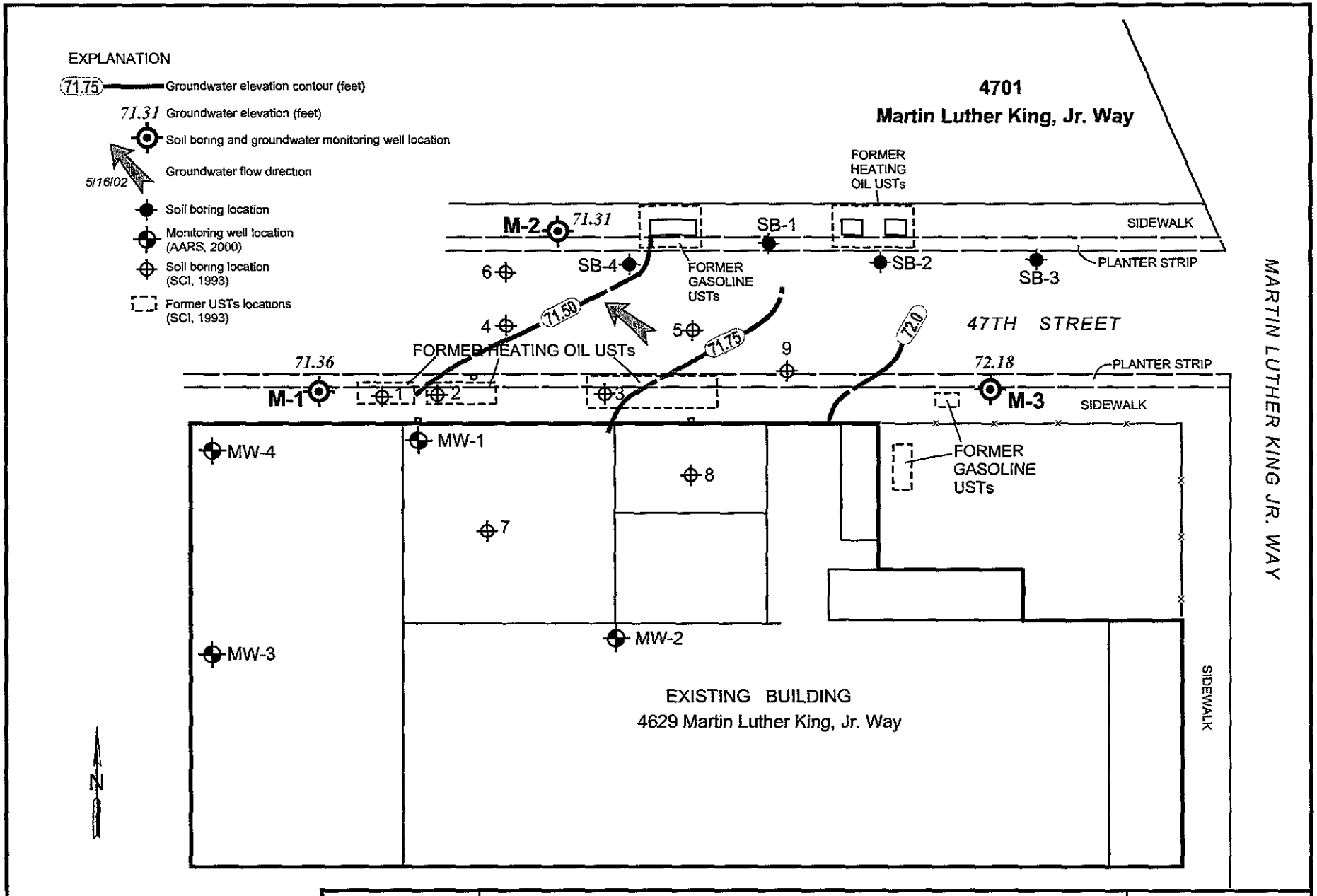


Figure 2-3	**GROUNDWATER ELEVATION - MAY 16, 2002**	WEST Environmental Services & Technology
August 2002	Children's Hospital - 4701 Martin Luther King Jr. Way, Oakland, California	

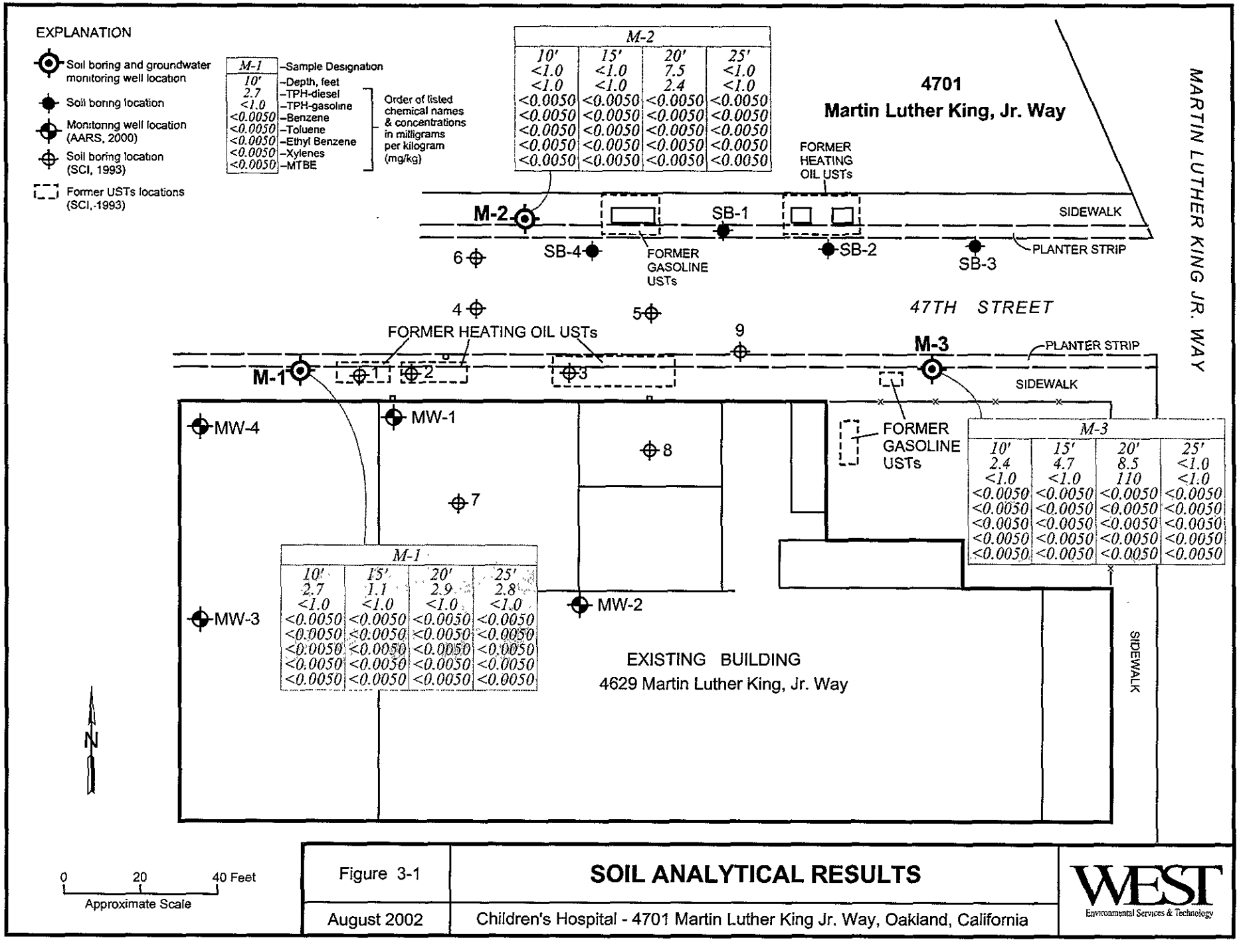


Figure 3-1	SOIL ANALYTICAL RESULTS	WEST Environmental Services & Technology
August 2002	Children's Hospital - 4701 Martin Luther King Jr. Way, Oakland, California	

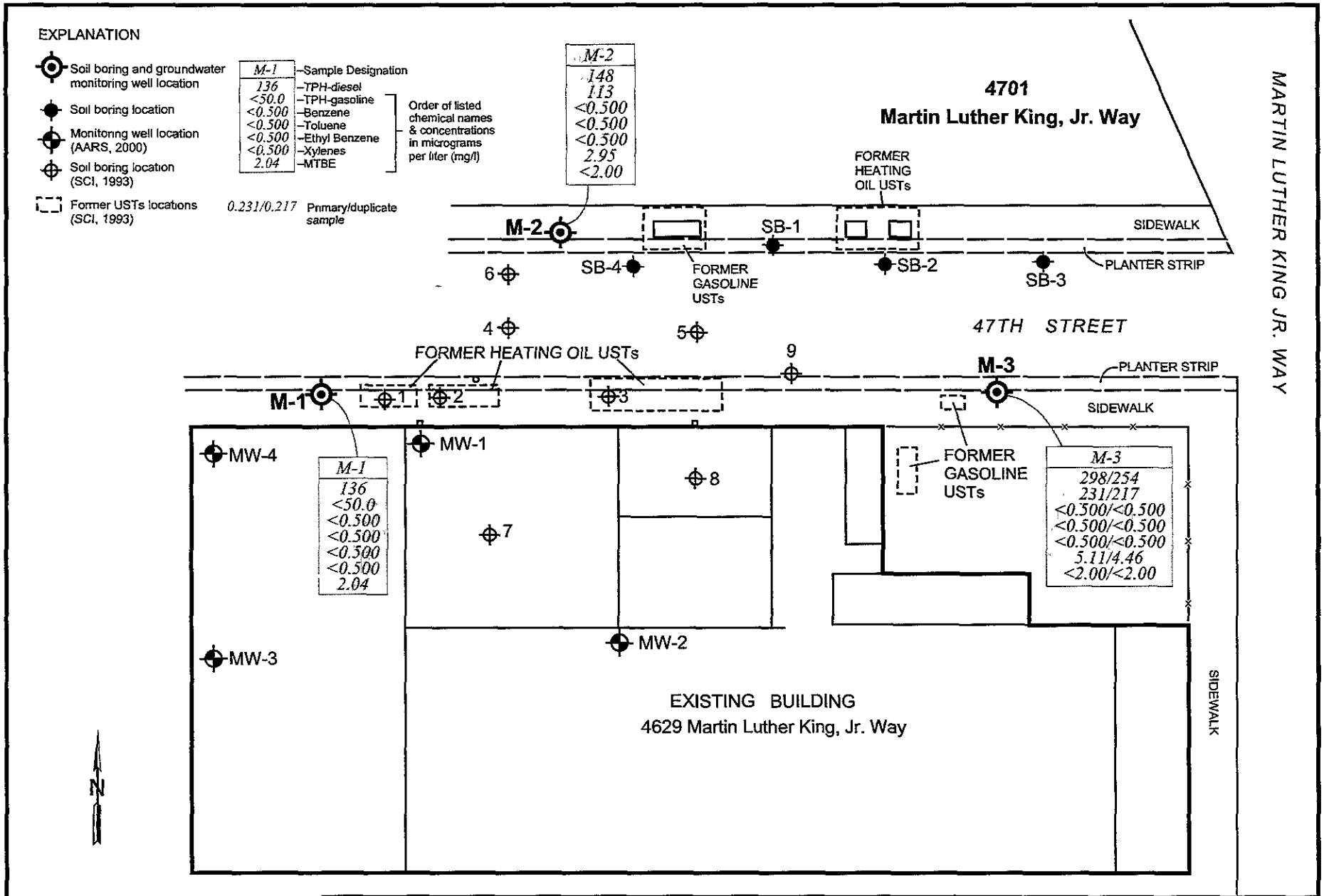
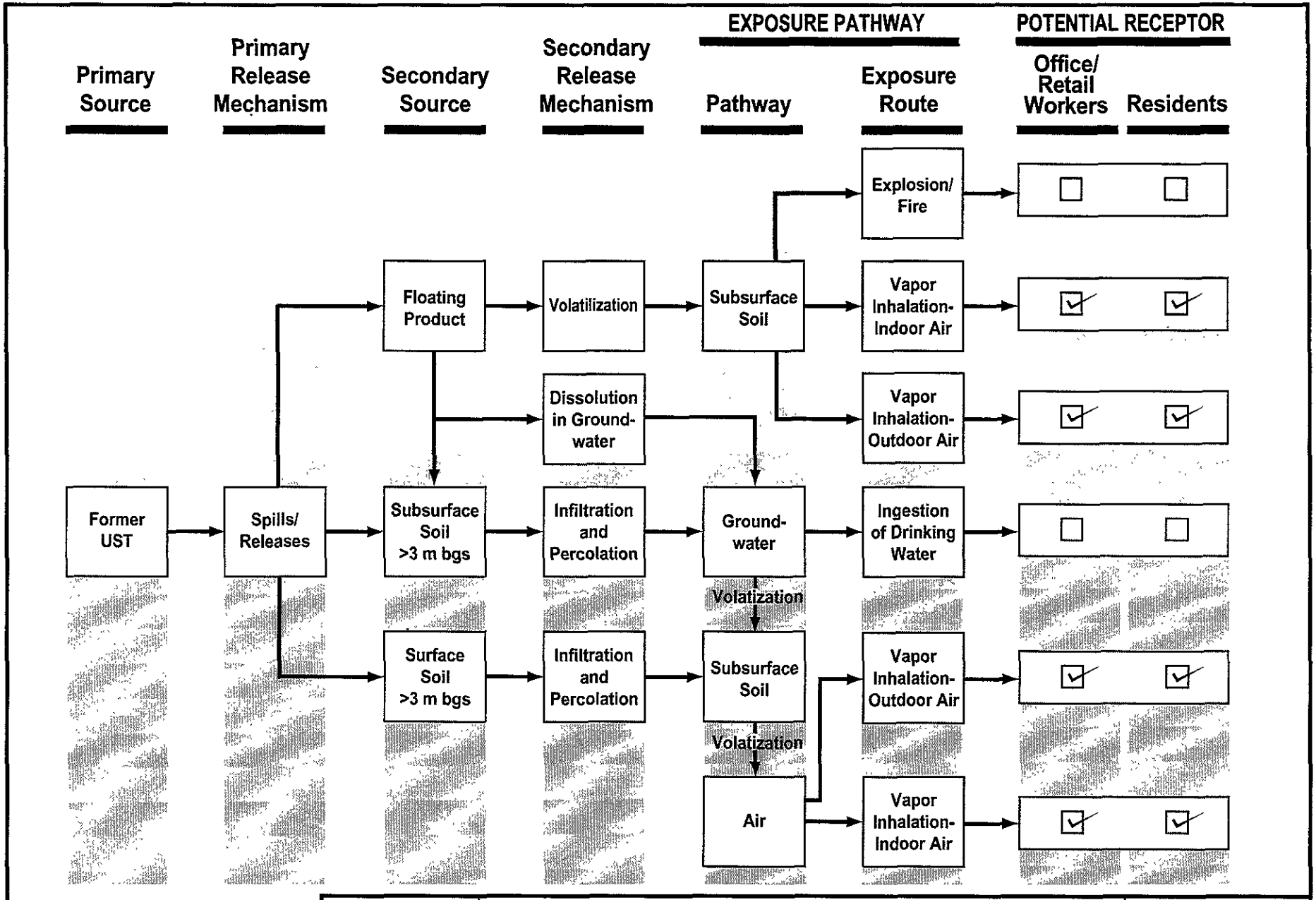


Figure 3-2	GROUNDWATER ANALYTICAL RESULTS	WEST Environmental Services & Technology
August 2002	Children's Hospital - 4701 Martin Luther King Jr. Way, Oakland, California	


Primary Source
Primary Release Mechanism
Secondary Source
Secondary Release Mechanism
EXPOSURE PATHWAY
Pathway
Exposure Route
POTENTIAL RECEPTOR
Office/ Retail Workers
Residents
Former UST
Spills/ Releases
Floating Product
Subsurface Soil >3 m bgs
Surface Soil >3 m bgs
Volatilization
Dissolution in Ground-water
Infiltration and Percolation
Infiltration and Percolation
Subsurface Soil
Ground-water
Volatization
Subsurface Soil
Volatization
Air
Explosion/ Fire
Vapor Inhalation-Indoor Air
Vapor Inhalation-Outdoor Air
Ingestion of Drinking Water
Vapor Inhalation-Outdoor Air
Vapor Inhalation-Indoor Air
Check indicates Potential Receptor Pathway
Figure 4-1
CONCEPTUAL SITE MODEL
August 2002
Children's Hospital - 4701 Martin Luther King Jr. Way, Oakland, California
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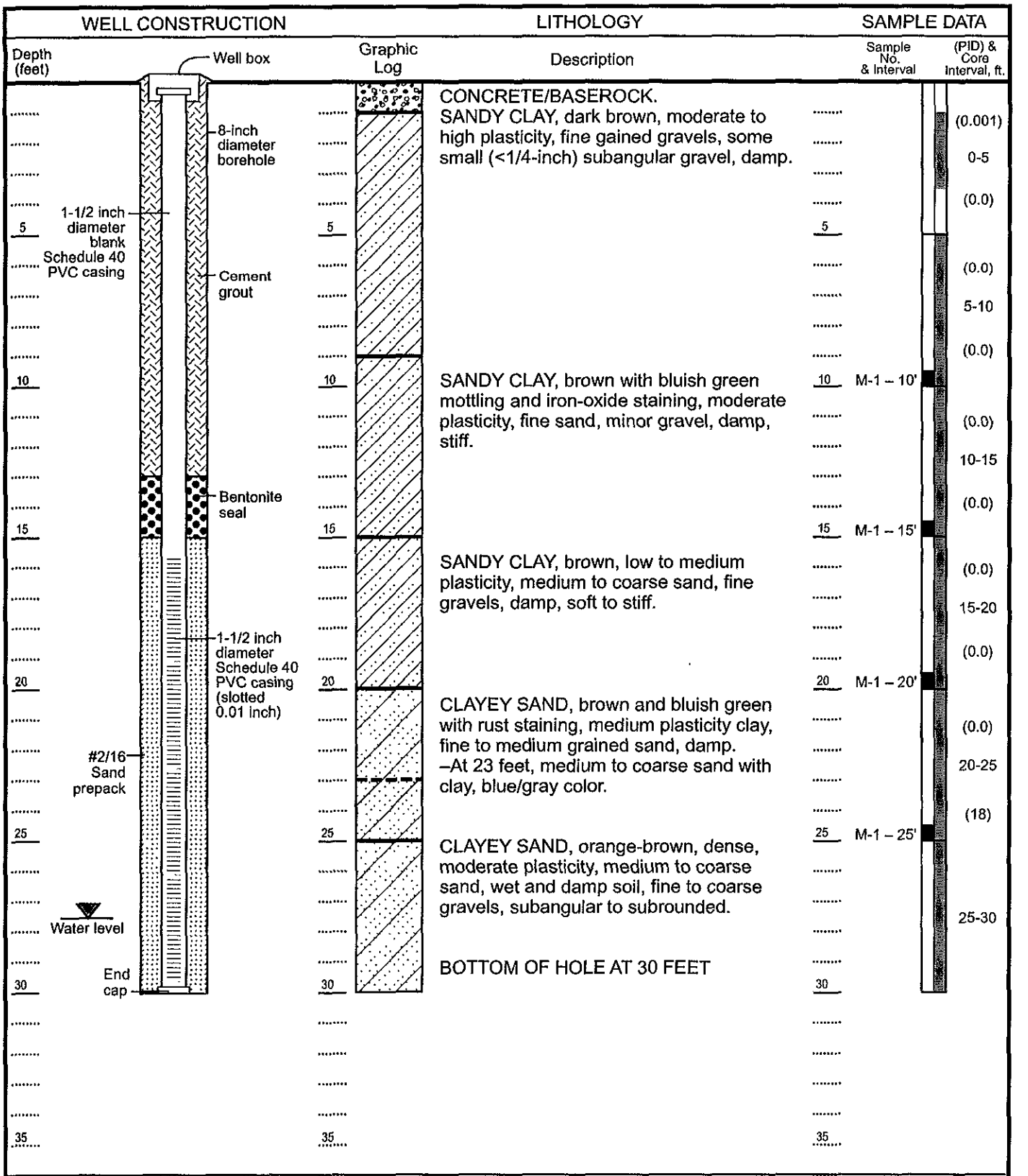
APPENDIX A

SOIL BORING LOGS

AND WELL CONSTRUCTION DETAILS

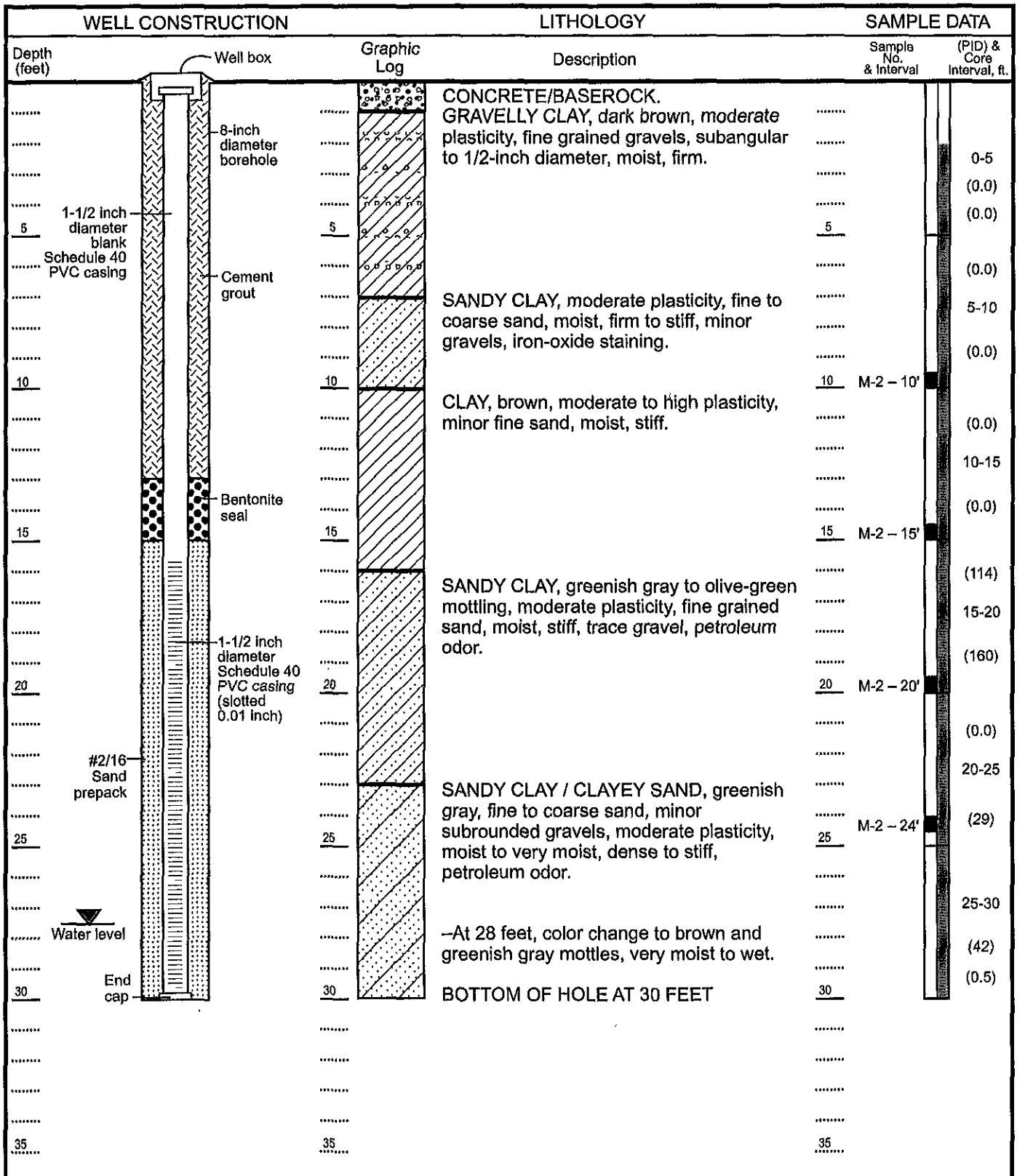


WEST Environmental Services & Technology

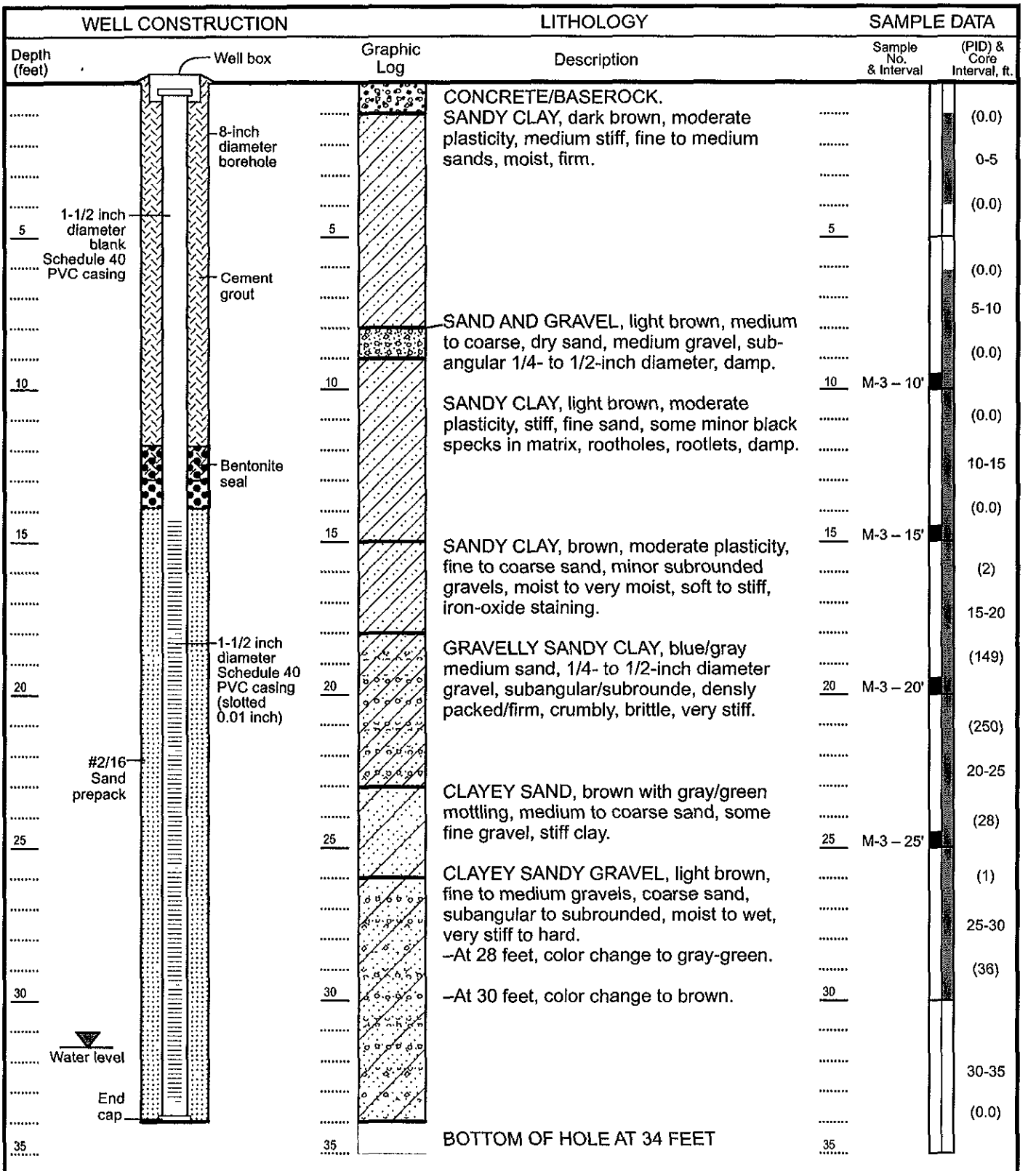
August 2002

Children's - 4701

Well Construction & Soil Boring Lithology for Boring No. M-1



WEST Environmental Services & Technology	August 2002 Children's - 4701	**Well Construction & Soil Boring Lithology for Boring No. M-2**



WEST Environmental Services & Technology

August 2002

Children's - 4701

Well Construction & Soil Boring Lithology for Boring No. M-3

APPENDIX B

CHAIN-OF-CUSTODY FORMS

AND LABORATORY CERTIFICATES

APPENDIX C

GROUNDWATER SAMPLE FIELD DATA SHEETS

AND WELL SURVEY INFORMATION