CONCEPTUAL SITE MODEL, RISK ASSESSMENT AND SUPPLEMENTAL INVESTIGATION PROPOSAL

FORMER TEXACO STATION No. 211577
631 QUEEN ANNE AVENUE NORTH
SEATTLE, WASHINGTON

AUGUST 21, 2002

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Delta Environmental Consultants, Inc.

Inogen® Environmental Alliance

Conceptual Site Model, Risk Assessment and Supplement Investigation Proposal

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631 QUEEN ANNE AVENUE NORTH
SEATTLE, WASHINGTON

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TABLE OF CONTENTS

1.0 INTRODUCTION 4
2.0 SUMMARY OF PREVIOUS INVESTIGATIONS 4
2.1 Project Overview 4
2.2 History of Environmental Activities 4
2.2.1 Environmental Reports & Other Documentation 5
2.2.2 Summary of Activities 6
3.0 BACKGROUND 13
3.1 Introduction 13
3.2 Property location and Description 14
3.3 Land Development History 14
3.4 Sub-Surface Utilities and Structures 14
3.5 Regional Geology 16
3.6 Area-Specific Geology 16
3.7 Hydrogeology 17
3.8 Water Use 17
4.0 ARNOLD PROPERTY 17
4.1 Owner / Operator History 17
4.2 History of Fuel Products Sold & Inventory Control 19
4.2.1 Products Sold 20
4.3 Underground Storage Tank History 20
4.3.1 UST Equipment Installation and Product Storage 20
4.4 Known Releases 22
5.0 MONTEREY PROPERTY 23
5.1 Property History 23
5.2 Background / History of Hydrocarbon Vapor Occurrences 24
5.3 Nature and Extent of Hydrocarbon Impacts 25
5.4 Building Drainage Structure / Preferential Pathways 26
6.0 ADJACENT AND NEARBY PROPERTIES 28
6.1 Del Roy Apartments 28
6.2 Alvena Vista Apartments 28
6.3 Lindberg Apartments 29

6.4 Unocal Service Station 29
6.4.1 Property Ownership *29*
6.4.2 Facility History *29*
6.4.3 Facility Operations *30*
6.4.4 History of Environmental Activities *31*
6.5 Paramount Dry Cleaners (a/k/a Orestes) 36
6.5.1 Property Ownership and Facility History *36*
6.5.2 History of Environmental Activities *37*
6.6 Marqueen Apartments and Garage (a/k/a Marqueen Hotel) 39
6.6.1 History of Environmental Activities *39*
7.0 OCCURRENCE AND DISTRIBUTION OF CONTAMINANTS 40
7.1 Introduction 40
7.2 Soil 40
7.3 Soil Vapor 41
7.4 Groundwater 42
7.5 Ambient Air 42
7.6 Indoor Air 42
7.7 Data Gaps 43
8.0 TRANSPORT MECHANISMS AND IMPACTED MEDIA 43
8.1 Introduction 43
8.2 Soil 43
8.3 Groundwater 45
8.4 Ambient Air 45
8.5 Indoor Air 46
9.0 EXPOSURE PATHWAYS AND POTENTIAL RISKS 46
9.1 Introduction 46
9.2 Soil 47
9.3 Groundwater 47
9.4 Ambient Air 48
9.5 Indoor Air 48
9.6 Data Gaps 49
10.0 SUPPLEMENTAL INVESTIGATIONS 50
10.1 Introduction 50

10.2 Synoptic Groundwater Sampling 50
10.3 Soil Borings and Monitoring Well Installations 51
10.4 Ambient Air Assessment 53
10.5 Indoor Air Assessment 53
11.0 SCHEDULE FOR PROPOSED INVESTIGATIONS 54
11.1 Groundwater 54
11.2 Soil Sampling and Monitoring Well Installation 55
11.3 Indoor and Ambient Air 55
12.0 LIST OF FIGURES, TABLES, AND APPENDIX 56
Figures *56*
Tables *57*
Appendix *57*
13.0 REFERENCES 58

1.0 INTRODUCTION

Delta Environmental Consultants, on behalf of Chevron-Texaco Products Company, has developed the following Site Conceptual Model, risk assessment and supplemental investigation proposal for Former Texaco Station No. 211577 located at 631 Queen Anne Avenue North in Seattle, Washington (a property location map is included as Figure 1). This document summarizes activities and information collected at this location by several previous consultants and the Washington State Department of Ecology (WDOE) since 1986. The purpose of this document is to identify and discuss petroleum impacts to soil and groundwater which currently exist at this location and to propose further investigative actions to fill data gaps necessary for the selection of a remedial remedy.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS

2.1 Project Overview

A gasoline service station has operated in various configurations on the Arnold Property for approximately 66 years, ending in 1993. In early 1978, residents of the Monterey Apartments notified the Seattle Fire Department of the presence of hydrocarbon odors in the basement laundry room and lower apartments. The Fire Department investigation focused on the Arnold Property and a then-active Unocal gas station, located at 700 Queen Anne Avenue North (Unocal) (Figure 2).

After the odors apparently abated in March 1978, no complaints were documented until January 1984 when Monterey Apartments residents complained of gasoline odors. Investigation identified the presence of separate phase hydrocarbons (SPH) in a sump at the Monterey Apartments. The Arnold Property and Unocal station were suspected as the likely sources. Since 1997, there have been no reports of hydrocarbon vapors at Monterey Apartments, or other adjacent locations.

2.2 History of Environmental Activities

Since the first reported hydrocarbon vapor complaints at the Monterey Apartments in February 1978, various agencies, consultants and contractors have conducted a number of separate investigations and sampling events at the Monterey Apartments and the Arnold Property.

Several remedial actions have also been performed; with varying levels of success. This section provides a brief summary of the documented environmental activities. Much of the investigation has been documented in reports, although several phases of work are described only with field notes and other incomplete documentation.

2.2.1 Environmental Reports & Other Documentation

The known, available reports include the following:

- GeoEngineers, 1986, Report of Hydrogeological Services, Subsurface Fuel Contamination Problem, Queen Anne District, Seattle, Washington, prepared for the Washington State Department of Ecology.

- Washington State Department of Ecology, March 1989, Monterey Apartments, Internal Report prepared by David South of Ecology (referenced in E&E 1991).

- Washington State Department of Ecology, March 17, 1989, Request for Proposal to Provide Technical Services at the Monterey Apartments, Queen Anne District.

- Ecology & Environment, September 11, 1990, Monterey Apartments Site - Soil-Gas Pilot Study Summary (draft, also referenced in other documents as "Trip Report").

- Ecology & Environment August 1991, Phase I Remedial Investigation Report, Monterey Apartments, Seattle, Washington.

- SAIC, 1993, Baseline Groundwater Monitoring Report, Monterey Apartments.
  Washington State Department of Ecology, May 1998, Monterey Apartments Ground Water Monitoring, October 1995 - November 1997.

- Farallon Consulting, January 11, 2000, December 1999 Groundwater Sampling Analytical Results, Queen Anne Texaco, Seattle, Washington.

- Farallon Consulting, July 21, 2000, December 1999 and June 2000 Groundwater Summary Report, Queen Anne Texaco, Seattle, Washington.

- Farallon Consulting, July 19, 2000, Pilot Test Summary Report, Queen Anne Texaco, Seattle, Washington.

Additional actions referenced in field notes or other unpublished documentation include:

- The initial vapor response activities conducted in 1978;

- Excavation and removal of the underground storage tanks (USTs) on the Arnold Property;

- Recovery of SPH from wells RW-1 and RW-2 in the Monterey Apartments vicinity;

- Installation of three additional SPH recovery wells: RW-3, RW-4, and RW-5;

- Abandonment of recovery well RW-1;

- Installation of an air monitoring system within the basement of the Monterey Apartments;

- Installation and operation of a soil vapor and groundwater extraction and treatment system at the Arnold property.

2.2.2 Summary of Activities

The following section summarizes the activities and findings presented in each report; reports are referred to by author and date. The reference to well numbers is based on the information provided in the reports. There has been inconsistent nomenclature used for the wells throughout this project. Recent work by Farallon has assigned a consistent well nomenclature.

City of Seattle Fire Department, 1978. During an investigation of odor complaints at the Monterey Apartments, SPH was identified within a sump that is apparently connected to the footing drainage system for the building. A sample of the SPH was collected and analyzed and found to be a petroleum hydrocarbon, which "falls in the range of being a gasoline". Product samples were collected from both the Texaco and Unocal service stations for comparison purposes. Neither of the samples were a positive match.

GeoEngineers, 1986. GeoEngineers performed services as requested by Crowley Environmental Services Corporation and the Washington Department of Ecology subsequent to the 1984-86 reports of hydrocarbon vapors at the Monterey Apartments. GeoEngineers' services included the installation of nine groundwater monitoring wells (MW-2 through MW-10) (see Figure 3). The presence of rubble fill near the northeast comer of the Monterey Apartment building precluded the installation of an additional monitoring well (MW-1). Five wells (MW-2 through MW-5 and MW-7) were installed at or near the Monterey Apartments; three wells (MW-6, MW-9, and MW-10) were installed at the Arnold Property, and one well (MW-8) was installed at Unocal.

Another SPH sample was collected from the floor drain sump and was submitted for chemical analysis. GeoEngineers reported that the SPH consisted of approximately 45% gasoline, 45% #1 diesel (kerosene or stove oil), and 10% #2 diesel.

Evidence of petroleum hydrocarbons in soil and/or groundwater was noted in groundwater monitoring wells MW-2 and MW-4 through MW-9. Well MW-6 contained two feet of SPH that was noted as "clear and fresh". Additionally, a trace amount of SPH was noted in well MW-7 on November 3, 1986. Groundwater mapping indicated a groundwater flow direction of west-southwest across the investigation area.

Washington State Department of Ecology, 1989. The request for proposal for the "Monterey Apartments site" issued by Ecology provided a summary of past investigations, construction details, and property histories for the apartment and service stations locations. Ecology's summary included the description of UST replacements and testing that had occurred at the Arnold Property.

Ecology identified several existing or former petroleum product USTs in the immediate vicinity. The USTs identified by Ecology included heating oil USTs at the Monterey Apartments, the Del Roy Apartments, the Queen Anne Apartments (also known as the Lindberg Apartments), the Alvena Apartments, and the Marqueen Apartments. Ecology also noted that former retail gasoline stations existed at the Marqueen Apartments, and the Group W Building (18 Mercer Street). A former Mobil station at the Group W Building location was completely removed, including USTs, but Ecology indicated that fuel USTs may be in place beneath the concrete slabs of the Marqueen and Queen Anne Apartments.

Ecology noted that previous activities associated with the Monterey Apartments study included the installation of two recovery wells RW-1 (installed by Crowley Environmental Services for the Arnolds in November, 1986 and RW-2 (installed by Ecology in July, see Figure 3). Both wells were considered ineffective and were inactivated after removing between 75 and 150 gallons of SPH.

Ecology noted difficulties reported by GeoEngineers during the installation of MW-10 during the 1986 investigation. Initial installation attempts encountered and punctured what apparently was a concrete tank and a strong gasoline odor was detected upon puncturing the concrete. It was believed that this location was the site of the 1922 UST installations which were abandoned in-place. Ecology reported SPH was detected in well MW-8 (at Unocal) during the period 1987 to 1988 and ranged from 0.01 to 0.16 feet thick.

Ecology required that the following investigations and activities be performed: determine the source of the gasoline leak, delineate lateral extent of the plume, recover the SPH, and (if necessary) clean up the groundwater (dissolved product). Ecology required that the determination of the source of the leak be performed in the following order, depending on the success of each stage in positively identifying the source of petroleum contamination: 1) locate the abandoned 1922 UST; 2) investigate the counterbalance tunnels beneath Queen Anne Avenue North; 3) and research the hydrogeology and construction history of Queen Anne Hill.

Ecology & Environment, September 11, 1990. E&E was retained by Ecology to perform a pilot soil-gas study at the Monterey Apartments. Other properties included in the soil-gas study included the Arnold Property, the Queen Anne counterbalance; Unocal; the Del Roy

Apartments; the Lindberg Apartments; and the Alvena Vista Apartments. E&E conducted the soil-gas survey during July, 1990, and completed the following activities: depth to groundwater measurements in the existing monitoring wells, collection and analysis of soil-gas samples from specific locations, collection and analysis of SPH samples, building inspections, and resident interviews.

E&E inspected the properties and interviewed residents to identify areas potentially impacted by petroleum product vapors. E&E reported that the Lindberg Apartments' basement had an uncovered, exposed soil surface and that there was one complaint of frequent gasoline odors. No other problems in the investigation area were noted.

E&E measured depths to and collected groundwater samples from monitoring wells MW-3 through MW-10 and recovery wells RW-1 and RW-2. SPH was measured in wells MW-6, MW-8, RW-1, and RW-2. E&E collected and analyzed samples of the SPH in wells MW-6 and MW-8. Analysis showed that the SPH in MW-6 was relatively undegraded gasoline with approximately 20 percent #2 diesel. The SPH in MW-8 was identified as severely degraded gasoline. The SPH sample from well MW-8 was also analyzed for lead.

E&E installed seven temporary soil-gas probes numbered SG01 to SG06 and collected one ambient air sample numbered SG07. Probe SG06 was installed in the up or cross-gradient direction from the Arnold Property and Unocal USTs; located in the median of Queen Anne Avenue immediately north of the intersection with West Roy Street (Figure 4).

The soil-gas samples were analyzed using modified EPA Method TO-14. E&E reported preliminary verbal results that indicated total benzene, toluene, ethyl benzene, and toluene (BTEX) concentrations were detected in all of the soil-gas samples and were highest (by several orders of magnitude) at locations SG01 and SG05 located on the south and west sides of the Arnold Property (Figure 4). E&E also noted that a high BTEX concentration detected at SG06, located in the assumed upgradient direction, may indicate the migration of fuel vapors northward along permeable preferential pathways. Final data were later reported in the E&E 1991 report as discussed below.

Ecology & Environment, August 1991. E&E performed the first phase of a remedial investigation (Phase I) in March and April 1991 under contract to Ecology. Tasks completed by E&E during this phase of work included collection and analysis of groundwater samples, completion of aquifer tests, a soil-gas survey, a terrain conductivity survey, sewer line/storm drain locate, and UST tightness testing. E&E concluded that the concentrations of petroleum hydrocarbons that persisted beneath the Arnold Property were the point source for petroleum hydrocarbon vapors that were observed in the Monterey Apartments and that an impacted groundwater plume extended westward at least 300 feet beyond First Avenue West. E&E suggested that the spill had persisted since at least 1986 and noted that mobilization of petroleum contaminants increased during seasonally high water table elevations and precipitation events. E&E also noted that the vapors would persist indefinitely unless reduced or removed but that the water quality was degraded for several reasons that made it unlikely to be classified as a drinking water source. E&E observed soil and groundwater petroleum contamination at the Unocal property but could not demonstrate that Unocal contributed to the plume beneath the Property.

E&E provided historical data relevant to the investigation that included: lower Queen Anne area utility and development history; gasoline service station property histories; a summary of previous investigations and spill histories. E&E stated that the GeoEngineers' 1986 study concluded that the Monterey Apartments building was impacted by petroleum hydrocarbon vapors because the foundation was constructed approximately 13 feet below ground surface ("bgs") and was therefore close to the groundwater table. E&E also noted that no other apartment buildings in the area were constructed with deep basements or foundation footings.

E&E collected soil-gas samples from six locations (SG01 through SG06), which were preliminarily reported in the E&E 1990 report (Figure 4). E&E presented final laboratory data for that study in the Phase I report. E&E collected groundwater samples from 14 groundwater monitoring wells within the study area, which E&E reported was the first comprehensive sampling of all existing wells in the area. Groundwater samples were collected from groundwater monitoring wells MW-3 through MW-10, wells MW-1U through MW-4U, wells RW-1 and RW-2, and well MW-11. E&E reported that well MW-11 is located on the 18 West Mercer Street property and indicate that the designation was provided by Converse (1990) for the purpose of the RI.

Groundwater samples were analyzed for BTEX, ethylene dibromide (EDB), total petroleum hydrocarbons (TPH), and total lead (unfiltered). Wells MW-3 and MW-10 were also evaluated for bacteria and biological parameters and groundwater geochemistry. Two additional groundwater samples were collected from temporary sampling points installed in the ACT parking lot and the Security Pacific parking lot (Figure 5). Results from this comprehensive sampling event indicated wide-spread petroleum hydrocarbon impacts were present in groundwater and extended west of 1st Avenue West (Figure 5).

E&E installed a total of 25 Geoprobe station locations within a two-block radius from the intersection of Queen Anne Avenue North and West Roy Street (these soil-gas survey locations labeled 1 through 25 are depicted in Figure 6). E&E collected soil-gas samples for VTPH and BTEX analyses. The results of this screening are discussed in detail in Section 7.3.

E&E evaluated groundwater elevation data and indicated that a groundwater flow direction of west-southwest, toward Puget Sound, was seasonally consistent. E&E reported that wet season water levels were 1 to 3 feet higher than dry season levels, and that SPH thickness in MW-6 and RW-1 decreased during the wet period but increased in MW-9 and RW-2 during the same period. E&E further suggested, based on BTEX analytical results, that during periods of increased precipitation, petroleum constituents are flushed from the point source and from the zone of groundwater fluctuation. E&E estimated the volume of product persisting beneath the Arnold Property to be 4,800 gallons.

E&E reported that concentrations of chlorinated organic compounds not associated with petroleum hydrocarbons, including tetrachloroethene (PCE) and trichloroethene (TCE), were detected in groundwater samples collected from groundwater monitoring wells MW-3 and MW-7. E&E suggested that concentrations of these compounds above the cleanup standards might exist at other locations.

SAIC/Glacier Field Notes, 1993. No report documenting the 1993 UST closures at the Arnold Property is available. The only information pertaining to tank closures was obtained from Ecology was a file entitled "Construction Overview File" which contained copies of various pages of some on-site personnel log books, unlabeled photographs (no photo log) and draft

drawings with analytical information. The available documentation suggests that significant soil impacts were identified in the vicinity of the eastern dispenser island. According to the field notes, impacted soil was placed back into the excavation as backfill material.

SAIC/Glacier installed recovery wells and a spray aeration vapor extraction (SAVE) system, which operated for a short time before it was determined inadequate for site conditions.

Groundwater Technologies, Inc., 1996. In April 1996, GTI replaced the SAVE unit with a catalytic oxidizer in conjunction with the vapor extraction wells. The vapor extraction system operated intermittently between September 1996 and December 1997, when it was shut-down. Following review of the file at both Texaco and Ecology, no reports related to the operation of this system could be located.

Washington State Department of Ecology, May 1998. Ecology collected groundwater samples periodically between October 1995 to November 1997 from seven wells on the Monterey Apartments property to define the distribution and concentrations of petroleum hydrocarbons. Ecology collected groundwater samples from wells MW-4, MW-6, MW-9, MW-10, VP-7, VP-8, and RW-2 five times during October 1995, January 1997, April 1997, July 1997, and November 1997 (note- SAIC installed 9 vapor extraction (VP) wells some time between 1993 and 1996 (Figure 2). No data or bore logs related to these wells could be located, and no record of there installation was present in Ecology's files. Well MW-6 was not sampled after January 1997 due to the presence of SPH. Ecology reported that the SPH thickness in well MW-6 averaged one foot and attained a maximum of three feet during the sampling period. Groundwater samples were analyzed for BTEX, TPH as motor gasoline (TPH-G), volatile organic compound (VOCs), and total recoverable lead.

Farallon Consulting, January 11, 2000. Farallon, on behalf of Texaco, collected groundwater samples in December 1999 and again in June 2000. In December 1999, Farallon sampled eight wells (MW-4, MW-9, MW-10, VP-2, VP-5, VP-7, VP-8 and VP-9). In June 2000, Farallon sampled ten wells (MW-4, MW-9, MW-10, VP-1, VP-2, VP-4, VP-5, VP-7, VP-8 and VP-9, see Figure 2). On both occasions, each of the groundwater samples collected were analyzed for TPH-G, BTEX, TPH as diesel (TPH-D), TPH as oil (TPH-0), and total and dissolved lead. Select wells were sampled for the presence and concentration of dissolved anions and cations

which act as indicators of natural attenuation. These indicators include dissolved ferrous iron, nitrate-nitrogen and sulfate, and dissolved manganese. Results from these two sampling events are included as Table 1.

Farallon Consulting. July 21, 2000. Farallon prepared a quarterly groundwater summary report on behalf of Texaco for all accessible wells (with the exception of the recovery wells), which were sampled in December 1999 and June 2000. Farallon tabulated groundwater sampling results from the recent samplings as well as those presented in the E&E (1991) and Ecology (1998) reports. These tables are included in this report as Table 1.

Farallon noted that concentrations of TPH as gasoline and BTEX detected in groundwater have not decreased significantly since 1995 and that the concentrations in wells VP-7 and MW-4 were consistently the highest of the wells sampled. Farallon stated that wells VP-1, VP-4 and MW-6 were not sampled in December 1999 due to the presence of SPH and that wells VP-1 and VP-6 were not sampled in June 2000 due to the presence of SPH. Farallon placed absorbent socks in wells VP-1, VP-4, VP-6, MW-6, and RW-2 to recover SPH after the December 1999 monitoring event. The absorbent socks were changed out monthly.

Farallon surveyed tops of well casings in January 2000 and calculated groundwater elevations; Farallon suggested that the groundwater flow direction is west-southwest and is likely affected by underground structures such as the Monterey Apartments basement and sewer lines.

3.0 BACKGROUND

3.1 Introduction

This section presents a summary of the subject location and the properties surrounding it. This section includes a summary of historic land use, the subsurface utilities and features present in the area, the regional and area specific geology and hydrogeology and the ecological setting with respect to natural resources impacted.

3.2 Property location and Description

The former Texaco Queen Anne Service Station No. 211577 is located at 631 Queen Anne Avenue North, at the intersection of West Roy Street, in the City of Seattle, Washington. The property is located in a residential/commercial neighborhood in the Queen Anne District of northwest Seattle. Located within one city block east, west and south of the former facility location are several multi-story apartment buildings, a hotel, several retail and commercial shops and a former Union Oil Company 76 (Unocal) service station located at 700 Queen Anne Avenue North (Figure 2).

3.3 Land Development History

The lower Queen Anne District has been developed since the late 1800s. The Arnold property has been used for petroleum related distribution activities since approximately 1927. The Monterey Apartments, east of and adjacent to the Arnold property, contains a three-story 21-unit apartment building built in 1905. Several other apartment buildings are present in the immediate vicinity of the Arnold property; these include the Del Roy Apartments, the Alvena Vista Apartments, and the Lindberg Apartments. Each of these buildings are reported to have been constructed at the same time as the Monterey Apartments in 1905 (Figure 2).

In addition to residential dwellings, several commercial/retail businesses have also been present in the immediate area. The northeast corner of the Roy Street and Queen Anne North intersection contained a Unocal station built in 1922. East of the Unocal property at 14 Roy Street is the former location of the Paramount Dry Cleaners. This property has housed dry cleaning operations since 1944. The property currently houses a four-story mixed use building with residential and retail spaces. Across Roy Street (south) of the Unocal station is the Marqueen Hotel with has undergone several types of land use. The first recorded was as an Engineering School and Garage built in 1919.

3.4 Sub-Surface Utilities and Structures

SEWER LINES

City of Seattle Engineering Department records indicate the presence of two sewer lines running north to south beneath Queen Anne Avenue North. A 12-inch sewer pie installed prior to 1903 runs parallel to the north-south centerline of the street. Several plat maps and City

Engineering record show a 6-inch side sewer running east from the Arnold property and connecting with the 12-inch line beneath Queen Anne Avenue North. A second relief sewer line running north-south beneath Queen Anne Avenue North was installed in 1934 (Sewer card No. 5359). This second line is 15-inches in diameter and services several storm-water catch basins and the former Unocal Service Station (Figure 7).

Measurements taken by the City Engineering Department in 1991 indicate that the 12-inch line is 14 feet below the street surface, and that the 15-inch line is 13 feet below the street surface. Several active side sewer and catch basin lines are connected to these sewer lines, including side sewers and catch basins originating on the former Texaco and Unocal properties (Figure 8).

GeoEngineers, in a supplemental Off-site Exploration report dated February 5, 2001, describes the location and depth of subsurface utilities running east/west beneath Roy Street. These utilities include a 6-inch diameter sanitary sewer line, a water line, natural gas line and a fiber-optic cable (Figure 9). The GeoEngineers report also includes several cross-sectional drawings depicting the subsurface features present beneath Roy Street between the former Unocal station and the Marqueen Hotel. Figure 9 illustrates the approximate depth of the subsurface utilities beneath Roy Street being no greater than 7 feet below the street grade.

STREETCAR COUNTERBALANCE SYSTEM

Two tunnels exist under Queen Anne Avenue North, between Lee Street and Mercer Avenue. The tunnels housed the tracks and 16-ton counter weights used to propel streetcars up and down the 17 percent grade of Queen Anne Hill from 1903 to 1940. The surface tracks were removed in 1944. The tunnels span approximately 16 feet in combined width, extend 8.5 feet below street level and are positioned under the eastern and central sections of Queen Anne Avenue (Figure 8 & 10). Both tunnels were constructed with their own drain system to collect any water transported downhill through the tunnels. According to City Engineering records, the counterweight drain was connected to and discharged to the 12-inch sewer line near the Valley Street intersection.

In November 1969, the City of Seattle Engineering Department conducted a walk-through inspection of the two tunnels to determine their general condition and degree of structural

integrity. The inspectors reported that each tunnel was 5 feet wide by 4 feet high. The average depth of the tunnel system ceiling was 4 feet below street level. In general, the west tunnel was in better condition then the east tunnel. The report also noted that 'strong sewer gases' were encountered near the intersection of West Roy Street, suggesting that a faulty sewer line or other sources may be impacting groundwater in that area.

3.5 Regional Geology

Regional geologic mapping of the Queen Anne area indicates that Vashon Till underlies the base of Queen Anne Hill with Older Sand units adjacent to the hill on the north side. The Vashon Till is a well-graded, consolidated mixture of clays and gravels sizes and contains local lenses of sand and gravel. The till is very dense and typically has a very low hydraulic permeability. The Older Sand (i.e. Esperance Sand) underlies the Vashon Till and consists of a well graded, medium to course grained sand with silts stringers and interbeds. Underlying the Esperance Sand is the Lawton Clay described as an older mixture of clay, till, and gravel and contains both vertical and lateral variations. The Lawton Clay has a mostly low to medium hydraulic permeability.

E&E (1991) interpreted the soil underlying the Property soils to be within a transitional zone of the Esperance Sand to the underlying Lawton Clay that are described as underlying the Vashon Till. Based on the regional geologic mapping, boring logs prepared by others, and previous aquifer tests, soil underlying the property indicated low soil permeability's. Farallon concluded that the soil underlying the area consists of a transitional zone between the Vashon Till and Esperance Sand. Boring logs and subsurface cross-sections are included in this report as Attachment A.

3.6 Area-Specific Geology

GeoEngineers described soils underlying the investigation area as silty sand and gravel fill up to 11 feet bgs, native silty sand extending to 16 to 29 bgs, and a basal unit of gray, silty clay at the bottom of the borings. The depth to the top of the clay is deeper towards the southwest where the bottom of the clay was not reached in any of the borings (Figures 11 and 12).

3.7 Hydrogeology

Groundwater occurs a few feet above the clay at depths ranging from 10 to 20 feet bgs. Based on a review of the available boring logs and descriptions from previous reports, the shallow groundwater in the area appears to be perched in discontinuous lenses and layers of fill, silty sand and sand that overlies the basal clay. Previous studies have indicated that the natural groundwater flow direction is towards the west-southwest (Figure 13).

The fill likely has a highly variable permeability that is more permeable than the underlying native soils. The native soils, which are saturated, may be of low permeability, as suggested by previous aquifer tests, well dewaterings, and the local presence of impermeable glacial till. The sand that is interbedded with glacial till, silts and clay, are relatively more permeable, and are expected to be laterally discontinuous and variable. Pathways in native soil of varying permeability's are expected to exist in the subsurface. Farallon indicated that groundwater beneath the Arnold property may be comprised of multiple shallow water-bearing zones each with unique flow directions and rates.

3.8 Water Use

The City of Seattle Public Utilities Water Services Department supplies public drinking water. No active drinking water or irrigation wells are known to exist in the lower Queen Anne District. Sanitary Sewer and drainage systems are operated and managed by City of Seattle Public Utilities Drainage and Waste Water Services Department.

4.0 ARNOLD PROPERTY

4.1 Owner / Operator History

From the available records it appears that there were urban-type land uses on the Arnold Property prior to its use as a service station. The records show property use as a service station from December 1927 to June 1993. This section presents a brief overview of the owners and operators of the Arnold Property, commencing with the first service station operation.

- **James Estate/Carrico Owned - California Petroleum Company & sub-lessee Operated**

The first mention of a service station on the Property is in a lease dated August 31, 1927, between California Petroleum Corporation ("CalPet") and the James Estate. On October 29, 1927, the James Estate sold the Property to Emerson and Massie Carrico ("Carricos"). A "company-owned" service station apparently was built on the property during 1927-28 and began operating about December 1927.

CalPet subleased the operation of the station to W.L. Barcus beginning in 1927. In 1929, Barcus' sublease with CalPet was cancelled and a sublease entered into between Barcus and Texaco, with William E. Lewis as operator.

In 1938, the Carricos entered into a 15-year lease (including a purchase option) with Texaco.

The history of operators during Texaco's lease arrangement with the Carricos is contained within an incomplete set of records. Texaco has product agreements for the period 1943 to 1953 that show M. McCarty and Win. E. Lewis as Retailers.

- **Texaco Owned - Lessee-Dealer Operated**

In 1954, Texaco exercised its lease option to purchase the Property. The existing service station was demolished and new service station built.

In 1967, Texaco remodeled the station.

According to available Texaco product agreements, the station was operated by the following retailers:

  - 1955 - 1968: McCarty/Lewis (Retailer)
  - 1957 - 1968: Byron Buxton (employee of McCarty/Lewis)
  - 1969 - 1977: Byron Buxton as Texaco Retailer

- **Arnold Owned and Operated**

On April 26, 1977, William & Erma Arnold ("Arnolds") purchased the Property and the improvements, which included the service station building and five of the eight USTs. On June 22, 1978, the Arnolds purchased the remaining three USTs (Figure 14).

From May 1977 to January 1988, the Arnolds operated the station as independent retailers selling Texaco products purchased from Texaco and later through a wholesaler. Texaco has no records pertaining to the contractual nature of Arnolds' operation except the Mutual Agreement of Cancellation dated January 5, 1988.

- **Yoo Owned and Operated**

In 1989, John and Young Hee Yoo ("Yoos") purchased the Property and improvements from the Arnolds. In December 1990, the Yoos brought suit for recission of the purchase agreement.

On June 15, 1993, a Judgment of Recission was entered, the effect of which was to return the Property to the Arnolds.

- **Arnold Reacquisition and Operated**

Since the 1993 judgment, the Arnolds; have continued to own the Property and operate a deli/convenience store known as "Manhattan Express."

4.2 History of Fuel Products Sold & Inventory Control

This subsection will summarize information compiled regarding the grades of gasoline and other fuels sold at the Arnold Property, and a history of the gasoline storage and inventory control procedures employed during the period from 1950 to 1993.

4.2.1 Products Sold

Circa 1930s: Texaco Products Agreements from the 1934-35 period indicate three grades of gasoline were sold at the station - Ethyl, Fire Chief (equivalent to regular) and a "third grade," which was a sub-octane regular leaded gasoline.

1954 - 1971: During this period Texaco-owned stations such as the subject station carried two grades of gasoline: regular and ethyl (also referred to as Supreme). Diesel fuel was not stored or sold by this station during this period.

1971: Texaco introduced a third-grade of gasoline, known as Low Lead.

Circa late 1970s: Texaco's regular leaded product was replaced with low lead product and a new offering of "No Lead" or unleaded gasoline was introduced. Texaco still had a slate of three products - Regular, Unleaded and Supreme.

1982: The Arnolds' station began selling #2 diesel. Because Texaco did not directly market diesel fuel through any investment retail outlets in the Seattle area until 1986, the Arnolds would have obtained diesel from another source, such as a wholesaler.

Texaco eliminated all leaded fuel products from its product fine. The new product grades were regular unleaded, power plus unleaded (mid-octane) and super unleaded (high octane).

4.3 Underground Storage Tank History

This section presents a history of the Underground Storage Tank systems at the property. A drawing summarizing the tank location is presented in Figure 14.

4.3.1 UST Equipment Installation and Product Storage

- **1927:** Based on limited available records, the UST equipment at the CalPet service station consisted of two 550-gallon USTs (Figure 15). These two 550-gallon USTs were most likely used for the storage of gasoline and were installed under the sidewalk (standard design to allow access and to protect the USTs). Product was dispensed

through a suction pump placed over the USTs. For this era of service station, the USTs were most likely constructed of steel. Historical records indicate eight 50-gallon USTs may have existed on either side of the "building," which at that time was located on the center of the Property. An eight-unit dispenser complete with eight 50-gallon USTs was used for the sale of lubricant oils.

- **1934 - 1935:** A 1934 drawing shows the abandonment of two 550-gallon USTs in the street (an area later taken by the City to widen Queen Anne Avenue) and the presence of one 550 gallon UST (probably for waste oil), one 1,000-gallon UST and two 4,000-gallon USTs. These USTs are shown on Figure 14 as Tanks #3, #4, #5 and #6. Based on the Products Agreement, three grades of gasoline were sold at this time: Ethyl, Fire Chief and "Third Grade" (sub-octane regular leaded gasoline). For this era of service station, the USTs were most likely constructed of steel.

- **1954:** Along with the demolition of the CalPet station, Texaco installed an additional 4.000-gallon UST. At this time, it is believed that Texaco installed pressurized lines and at least one submersible turbine pump. The eight-unit lube oil USTs most likely were removed with the demolition of the CalPet service station. This tank is shown on Figure 14 as Tank 7A.

- **1967:** Texaco remodeled the service station and installed two 10,000-gallon USTs (steel). These tanks are shown on Figure 14 as Tanks #8 and #9. Originally Texaco proposed to install one 6,000-gallon UST and use the remaining three 4,000-gallon USTs. Apparently that Scope of Work changed to include building remodel and installation of the two 10,000-gallon USTs instead. It does not appear from any records that a 6,000-gallon UST was installed in 1967.

- **1971:** Texaco installed one new 6,000-gallon UST (steel) with the introduction of Low Lead gasoline in the Seattle area. This tank is shown on Figure 14 as Tank #10.

- **1977-78:** On April 26, 1977, the Arnolds purchased the Property and the improvements, which included the service station building and five of the eight USTs [Tanks #3, #4, #8,

#9 and #10) (Figure 14). On June 22, 1978, the Arnolds purchased the remaining three USTs (Tanks #5, #6 and #7A)(Figure 14)].

- **1982:** The Arnolds replaced one of the 4,000-gallon (steel) USTs (#7A) with one new 6,000 gallon UST (steel) and replaced 6-8 feet of piping (steel). The new tank is shown in Figure 14 as Tank #7B.

- **1984:** The Arnolds demolished the dispenser island on the east side of the Property to construct a seating area for the deli.

- **1987:** The Arnolds; "re-lined" three of the eight USTs on the Property (two 10,000 & one 6,000) and re-piped the three USTs with plastic piping.

- **1989:** The Yoo's purchased the Property and the improvements that included the service station building and the eight USTs.

- **1993:** The remaining eight USTs on the Arnold Property were "closed" under the direction of Ecology. (Shown on Figure 14 as Tanks #3, #4, #5, #6, #7B, #8, #9 and #10.) This tank closure reportedly consisted of removing seven USTs and abandoning in place one UST (Tank #6) by filling it with "25 cubic yards of concrete". The information available regarding this event consists of field notes, unlabeled photographs, handwritten analytical data, soil sample locations handwritten on a plot plan, and some weekly work summaries. A Tank Closure Report is not available and reportedly does not exist. Therefore, information regarding the construction or condition of the UST systems (tanks and piping) is unavailable.

4.4 Known Releases

The following section presents information on known and reported releases at the Property.

- **1977 - 1978:** A dispenser was identified as leaking during an inspection. The Seattle Fire Department notes state that the Arnolds related a drive-off several months earlier,

suggesting that the leak had been ongoing for some time. The dispenser was taken out of service for repair.

- **1978:** During a test performed by ASTEC in March 1978, two small leaks were discovered under the dispensers, and were repaired. However, ASTEC stated that there were no signs that gasoline had been leaking at these points.

- **1983:** Report of a substantial release from a drive-off, with resulting pump damage. The City of Seattle Fire Department responded and washed surface spillage into storm drain catch basin.

- **1991:** E&E Tank Tightness Test shows the Super Unleaded tank was not tight and three of four lines could not pass the required UST regulatory leak detection testing methods.

- **Circa 1993:** During closure of the USTs, the diesel pump was reported leaking on top of the tank.

5.0 MONTEREY PROPERTY

This section summarizes the information concerning the history of contamination problems at Monterey Apartments, the nature and distribution of impacts and the potential factors contributing to the occurrences (including sources, preferential pathways and drainage structure).

5.1 Property History

The Monterey Apartments are located at 622 First Avenue West. The apartments were constructed in 1905 and consist of 21 units in a three-story building. The building is 10-13 feet lower than any of the other buildings in the area, and has a basement with a concrete floor and a tile drainage system connected to two basement sumps and several window wells. This drainage system reportedly dates back to the early 1900's, and is used to collect water from the northeast side of the apartment building. The apartment building has a utility room in the basement directly east of the laundry room (Figure 16).

5.2 Background / History of Hydrocarbon Vapor Occurrences

This section provides summaries of the documentation regarding hydrocarbon vapors detected at the Monterey Apartments property.

- **1978:** Shortly after installation of drains on the northeast side of the building, tenants of the Monterey Apartments noticed petroleum odors within the building's basement-level units. The Seattle Fire Department responded to the complaint and conducted an investigation. SPH was identified within a sump that is apparently connected to the footing drainage system for the building.

- **1984:** In January 1984, the Seattle Fire Department conducted an inspection and noted a faint odor in the basement.

- **1985:** In May 1985, visible product and vapors were reported in the basement level sump. The Seattle Fire Department responded and took readings with an explosimeter throughout the building and in the drain opening. The Fire Department set up an exhaust fan to dissipate the fumes. The laundry room was barricaded and the building manager instructed to prohibit its use until further notice.

- **May 1986:** During installation of a new pipe in the basement window, the apartment manager reported being overcome by gasoline fumes.

- **September 1986:** Ecology initiated action at the property following notice from the King County Public Health Department that apartment residents had experienced problems with hydrocarbon odors for approximately 8 years. The Seattle Fire Department confirmed that they had responded to several complaints of odors since 1978. Between 1/4 and ½-inch of gasoline was noted on the water in the catch basin. According to Fire Department notes, "Until 9 months ago, problem was intermittent only appeared during rain storms. Since then, it has become more unpredictable, occurring during dry periods as well, there is no longer a pattern. Vapor alarms were installed within the basement of the apartment building.

- **1987:** In April 1987, odor problems were reported increasing again.

- **1989:** In January and February 1989, the vapor alarms installed by the Fire Department went off, and a notation was made to the Seattle Fire Department.

5.3 Nature and Extent of Hydrocarbon Impacts

Historic information regarding the nature and extent of petroleum hydrocarbons in soil and groundwater at the Monterey Apartments is complex and not entirely consistent. This section provides a review of the available data with respect to these issues.

Two SPH samples were collected from the footing drain sump adjacent to the apartment building. EPA analysis of the first sample collected in 1978 sample identified the product as "falling in the range of a gasoline". Samples collected from the footing drain in 1986 were identified as being a mixture of 45% gasoline, 45% No. 1 diesel, and 10% No. 2 diesel.

The composition of the product sample collected in 1986 indicates the presence of other potential sources. This is based on the presence of No.1 diesel fuel (also marketed as kerosene, stove oil, or Jet A fuel). No.1 diesel fuel is not a product that was distributed at service stations. The diesel fuel that is distributed at service stations as a motor fuel is No. 2 diesel. No. 1 diesel is a product that has historically been used as heating oil, particularly up until the 1930s. Furthermore, this SPH mixture is inconsistent with the composition of SPH found in MW-6, the presumed source of the Monterey Apartment impacts, which contained 80% of relatively fresh gasoline and 20% #2 diesel fuel. This mixture is consistent with products known to have been distributed at the Arnolds Texaco Station.

Concentrations of dissolved hydrocarbons in groundwater at the Monterey Apartments vary significantly in their composition. Well VP-1, located between the Monterey and Del Roy buildings, contains higher concentrations of diesel-range hydrocarbons than gasoline-range hydrocarbons. However, dissolved hydrocarbons in well MW-4, located approximately 15 feet west (down gradient) of well VP-1, contains primarily gasoline range hydrocarbons. Given the proximity of wells MW-4 and VP-1 to one another, the presence of diesel range hydrocarbon in

VP-1 is likely the result of leaks from a heating oil UST. Based on a WDOE drawing entitled 'Monterey Apartments Vicinity Map' and adapted from Miller, 1986, well VP-1 is located within a few feet of a heating oil tank. Furthermore, SAIC's drawing of the piping for the VES system installed in 1993, noted that the piping had to be diverted to avoid an "abandoned heating oil UST" on the north side of the Monterey Apartments immediately adjacent to VP-1 and VP-2 (Figure 18). In the most recent groundwater sampling, wells VP-1 and VP-2 contained a substantially higher amount of diesel-range hydrocarbons than gasoline-range. The diesel in well VP-1 is almost certainly the result of leaks from the heating oil UST, diesel in well VP-2 however is probably due to releases from the former Texaco station. Well VP-8, located approximately 55 feet northeast of well VP-5, also contains higher levels of diesel range than gasoline range hydrocarbon. Again, the WDOE drawing depicts a second heating oil tank on the west side of the Queen Anne (now Lindberg) Apartments 25-30 feet north of the southwest building corner, very close to where VP-8 is located. The diesel range petroleum in this well is also likely the result of heating oil releases from or overfills of this tank.

5.4 Building Drainage Structure / Preferential Pathways

Several of the investigations performed have focused on the potential role of preferential pathways in the subsurface migration of hydrocarbons to the Monterey Apartments. Such an evaluation is significantly complicated due to the geologic conditions present, the age of development in the area, and the absence of accurate and complete construction records. Nevertheless, enough information has been obtained to demonstrate that preferential pathways are critical to understanding the sources and migration of hydrocarbon impacts at this location. This section discusses some of the available information regarding preferential pathways.

The hydrocarbon vapors identified within the Monterey Apartments are believed to result from SPH accumulating or collecting in the footing drain system for the building. However, the construction details of the footing drain system are not well understood. It is believed that the sump located at the base of the outside stairwell along the northeast portion of the building is connected to this drainage system (Figure 16). However, less clear is where this drainage system discharges and how seasonal groundwater fluctuations affect the operation of this drainage system.

During 1986, the Seattle-King County Public Health Department placed dye in a stormwater catch basin on the comer of W. Roy and Queen Anne Avenue North (near the southwest comer of Unocal, see Figure 7). Two days later, the dye was observed within the apartment drain sump, which is presumably connected to the footing drains. This strongly suggests that the footing drain system is directly connected to the storm sewer system and also implies that any discharges to the storm system could end up within the footing drain around the Monterey Apartments. This apparent connection, along with the mixture of hydrocarbons found in the 1986 sump SPH sample, indicates that preferential pathways are a factor in the distribution of hydrocarbons.

A UST (contents unknown) has been noted historically on several drawings located within the alley north of the apartment building. One drawing (Figure 17) of the piping trench portion of the groundwater and vapor extraction system installed between the Monterey and Del Roy Apartments shows an area were the piping was relocated due to an "abandoned UST."

The basement of the Monterey Apartments, at approximately 13 feet bgs, has been identified as being in contact with shallow groundwater. E&E has hypothesized that seasonal and storm-related complaints of odors and observations of SPH in wells adjacent to the basement wells indicate that the basement likely acts as a barrier to west-southwestward migration of groundwater and SPH when the water table is higher than the basement slab.

Additionally, numerous other known and unknown utilities and other subsurface structures are located in the area (Figure 7). Many of these are located at depths that will facilitate the preferential migration or otherwise alter the normal migration of contaminants through the subsurface.

The occurrences of SPH in the basement and stair well drain sumps and the incidence of gasoline vapors at the Monterey Apartments during the late 1970's and through the 1980's may also be a result of free-phase and residual SPH within and on top of the groundwater beneath the apartment building. Seasonal and storm induced fluctuations in groundwater elevation beneath the apartment building would tend to force any SPH present on the groundwater surface upward into the more permeable backfill around the stairwell and basement drains and their associated piping. Ultimately, the SPH would be forced into the drain sumps or piping;

through seams or cracks, and would accumulate in the drain sumps. Based on the 1999 and 2000 groundwater samplings performed by Farallon, the distribution of SPH in wells on the Monterey Apartments property is wide spread. This would indicate that preferential pathways - although perhaps important with regards to vapor infiltration and the presence of SPH in the drain sumps of the apartment building, are not a primary factor in the transport and occurrences of SPH at this location.

6.0 ADJACENT AND NEARBY PROPERTIES

Several adjacent and nearby properties have been identified which may be potential contributors to the petroleum hydrocarbon impacts present beneath the Arnold and Monterey Apartments properties. This section summarizes present and previous land use histories for each of the properties identified as potential contributors and discusses environmental investigations and activities conducted at each of these properties.

6.1 Del Roy Apartments

The Del Roy Apartments are located at 25 West Roy (formerly 628 First Avenue West), adjacent to and north of Monterey Apartments (Figure 2). The date of original construction for the apartment building could not be determined. Conversations with Queen Anne historians place the apartments construction date either just prior to or at the same time as the Monterey Apartments in 1905. The basement of the apartments has a boiler room on the western side of the central courtyard. An abandoned heating oil tank (contents unknown) is located in the central courtyard directly north of the piping installed to connect the groundwater and vapor extraction system (Figure 18).

6.2 Alvena Vista Apartments

This property is a multi-story apartment building located at 612 First Avenue West, directly south of the Monterey Apartments (Figure 2). The two buildings are separated by an asphalt-covered parking lot. No date of original construction could be located. Conversations with local historians place the date of construction at about the same time as the Monterey Apartments in 1905. An abandoned heating oil tank (contents unknown) is located along the southwest of this building.

6.3 Lindberg Apartments

This property is located at 625 Queen Anne Avenue North, adjacent to and east of the Monterey Apartments (Figure 2). The building was constructed in 1905 as mixed-use with 24 apartment units and retail spaces that have ranged over the years from restaurants to beauty shops. The apartments were originally constructed with a boiler room in the basement. An abandoned heating oil tank (presumably installed in 1905 along with the boiler) is located along the western side of the building adjacent to the Monterey Apartments. The storm sewers are believed to run down the alley shared with the Monterey Apartments. In 1975, a transformer vault was installed. A 1991 investigation by E&E revealed that one corner of the buildings basement has no floor and that during an interview with the apartment residents, one resident complained of frequent gasoline odors within the basement. [E&E, 1991.]

6.4 Unocal Service Station

This property is located at 700 Queen Anne Avenue North. A Union Oil Company ("Unocal") service station operated at this location from 1922 through 1991 (Figure 2).

6.4.1 Property Ownership

From 1922 -1964 the Unocal property was owned and operated by a W. McKales. In 1964, Unocal purchased the property and operated a gasoline service station there until December 1991. From 1992 to the present the property has been a vacant lot. The property has recently been redevelopment as a multistory, mixed-use building with underground parking.

6.4.2 Facility History

- **1922 - 1966:** For a forty-year period, the property was occupied by a sales building and two service islands for fueling connected to five (5) steel gasoline USTs with two separate sets of product piping.

- **July 1966:** The facility was reconfigured and relocated to the southeast of the property. The pre-1966 surface facilities were removed at that time.

- **November 1979**: According to Unocal representative, Allen Hallaskhurst, the steel product and vent piping were replaced with fiberglass piping.

- **July 1986:** The steel USTs installed in 1966 were replaced with two fiberglass-coated steel USTs in the same location.

- **February 1992:** Unocal performed tank and line removal and test pit exploration activities (Figure 19).

  The following six USTs were removed:

  -Two 12,000-gallon - stored gasoline;
  -One 550-gallon fiberglass-coated steel - stored heating oil;
  -One 550-gallon fiberglass-coated steel - stored waste oil;
  -One 2,000-gallon steel - contents gasoline/diesel/waste;
  -One 4,500-gallon steel filled w/ concrete - contents unknown

  Unocal also removed:

  -(2) sets of Post-1966 product lines
  -(2) sets of Pre-1966 product lines
  -(2) hydraulic hoists
  -(1) service bay sump

6.4.3 Facility Operations

GeoEngineers' 1989 report identified a subsurface release of unknown size and origin had occurred sometime in the past.

Unocal also was known for its "Sparkling Clean Service Bays" program, which was achieved by washing their service bay floors with solvents every night. Unocal averaged approximately 50 gallons/week. The solvent was washed down the bay drains typically connected to the sanitary/storm sewer. Evidence of stoddard solvent contamination found at the south excavation wall of the 4,500-gallon tank further supports the use of cleaning solvents at this location.

6.4.4 History of Environmental Activities

- **GeoEngineers, 1986** - In a report prepared for Ecology, GeoEngineers concluded that petroleum hydrocarbon contamination of soil at the Unocal property appeared to be unrelated to the Arnold Property hydrocarbon contamination. GeoEngineers based this conclusion on the apparent unweathered nature of the SPH in MW-6 at the Arnold Property and the absence of SPH in both wells MW-8 (on the Unocal property) and MW-10 (located downgradient from Unocal on the upgradient portion of the Arnold Property).

- **GeoEngineers, March 9, 1989.** GeoEngineers was retained by Unocal to perform a subsurface contamination study at the Unocal property.

  GeoEngineers' services included the installation of four groundwater monitoring wells (MW-1U through MW-4U) and the collection of soil samples from each well boring (Figure 28). Soil samples were analyzed for BTEX, TPH and chlorinated solvents from MW-1U, which was installed adjacent to a waste oil storage UST. The groundwater wells were surveyed and sampled including well headspace vapor sampling. GeoEngineers also researched drain and utility locations that could act as potential conduits for contaminants.

  GeoEngineers reported finding 1.5 to 3 feet of silty sand and gravel fill underlain by native silty sand and silty clay. At locations MW-3U and MW-8, the fill directly overlies the native silty clay (See Appendix A). Evidence of hydrocarbons in the subsurface was noted in soil at one and 14 fourteen feet bgs at MW-3U and MW-4U respectively. Depth to water was reported as 7.4 to 10.7 feet bgs and the groundwater flow direction was reported being south to southwest. Underground vault tunnels, and utilities in the area appeared to be four to 10 feet above the water table, with the exception of the sanitary sewer noted at the depth of the water table fluctuation zone.

- **GeoEngineers, June 25, 1992.** GeoEngineers was retained by Unocal to observe soil conditions beneath the property for the potential presence of petroleum-related

contamination during UST removal activities and test pit explorations and to develop recommendations for remediation of any contamination encountered.

GeoEngineers' field observations and laboratory testing indicated that the soil contamination at the property was divided into three areas based on contaminant type. Area 1 - West/Southwest of the property - primarily contaminated with gasoline. Area 2 - South central part of the property - contaminated with gasoline and/or stoddard solvent. Area 3 - Eastern part of the property - contaminated with hydraulic oil, motor oil, diesel and/or stoddard solvent.

GeoEngineers found gasoline-related hydrocarbons in groundwater samples obtained in MW--3U, MW-4U and MW-8 (1986-DOE Study) at concentrations exceeding MTCA Method A groundwater cleanup levels. GeoEngineers noted that it is possible that free product and/or dissolved hydrocarbons in the groundwater extend towards the south and west and may have migrated along existing utility corridors beneath Queen Anne Avenue North.

GeoEngineers suggested several possible sources for the Stoddard solvent contamination in Areas 2 & 3 including past service station related-activities at the Unocal propertyand the former dry cleaning facility at the Orestes Restaurant (formerly Paramount Cleaners) property.

GeoEngineers recommended installing four monitoring wells in the sidewalks bordering the west and south property boundaries and along the south side of Roy Street to determine the extent and significance of the sub-surface contamination.

- **GeoEngineers, November 15, 1994** - GeoEngineers conducted further investigation at the Unocal propertyin 1994, which included obtaining groundwater samples from monitoring wells. GeoEngineers identified free product in Unocal well MW-8 between September 1993 and September 1994 ranging from 0.54 foot to 2.77 feet. Hydrocarbon vapor concentrations were found in wells adjacent to the property, some up to 10,000 ppmv. BTEX, gasoline-range, diesel-range and/or heavy oil-range hydrocarbons were found in the groundwater in wells MW-6U and MW-9U. PCE and TCE concentrations exceeding MTCA Method A cleanup levels were detected in MW-5U at the eastern edge of the Unocal property.

- **GeoEngineers, February 17, 1998** - In their report concerning groundwater monitoring and sampling results from August and November 1997, GeoEngineers stated that free product was detected in monitoring well MW-7U. Free product was not observed in other monitoring wells on or adjacent to the Unocal property. Petroleum-related contaminants were detected at concentrations exceeding MTCA Method A cleanup levels in the groundwater in all of the wells sampled. PCE and TCE were detected in MW-5U at concentrations above MTCA Method A cleanup levels. These analytical results are included in this report as Tables 2 and 3.

- **Unocal Letter, December 10, 1998, from Mark Brearley to DOE Project Manager, Ronald Timm.** Unocal reported that it had completed soil cleanup at the facility in 1998, and that residual soil contamination (above MTCA Method A cleanup levels for TPH) remained along the south and west sides of the property boundary.

- **GeoEngineers, March 19, 1999 - Supplemental Remedial Action East Property Boundary.** During routine groundwater monitoring activities on February 4, 1999, GeoEngineers observed SPH floating on surface water in the NE comer of the property. The SPH had impacted a significant portion of the ground surface at the Unocal property and discharged into the storm/sewer catchbasin at the southwest comer of the property. Based on visual observations and sampling, the soil impacts associated with this release reached depths of at least 4 feet bgs. GeoEngineers identified two possible mechanisms for the contaminant releases: 1) subsurface migration of free product from the vicinity of a subsurface utility vault adjacent to Unocal's eastern property line; and 2) discharges from a pipe broken in January 1999 on the former Orestes property a few feet east of Unocal's NE property comer (Figures 19 and 20).

    - UTILITY VAULT: Free product was observed in the utility vault near the Unocal/former Orestes property boundary in January 1999. It is unknown how long the product was present in the vault. It is also possible that high ground water and/or surface water conditions produced by heavy rains in December 1998 and January 1999 caused product to overflow the utility vault and release

petroleum hydrocarbons to the Unocal property sometime before GeoEngineers' February 1999 field visit. This utility vault was subsequently removed in 1999.

- BROKEN PIPE: A 4-inch steel pipe located directly east of Unocal's eastern property boundary on the Orestes property was broken during January 1999 activities on the property. Heavily contaminated soil was discovered by GeoEngineers surrounding the uncapped pipe on February 11, 1999. The origin of the pipe could not be determined; however, Kleen Environmental, remediation consultants for the Orestes property, indicated in a letter to Ecology in February 1999 that the pipe was a sewer line from an undetermined source. The broken pipe was not capped when the pipe was encountered in February 1999. When the pipe was exposed, field screening indicated that the soil directly surrounding and beneath the pipe was heavily contaminated. The area was not over-excavated.

Twenty soil samples were obtained from the sidewalls of the eastern property line remedial excavation. Concentrations of gas, diesel and/or lube oil-range hydrocarbons were greater than the MTCA Method A cleanup levels in six samples from the eastern, southern and western walls (Figure 21). Unocal instructed GeoEngineers to terminate further excavation to the south and west. The contents of the catchbasin in the SW comer of the Unocal property contained 31,700 ppm TPH-G; 807,000 ppm diesel; and 31,900 ppm lube oils. The basin was pumped out on February 10, 1999.

GeoEngineers concluded that the petroleum and VOC contaminants discovered on the Unocal property in February 1999 did not resemble the residual contaminant that remained in 1993 and 1998 in the sidewalk excavation adjacent to the Unocalproperty. Some of the VOCs detected in the February 1999 samples from the Unocal property match VOCs detected in samples from the former Orestes property in 1998 and 1999, specifically 1,2,4-trimethylbenzene detected in the southwest catchbasin sample.

- **GeoEngineers, October 13, 1999 - August 1999 Off-Site Explorations and May and September 1999 Groundwater Monitoring.** On August 28, 1999, three additional monitoring wells (MW-10U, MW-11U, and MW-12U) were completed to evaluate

subsurface conditions between the Unocal property and existing monitoring well MW-7U. The objective of the assessment was to further evaluate the source of product in monitoring well MW-7U. Two of these wells were located in the southern sidewalk of the Unocal property along Roy Street. The third well was located in the middle of Roy Street (Figures 22 and 23). The contaminated soil in Roy Street extended from the unsaturated zone beginning at about 7.5 feet bgs, to the upper portion of the saturated zone (14 to 16.5 feet bgs). Contaminants identified were primarily petroleum hydrocarbons and non-chlorinated VOCs.

Groundwater monitoring showed continued free product in MW-7U (0.66 feet). Dissolved lead above MTCA cleanup levels was in MW-8U. Several non-chlorinated VOCs were found in MW-6U and other surrounding wells. Unocal subsequently decommissioned MW-8.

GeoEngineers, February 5, 2001 - Off-Site Explorations Marqueen Property. In August 2000 Geoengineers installed a passive LNAPL skimmer in monitoring well MW-7U located in the Roy Street right-of-way. This skimmer reportedly was initially successful in recovering LNAPL, however recovery rates quickly diminished. It is not known if this skimmer is still in place or if it has been removed.

On September 5, 6 and 8, 2000, Geoengineers monitored the completion of nine soil borings (MQ-1 through MQ-9) (Figures 22 and 24). One-inch pre-packed monitoring wells were installed in four of the nine borings (MQ-2 through MQ-5). Soil and groundwater samples were collected and analyzed from each boring and well. Groundwater was observed in each of the four wells at depths ranging from 18 to 21 feet bgs. Gasoline range hydrocarbons, ethylbenzene and xylenes were detected at concentrations exceeding MTCA method A cleanup levels in samples collected from soil borings MQ-1, MQ-2, MQ-3, MQ-5 and MQ-7 through MQ-9 at depths ranging between 16 and 22 feet below the grade of Roy Street. Boring MQ-4 and MQ-6 completed inside the Marqueen garage were free of both gasoline range and BTEX impacts. Groundwater samples collected from wells MQ-2 through MW-5 and from discrete groundwater samples collected from MQ-6 and MQ-8 on September 8, 2000 contained one or more of the BTEX compounds and/or gasoline- and diesel range hydrocarbons at

concentrations exceeding MTCA Method A cleanup levels. Geoengineers concluded that the Unocal property was the most likely source of gasoline contaminated soil and groundwater detected beneath Roy Street and the northwest portion of the Marqueen property. Chlorinated VOCs (PCE, TCE and VC) were also detected in groundwater samples collected form MQ-4, MQ-5, MQ-6 and MQ-9. Based on groundwater flow direction the most likely source of these chlorinated VOCs is the former dry cleaning property located east of the Unocal property.

6.5 Paramount Dry Cleaners (a/k/a Orestes)

This property is located at 14 Roy Street and is occupied currently by a four-story, mixed use building with 28 residential units, retail space, and an underground parking garage (Figure 25).

6.5.1 Property Ownership and Facility History

- **1944 - 1953:** In 1944, Clyde Cleaners was established as a laundry and dry cleaning business. In 1946, Clyde Cleaners added a cleaning plant. This building had a boiler room with an underground tank space on the western edge of the property adjacent to the Unocal station. In 1951, a retaining wall and a building addition consisting of five garage bays was added along the northern property boundary.

- **1953 - 1973:** In 1953, Paramount Cleaners was established as a self-service laundry and dry cleaning business. That same year, Paramount added a boiler room and installed one 4,000-gallon underground storage tank. In 1954 a second addition to the existing building was made. In 1964, a hot water boiler and burner were installed.

- **1974 - 1983:** The property was occupied by a retail plant store.

- **1983 - January 1997:** The property was occupied by a series of restaurants. Orestes Restaurant was the last to occupy the propertyin January of 1997. The owners of the property, Roy Street Holdings, Inc./Motion Financial Management Group, demolished the restaurant in November 1997.

- **February 1997 - 1999:** 80% of the property was bare ground, while asphalt parking covered the remaining 20%.

- **May 2000:** Motion Financial Management, Ltd. constructed a four-story mixed use building on the property.

6.5.2 History of Environmental Activities

- **1995 - 1996:** Clayton Environmental Consultants conducted a Phase I Site Assessment and a series of soil and groundwater quality studies. Results from their subsurface investigation indicated that soil and groundwater were contaminated with petroleum and chlorinated hydrocarbons (HVOCs). Chlorinated solvents and petroleum hydrocarbons were detected in shallow groundwater located approximately 7-12 feet bgs at concentrations above MTCA Method A cleanup levels. The investigation also indicated that a 4,000-gallon UST used to store dry cleaning chemicals was located on the property, but its location was not known.

- **December 1997 - March 1998:** Quality Environmental Services Team, Inc. (QUEST) removed one 4,000-gallon steel PS-300 oil UST; one 860-gallon steel mineral spirits UST; one 175-gallon; and one 200-gallon vessel containing mostly water and product (type unknown). QUEST identified and removed subsurface piping that extended between the former 4,000-gallon and 860-gallon tanks (Figure 26). Soil samples collected in various UST and vessel excavations contained concentrations of petroleum hydrocarbons and chlorinated hydrocarbons that exceeded MTCA cleanup levels.

- **March 23, 1998:** The Seattle Fire Department investigated the locaton and notified Ecology after receiving several calls from citizens about strong odors emanating from the property.

- **March 24 - 27, 1998:** QUEST worked with Ecology and the Puget Sound Air Pollution Control Agency (PSAPCA) to respond to the spill. A PSAPCA inspector noted the tank pit was full of a brownish water; and then had to leave the area because of the Level 2-3

petroleum-solvent exposure; and Ecology noted that there were "environmental and public health issues resulting from this release."

- **August 1998:** Kleen Environmental Technologies (Kleen), at the request of Motion Financial Management Group, conducted a supplemental investigation at this property. The purpose of the investigation was to fill in data gaps associated with the geology and subsurface soil quality at the property, and develop a cleanup action plan. At this time, Motion Financial Management Group petitioned Ecology to enter its Voluntary Cleanup Action Technical Assistance program. Kleen's investigation indicated that contaminated soil was predominately confined to the western third of the property from the surface to approximately 10- 15 feet bgs, and was associated with the former electrical vault, the two former chlorinated solvent vessels, and the former 860-gallon mineral spirits UST (Figure 26). Petroleum hydrocarbon concentrations in the soil ranged from 109 pprn to 10,619 ppm, and kerosene was also identified. Chlorinated hydrocarbons in the soil were less than MTCA Method B soil cleanup standards.

- **February 1999 Draft Cleanup Report:** In January 1999, Kleen conducted a remedial excavation at the property that consisted of excavating five test pits on the west half of the propertyand removing a utility vault on the western edge of the property (Figure 26). Free product was observed floating on the groundwater in the utility vault excavation. Kleen's reports do not document sampling the floating product. During the excavation, Kleen broke a pipe that they believed was a sewer line from an undetermined source, and reported it to Ecology.

A total of 829 tons of contaminated soil was removed from the property. Concentrations of petroleum hydrocarbons and HVOCs exceeding MTCA Method A cleanup levels remain in the soil along the west and south property boundaries. An impermeable geo-membrane liner, approximately 125 feet long, was placed along the west wall of the excavation, before the excavation was backfilled. Kleen recommended no further soil cleanup action at the property; and concluded that future development would improve groundwater quality underlying the property because the development would function as a cap, preventing infiltration of rainwater and the migration of soluble petroleum and chlorinated hydrocarbons remaining in the soil.

- **March 1, 1999:** Ecology issued a No Further Action letter to the property owners.

- **January 11, 2000:** Seattle Fire Department issued a temporary permit to remove one 675-gallon heating oil tank.

- **June 2000:** Seattle Fire Department issued a temporary permit to remove one 800-gallon fuel oil tank.

6.6 Marqueen Apartments and Garage (a/k/a Marqueen Hotel)

This property is located at 10 Mercer St., (formerly 600 Queen Anne Ave. North). It is currently a mixed-use building with a hotel, retail space, and an underground parking garage (Figure 26). In the past, this property has been used as an engineering school, a garage, an apartment building and a public garage.

6.6.1 History of Environmental Activities

- **RZA AGRA, Inc, October 11, 1993 - Underground Storage Tank Removal Summary Report.** Diamond Parking hired RZA AGRA to observe UST removal and excavation procedures and perform sampling to evaluate whether or not petroleum hydrocarbons were present in the soils in the immediate area of the tank excavation. From August 16 to September 3, 1993, Meridian Construction removed three steel USTs one 1,200-gallon gasoline tank; one 2,000-gallon gasoline tank; and one 2,000-gallon heating oil tank. According to information provided by Diamond Parking, the heating oil tank was used for the adjacent hotel. The 1,200-gallon UST was suspected of also being a heating oil tank; and the 2,000-gallon gasoline tank was an undocumented tank. Upon inspection, the USTs appeared to be in poor condition, with pitting and corrosion evident. The heating oil tank contained several <1/4" holes. All three USTs contained a mixture of product and water. Soils surrounding each of the USTs exhibited petroleum hydrocarbon staining, distinct petroleum hydrocarbon odors, and other indicators of petroleum impact. Approximately 200 cubic yards of impacted soils were removed from the excavation, although impacted soil beneath the foundation of the parking garage

was left in place. Petroleum impacted soils in this area were contained within a zone one to two feet thick, extending the length of the excavation. Soils encountered during the excavation consisted of four feet of silty sand fill, which contained construction debris such as concrete blocks. The soil was underlain by six feet of sandy silt, which formed the west wall of the excavation. A soil sample was not taken from the east wall of the excavation for the heating oil tank because the UST extended beneath an existing driveway along Mercer Street. This area was not over-excavated for the same reason. Concentrations of gasoline-range hydrocarbons in the impacted soil ranged from 2,500 ppm to 12,000 ppm.

AGRA Earth & Environmental, Inc., March 3, 1999 - AGRA, consultants for the Marqueen Hotel, conducted a file review of WDOE's Unocal property files and concluded in a letter to Ecology (AGRA. March 3, 1999) that Unocal was the most likely source of the free product found in monitoring well MW-7U and on the Marqueen property.

7.0 OCCURRENCE AND DISTRIBUTION OF CONTAMINANTS

7.1 Introduction

This section describes the contaminants detected in soil and groundwater on and beneath the Arnold and Monterey Apartments properties. All of the data regarding the occurrence and distribution of contaminants at these locations was obtained from soil borings and groundwater sampling performed by others over the last twelve years. Samples from two different media (soil and groundwater) have been collected and analyzed for various constituents. No ambient or indoor air samples have been collected at either of these properties, and no evaluation of ambient or indoor air quality has been performed.

7.2 Soil

Data regarding the location and magnitude of petroleum hydrocarbon impacts to soils at the Arnold and Monterey Apartments properties is principally based on information contained in the "Report of Hydrogeologic Services, Subsurface Fuel Contamination Problem" based on work performed by GeoEngineers, Inc. in 1986. The data presented in this report was collected during the installation of nine monitoring wells (MW-2 through MW-10) by GeoEngineers in

1986. This report is incomplete in that it does not contain soil analytical results for any of the soil samples collected. The GeoEngineers report does however describe the presence of odor and/or visual signs of hydrocarbon-contamination in soil samples recovered during the installation of monitoring wells MW-2, and MW-4 through MW-9.

The few records available from the remedial excavation are in the form of field notes and logs. These field notes indicate that gasoline- and diesel-impacted soils were apparently identified within much of the 1993 excavation. The highest concentrations of soil impacts were identified in the eastern portion of the excavation, in the vicinity of the eastern dispenser island. Substantial soil staining was observed from shallow soils down to 11-12 feet bgs and around the UST fill pipes. This suggests that the impacts are the result of leaks from product piping and/or dispensers and possibly tank overfills. This is also consistent with the observations of an ongoing leak from the turbine above the diesel UST. Based on the high concentrations of benzene relative to remaining aromatic compounds in groundwater, the gasoline impacts appeared to be relatively unweathered. This suggests that the gasoline impacts may be the result of a fairly recent release(s).

7.3 Soil Vapor

Soil vapor data was collected by Ecology and Environment, Inc. (E&E) in 1991 during a survey performed for the Department of Ecology in an effort to identify the source of the petroleum impacting the Monterey Apartments. During this investigation, E&E installed 25 geoprobe sampling points and collected soil vapor data from 25 locations distributed in a two-block radius around the apartment building (see Figure 6). Soil gas data was analyzed for BTEX and volatile TPH. The result of this investigation indicated that volatile TPH concentrations in soil gas extended from the Arnold property westerly across 1st Avenue West and potentially as far west as 2nd Avenue West (see Figure 27). Soil gas samples collected from the Unocal property and from the Marqueen property indicate the presence of a soil gas plume originating from the Unocal property. This plume does not appear to intercept or commingle with the plume originating from the Arnold property.

7.4 Groundwater

Beginning in 1986 with the installation of monitoring wells MW-2 through MW-10, groundwater quality beneath both the Arnold property and the Monterey Apartments property has been routinely assessed. Two of these groundwater monitoring wells (MW-6 and MW-9) installed in 1986 have contained or continue to contain SPH. MW-6, located in the southwest comer of the Arnold property, contained approximately 2 feet of SPH when first installed. The SPH was observed to be "clear and fresh", and a sample of this SPH collected in 1986 contained 80% unweathered gasoline and 20% #2 diesel fuel. Well MW-9, located northwest of the north dispenser island, has intermittently contained SPH. Farallon Consulting collected the most recent groundwater sampling data in June 2000. During that sampling event, separate phase hydrocarbon was observed in monitoring wells MW-6 on the Arnold property and VP-6 on the Monterey Apartments property (see Figure 28).

Dissolved phase petroleum hydrocarbons were present in all of the wells sampled, and with the exception of well MW-10 in the northeast corner of the Arnold property, the concentrations of TPH-G, TPH-D, benzene and one or more of the BTEX compounds exceeded MTCA Method A cleanup levels.

No groundwater data has been collected west of wells MW-4 and VP-7. Due to the benzene in both of these wells, additional wells should be installed both west and southwest of the Monterey Apartments so that groundwater quality down gradient of this location can be further assessed.

7.5 Ambient Air

No ambient air sampling has been performed and no ambient air data has been collected from either the Arnolds or Monterey Apartments properties.

7.6 Indoor Air

A soil vapor study, performed by E&E in 1990, indicated the presence of volatile TPH in shallow soil gas samples collected from the Monterey Apartment property. The concentration contour map produced by E&E depicting volatile TPH soil gas distributions further supports the presence of volatile hydrocarbon vapors beneath the Monterey Apartments (Figure 27). As a

result, the indoor air quality in the basement of the Monterey apartments may have been impacted. The extent of this impact will be evaluated as part of the supplemental investigative actions proposed later in this report.

7.7 Data Gaps

Due to the limited amount of soil data from previous investigative and remedial activities performed at both the Arnold and Monterey Apartments properties, additional soil borings should be performed at both these locations to fully characterize the petroleum impacts presumed to be present. The nature and distribution of petroleum hydrocarbons potentially present in groundwater north, west and southwest of the Monterey Apartments Property also warrants further evaluation. Currently neither the vertical nor lateral extent of petroleum hydrocarbon impacts to soil and groundwater at and beneath either the Del Roy or Alvena Vista Apartments or west of 1st Avenue West has been sufficiently explored. The magnitude and extent of potential hydrocarbon impacts to both ambient and/or indoor air at this location warrants further assessment.

8.0 TRANSPORT MECHANISMS AND IMPACTED MEDIA

8.1 Introduction

This section describes the route of transport for contaminants detected in soil and groundwater beneath the Arnold and Monterey Apartments properties. Also discussed are the probable routes of petroleum hydrocarbon transport in soil vapor and ambient air. Information regarding transport of petroleum hydrocarbon at these locations is based on the compounds present and known and accepted factors influencing the migration of these compounds in soil, water and air. For the purpose of this report, any media containing or conveying petroleum hydrocarbon constituents at concentrations exceeding MTCA Method A cleanup levels will be considered impacted. This is not meant to imply that analytical results verifying MTCA Method A excedences have been obtained, but rather that the potential exist for impact to the medium is present.

8.2 Soil

Gasoline- and diesel-impacted soils were encountered within much of the 1993 excavation. The highest concentrations of soil impacts were identified in the vicinity of the eastern dispenser

island. Substantial soil staining was observed from shallow soils down to 11-12 feet bgs, and in soils around the UST fill pipes. This suggests that the impacts are the result of both leaks from product piping and/or dispensers and potentially from tank overfills. During the December 1999 and June 2000 groundwater sampling events, SPH was observed in wells MW-6, VP-1, VP-4, VP-6 and RW-4. The presence of SPH in these wells indicates that the volume of petroleum released was sufficient to produce a light non-aqueous phase liquid (LNAPL) capable of bulk fluid movement through both the unsaturated and saturated soils. This LNAPL layer appears to be have migrated westerly from the original point of release (assumed to be in the area of the eastern fuel dispenser island on the Arnold property) towards the Monterey Apartments. Vertical movement of LNAPL within the soil stratum would have been arrested at the static groundwater depth, at which point convective and advective forces would control the lateral extent of LNAPL dispersion. Various estimates have been proposed regarding the volume of petroleum hydrocarbon released to the soils at this location. These estimates appear to be based on the uniform dispersion of LNAPL in homogenous media, an assumption which, although conservative with regard to potential magnitude is inappropriate. A more likely scenario for the movement of LNAPL at this location incorporates both uniform dispersion of LNAPL on the groundwater surface and preferential migration in or along utility trenches or backfill materials with greater porosity and permeability then the native silty sands and till.

Although soil analytical results are not available for review, the presence of SPH in wells VP-1, VP-4 and VP-6 on the Monterey Apartments property indicates that soils at these three wells have been (at least in part) impacted by separate phase petroleum hydrocarbons, however the vertical and lateral extent of these impacts is presently unclear. LNAPL mobility is almost certainly influenced by the higher permeability sand layers interbedded in the glacial till, silts and clay beneath both properties. This sand layer, as described in Section 3.7, is laterally intermittent and discontinuous thus producing the capacity for LNAPL to reside at various unrelated locations.

Regardless of which transport processes are most influential, the presence of SPH in these three wells indicates that both the saturated and unsaturated soils beneath the Arnold property, the Monterey Apartments and possibly other adjacent properties have been impacted by both separate and dissolved phase petroleum hydrocarbons. The total volume and disposition of the soil removed from the Arnold property during the 1993 remedial excavation is not well

documented, but it has been suggested that these soils were returned to the excavation following tank and product line removal. Because the current condition of these soils is unknown, soils near the Monterey Apartments should be considered impacted until further investigation can demonstrate otherwise. Section 10 discusses further investigative actions proposed for this location.

8.3 Groundwater

Dissolved concentrations of gasoline, diesel and BTEX exceeding the MTCA Method A cleanup levels have been observed in all but one of the wells (MW-10) present on these properties. Migration of these dissolved constituents in ground water is primarily driven by advective groundwater transport toward the west-southwest at an average gradient of 0.05 ft/ft. No information regarding soil organic carbon content (Foc) has been collected, so retarded constituent transport velocities can only be estimated. Since benzene is typically the first of the BTEX compounds to be detected in down gradient receptors we have chosen to use it as a basis for estimating a conservative hydrocarbon transport rate. Using a hydraulic conductivity of 5.0E-5 ft/sec or 4.32 ft/day (as reported by E&E), an effective porosity of 0.35 (typical for alluvial deposits) and an average hydraulic gradient of 0.05 ft/ft (based on historic groundwater elevation data from wells in the area) the groundwater flow velocity is estimated at 0.617 ft/day. Using the Koc value from MTCA for benzene (62ml/g) and the prescribed Foc from MTCA (0.001 g soil organic per g soil) and a bulk density of 1.6 gm/cc (common for alluvial soils), the retarded velocity for benzene in groundwater becomes 0.48 ft/day. The potential for dissolved phase petroleum hydrocarbon impacts groundwater down-gradient of the Arnold and Monterey Apartments properties must be further explored. Section 10 outlines further sampling actions to be performed with regards to better defining the extent of groundwater impacts present.

8.4 Ambient Air

No ambient air data has been collected in this general area, however as will be discussed in the next section, the primary transport route to ambient air for the volatile constituents presents would be through volatilization from soil or groundwater. Because the area is largely covered by buildings, pavement, concrete and other forms of surface capping, the likelihood that ambient air has been impacted as a result of the petroleum compounds released to soil and groundwater is minimal. Section 10 contains a discussion of further investigative actions

proposed to address potential ambient air impacts. These actions include directly sampling ambient air or possibly sampling shallow soil gas to determine if ambient air is an impacted media of concern.

8.5 Indoor Air

Like ambient air, no indoor air data has been collected at the Arnold's property or at the Monterey Apartments property either, however as will be discussed in the next section, the primary transport route to indoor air for the volatile constituents presents would be through volatilization from soil or groundwater to enclosed building spaces. Because many of the buildings in this area were constructed without means to seal the enclosed space from the intrusion of soil vapor, indoor air is a media, which warrants further investigation. In addition to the intrusion of soil gas to the indoor spaces, the presence of floor drains and sumps in the floor and foundations of the Monterey Apartments has resulted in gasoline vapors, and could likely be acting as a conduit for intrusion of soil gas vapors. For these reasons, indoor air will be considered an impacted media until such time as further testing can be performed. Section 10 contains a discussion of further investigative actions proposed to address indoor air intrusion. These actions may include sampling the indoor air of the Monterey Apartments to determine if volatile hydrocarbon compounds are present, or performing soil or soil gas sampling beneath the Monterey Apartments.

9.0 EXPOSURE PATHWAYS AND POTENTIAL RISKS

9.1 Introduction

A preliminary identification of potential human exposure provides much needed information and involves the identification of (1) media of concern, (2) areas of concern (i.e., general locations of the media to be sampled), (3) types of chemicals expected at the location, and (4) potential routes of contaminant transport through the environment (e.g., inter-media transfer, food chain). This section provides general information on the preliminary identification of potential human exposure pathways, and which of these pathways may pose a risk to human health and the environment.

9.2 Soil

Soil represents a medium of direct contact exposure and often is the main source of contaminants released into other media. Some of the potential exposure pathways resulting from the presence of the petroleum hydrocarbons released to soils are-

- Exposure of construction workers through dermal contact
- Incidental ingestion of petroleum contaminated dust and particulates.

Potential exposure of construction workers is typically mitigated through the use of appropriate institutional and engineered controls. Incidental ingestion of dust and particulates is less likely since most of the soils, which have or may have been contaminated by petroleum hydrocarbons, are subsurface. Because the majority of the properties in this area arel covered by asphalt and concrete surface seals this exposure route has been eliminated. Impacted soil may however, pose a significant source of vapor to ambient and indoor air and act as a source for petroleum leaching to groundwater.

9.3 Groundwater

Based on groundwater samples collected in June 2000 by Farallon Consultants, total petroleum hydrocarbons as gasoline and diesel along with BTEX compounds are present in groundwater beneath both the Arnold and Monterey Apartments properties. Possible routes of exposure to this petroleum hydrocarbon contaminated groundwater include dermal exposure and direct ingestion, however neither of these two exposure routes is present. Groundwater from the area around the Arnold's property is not known to discharge to nearby surface receptors and a water well search, performed by GeoEngineers for Unocal, did not identify any drinking water wells within a one-half mile radius of the adjacent Unocal property. Furthermore, the shallow perched groundwater present within the Queen Anne district contains high concentrations of dissolved salts, ferrous iron, calcium and magnesium (hardness ions), in addition to elevated numbers of both total heterotrophic and coil form bacteria. Subsequently, the groundwater in this area would not qualify as potable regardless of the dissolved petroleum hydrocarbons present. Based on the pertinent area conditions, groundwater does not appear to present a human health risk. Groundwater impacts may however be responsible for ambient and indoor air

impacts. Due to the lack of current soil data, none of these potential pathways can presently be evaluated.

9.4 Ambient Air

Volatilization of contaminants located in subsurface soils and in groundwater, and the subsequent mass transport of these vapors to the ambient air can constitute a potential inhalation exposure pathway. The magnitude of risk associated with this pathway is determined by a number of physical and chemical processes. Vapor flux rate from the soil, soil and groundwater temperatures, wind speeds and directions, the location of individuals and populations which may serve as receptors and the duration of exposure are just a few of the physical and location-specific factors which contribute to the degree of risk posed by this pathway. Attempting to model the risks associated with this pathway is extremely difficult. In most cases, ambient air sampling is first performed to determine if this pathway is of potential concern prior to further risk assessment. Due to the complexities involved, this pathway and any potential risks resulting from it may be further assessed through, either ambient air sampling or shallow soil gas sampling.

9.5 Indoor Air

Volatilization of contaminants located in subsurface soils and in groundwater, and the subsequent mass transport of these vapors into adjacent indoor spaces can constitute a potential inhalation exposure pathway, which must be evaluated when preparing risk assessments.

To assist with these types of assessments, Johnson and Ettinger (1991) created several models which incorporate both convective and diffusive mechanisms for estimating the transport of contaminant vapors originating from subsurface soils or groundwater into indoor spaces located directly above the source of contamination. Inputs to these models include chemical properties of the contaminant, saturated and unsaturated zone soil properties, and structural properties of the building. These models then produce either a risk-based soil or groundwater concentration, or an estimate of the actual incremental risk associated with an initial contaminant concentration. That is, the model will back-calculate an "acceptable" soil or groundwater concentration given a pre-defined risk level (i.e., target risk level or target hazard

quotient), or the model may be used to forward-calculate an incremental cancer risk or hazard quotient based on an initial soil or groundwater concentration.

Delta proposes utilizing the Johnson and Ettinger model to further assess the potential for indoor air intrusion into surrounding buildings in this area. Two media (soil and groundwater) will be evaluated using the model, and benzene will be used as the chemical hazard modeled. Benzene will be chosen due to its high vapor pressure and high carcinogenicity potency factor. For these two reasons, benzene is expected to produce the most conservative (i.e. lowest acceptable permissible exposure limit) of the hydrocarbon compounds present. Data collected during the groundwater and soil sampling tasks mentioned in sections 8.2 and 8.3 will be used for this modeling. This data in addition to the physical soil properties analyses mentioned in Section 8.3 will be used to calculate the concentration of petroleum hydrocarbons in soil and groundwater, which will be protective of indoor air.

9.6 Data Gaps

The following data gaps regarding potential exposure pathways and the risks they pose have been identified and require further assessment:

- Again, due to the lack of available soil data, none of the pathways involving soil as a source of vapor impacts to ambient or indoor air or as a source of groundwater contamination could be evaluated. Additional soil borings and soil analytical data are required.
- No soil property data is known to have been collected from any of the potentially impacted properties in this area. In order to better model both ambient and indoor air intrusion risks posed by the contaminants present, soil properties data; specifically air permeability, fraction organic carbon and total and effective porosity should be collected.
- Groundwater quality data from down gradient locations is required, before further assessment of the potential risks posed to surrounding properties and buildings can be assessed.

10.0 SUPPLEMENTAL INVESTIGATIONS

10.1 Introduction

This section describes investigative actions required to characterize the vertical and lateral extent of gasoline and diesel petroleum hydrocarbons is soil and groundwater beneath both the Arnold's and Monterey Apartments properties and several adjacent locations, and to further evaluated the potential risk these petroleum hydrocarbons may pose to human health and the environment. To accomplish these tasks, Delta proposes the following additional field investigations and data collection efforts.

10.2 Synoptic Groundwater Sampling

In June 2000, Farallon sampled 12 of the monitoring wells distributed between both the Arnold and Monterey Apartments properties and collected groundwater samples from ten of these (two of the wells samples contained SPH, therefore no samples were collected). These ten samples were analyzed for total petroleum hydrocarbons as gasoline and as diesel, total dissolved lead and for the BTEX compounds. Select samples were also evaluated for the presence of chlorinated volatile organic compounds, dissolved iron, manganese, nitrate, sulfate and oxygen. Groundwater quality at this location has not been evaluated since that time.

Delta Environmental proposes gauging and sampling 18 monitoring wells (VP-1, VP-2, VP-3 [MW-2], VP-4, VP-5 [MW-5], VP-6, VP-7 [MW-3], VP-8 [MW-7], MW-4, MW-6, MW-10, MW-11 RW-2, RW-3, RW-4 and RW-5. These wells are located on the Arnold, Monterey Apartments properties and at the southeast corner of the 18 Mercer Street building (Figure 28).

Prior to purging and sampling these monitoring wells, the depth to water in each well will be measured with respect to the top of the well casing to the nearest 0.01-foot. Depth to water and SPH thickness (if present) will be determined using an electronic interface probe.

Prior to groundwater sample collection, three casing volumes of groundwater will be purged from each monitoring well using a disposable bailer. Groundwater samples will be collected by bailer for from each of the wells indicated above. Groundwater samples will be analyzed for Benzene, Toluene, Ethyl benzene, and Xylenes (BTEX compounds) by EPA Method 8021b, Total Petroleum Hydrocarbons as Gasoline (TPH-G) by Northwest Method NWTPH-g, and for

Total Petroleum Hydrocarbons as Diesel (TPH-D) by Northwest Method NWTPH-d with silica gel acid cleanup. A groundwater sample from each well sampled will also be analyzed for dissolved lead using EPA 6000/7000 series methods.

In addition to the analyses listed above, selected groundwater samples will also be collected for the following analysis, most of which are required by MTCA and listed in Table 830-1.

- EPA Method 8260b – This analysis will be used to assess the presence and concentration of halogenated compounds, fuel additives and blending compounds, naphthalene's, and several of the principle fuel oxygenates known to be present in gasoline distributed in Washington State.
- Carcinogenic Poly Aromatic Hydrocarbons (cPAHs), and Semivolatile Organic Compounds (SVOCs) will be quantified by EPA Method 8270c.
- Select groundwater samples will be collected and submitted for analysis of the eight principle metals listed in the Resource Conservation and Recovery Act (RCRA). This procedure is used to detect and quantify the concentration of the principle heavy metals known to constitute environmental concerns. Although this analysis is not specifically required by MTCA, several of the RCRA listed metals have previously been detected in groundwater from this area at concentrations exceeding MTCA Method A cleanup levels. For this reason, additional analyses will be performed to determine the nature and extent of these exceedences.

10.3 Soil Borings and Monitoring Well Installations

Following the results from the groundwater sampling listed above, Delta Environmental Consultants will subcontract the drilling of up to 12 soil borings and complete as many as 8 of these borings as groundwater monitoring wells (Figure 29). Each soil boring will be drilled to a total depth of 35 feet below grade, using a hollow-stem auger drill rig. During drilling and well installation, a Delta Environmental engineer using the Unified Soil Classification System will log each well boring and collect soil samples from a split-spoon sampler driven ahead of the hollow stem auger flights. Soil samples will be collected from each boring at 5-foot intervals to the total depth explored. Soil from each sampled interval will be field screened for the presence of hydrocarbons using a photo-ionization detector (PID) with a 10.0 electron volt (eV) lamp. The results of this field screening will be recorded on the soil boring logs and be used to select

which samples will be submitted for laboratory analysis. At a minimum, one soil sample from the capillary fringe or vadose zone will be collected and submitted for laboratory analysis. Soil samples preserved for analysis will be retained in laboratory-supplied glass jars with Teflon® lined lids. Soil samples will be analyzed for Benzene, Toluene, Ethyl benzene, and Xylenes (BTEX compounds) by EPA Method 8021b, Total Petroleum Hydrocarbons as Gasoline (TPH-G) by Northwest Method NWTPH-g, and for Total Petroleum Hydrocarbons as Diesel (TPH-D) by Northwest Method NWTPH-d with silica gel acid cleanup. A soil sample from the capillary fringe soils in each boring will also be analyzed for total lead using EPA 6000/7000 series methods. Soil samples from selected locations and sampling depths will also be submitted for Semi-Volatile Organic Compounds (SVOCs) analysis by EPA Method 8270c and for Extractable Petroleum Hydrocarbons (EPH) and Volatile Petroleum Hydrocarbons (VPH) analysis using the WDOE interim TPH methods.

In addition to the analyses listed above, soil samples from selected locations and intervals will also be collected for the following physical properties analysis.

- Fraction Organic Carbon (FOC) by ASTM D-2974
- Bulk density by ASTM D-2937
- Specific gravity by ASTM D-854
- Total and effective porosity according to the method described in Freeze and Cherry, 1979 (Groundwater)
- Moisture content by ASTM D-2216
- Saturated hydraulic conductivity by one of the following methods – ASTM D-2434 or ASTM D-5084
- Air permeability by SSSA 48 / ASTM D-4525

These analyses will allow more accurate soil vapor intrusion modeling to be performed and soil and groundwater concentrations protective of indoor air to be determined.

10.4 Ambient Air Assessment

In order to further assees the potential risk to both ambient and indoor air posed by petroleum hydrocarbons in soil and groundwater beneath the Arnold's and Monterey Apartments properties, Delta proposes either-

1. Collecting ambient and indoor air samples using lab supplied pre-evacuated 1-liter summa canisters fitted with fixed orifice sample nozzles, or
2. Collecting shallow soil gas samples using a geoprobe soil-gas sampling apparatus and summa canisters.

Ambient air or shallow soil gas samples will be collected from the 1) Southwest corner (within the treatment system compound) of the Arnolds property, and from 2) Northeast corner of the intersection of West Roy Street and Queen Anne Avenue North (Background sampling location).

Canisters used to collect ambient air samples will be fitted with Teflon tubing set to collect air samples from 4.5 to 5.5 feet above ground level (i.e. breathing zone height). These Canisters will be set to collect a 1-liter volume over an eight-hour sampling period. Canisters used to collect soil gas will be set to collect a 1-liter volume of soil gas over a 15-minute period.

Following sample collection the each canister will be transported under chain of custody to a chevron approved analytical laboratory for volatile hydrocarbons analysis by EPA Test Method TO-14.

10.5 Indoor Air Assessment

Delta proposes further assessment of indoor air quality within the Monterey Apartments by one of the two following methods.

1. Directly sampling indoor air using lab supplied pre-evacuated 1-liter summa canisters fitted with fixed orifice sample nozzles. The canisters are designed to collect indoor air samples over an eight hour period. Three samples will be collected from the soil directly below the basement floor of the Monterey Apartments building.

2. Collecting soil or soil vapor from directly below the basement floorof the Monterey Apartments building using an angled geoprobe or by hand driven soil gas probes. Samples would be collected from beneath the building in the vicinity of well VP-6, and from beneath the central and eastern portions of the buildings footprint.

A total of three indoor air samples or three soil gas samples in all will be collected using lab supplied pre-evacuated 1-liter summa canisters fitted with fixed orifice sample nozzles. The orifice size of the sampling nozzle will be set to collect the full volume of the summa canister over an eight-hour sampling period from interior locations or a 15-minute period from soil gas probes.

Following sample collection, each canister will be transported under chain of custody to a Chevron approved analytical laboratory for volatile hydrocarbons analysis by EPA Test Method TO-14.

11.0 SCHEDULE FOR PROPOSED INVESTIGATIONS

Delta will discuss the proposed field investigation actions presented in Section 10 with Ecology. Following approval from Ecology, Delta will draft a formal Workplan. Pending approval of the Workplan by both Ecology and this projects stakeholders, Delta will proceed with field investigations and sampling actions in accordance with the following schedule.

11.1 Groundwater

Delta expects to complete gauging and sampling of 18 monitoring wells on the Arnold's and Monterey Apartments properties within three to four weeks. After the laboratory analysis reports have been received, a data report will be prepared summarizing the work performed. The report will include the following elements:

- A brief description of the work performed
- Tables of laboratory analytical results
- A map of actual sampling locations with well numbers
- Laboratory analysis reports and chain of custody forms

- Groundwater purge and sample forms

Following submittal of the report, any changes necessary regarding the location of soil boring and monitoring well installation locations that may be warranted as a result of this investigation.

11.2 Soil Sampling and Monitoring Well Installation

Delta will schedule fieldwork once the location of soil borings and monitoring wells has been finalized. The anticipated schedule for implementation of this investigation is as follows:

1) Contracting and scheduling of drillers – 3 weeks
2) Underground utilities marking – 3 days
3) Soil and groundwater sample collection – 7 days
4) Laboratory analysis – 2 weeks
5) Data report will be submitted to WDOE within four weeks of obtaining laboratory results.

11.3 Indoor and Ambient Air

The anticipated schedule for collecting ambient and indoor air samples is as follows:

1) Contracting and scheduling of air or soil gas sampling – 4 weeks
2) Site visit and sample collection point assessment – 1 day
3) Ambient and indoor air or soil gas sample collection – 3 days
4) Laboratory analysis – 3 weeks
5) A report will be submitted to WDOE within four weeks of obtaining laboratory results.

After the laboratory analysis reports have been received, a data report will be prepared summarizing the work performed. The report will include the following elements:

- A brief description of the work performed
- Tables of laboratory analytical results
- A map of actual sampling locations
- Laboratory analysis reports and chain of custody forms

12.0 LIST OF FIGURES, TABLES, AND APPENDIX

Figures

1. Property Location Map, Delta Environmental Consultants, May 2002.
2. Vicinity Map with Adjacent Properties, Delta Environmental Consultants, May 2002
3. Site Plan, GeoEngineers, December 1987.
4. Soil-Gas Stations, Ecology and Environment, Inc., June 1991.
5. Benzene Groundwater Concentration Map, Ecology and Environment, Inc., April 1991.
6. Phase 1 RI Soil-Gas Survey Station Locations, Ecology and Environment Inc., July 1991.
7. Underground Utility Locations, GeoEngineers, February 1989.
8. Subsurface Section, GeoEngineers, January 1989.
9. Cross Section A-A', GeoEngineers, February 2001.
10. Subsurface Utilities, GeoEngineers, January 1993.
11. Monterey Apartments Monitoring Well Locations and Ground-water Table Contours, Washington State Department of Ecology, Circa 1987.
12. Monterey Apartments Subsurface Section, Washington State Department of Ecology, Circa 1987.
13. Water Table Elevation Map, Ecology and Environment Inc., July 1991.
14. Approximate Tank Locations, Systems Interface Inc., August 2000.
15. Drawing, *October 10, 1934, California Petroleum Texaco.*
16. Stairwell Sump at Monterey Apartments, Delta Environmental Consultants, May 2002.
17. Recovery System Plan, SAIC/DPRA, March 1993.
18. Monterey Apartments Vicinity Map, Washington State Department of Ecology, Circa 1987.
19. 1993, 1998 and 1999 Excavation Areas, GeoEngineers, November 1999.
20. Layout of Site and Surrounding Properties, GeoEngineers, October 1999.
21. Soil Sample Locations, 1999 Excavations, GeoEngineers, July 1999.
22. Soil Chemical Analytical Results, GeoEngineers, November 2000.
23. Summary of Ground Water Analytical Data, GeoEngineers, October 1999.
24. Ground Water Chemical Analytical Results, GeoEngineers, October 1999.
25. Site Plan, GeoEngineers, January 1993.
26. Layout of Site and Surrounding Properties, GeoEngineers, October 1999.

27. Soil-Gas Concentration Map – VTPH, Ecology and Environment Inc., July 1991.
28. Groundwater Analytical Concentrations, June 2000 Sample Event, Farallon Consulting, July 2000.
29. Proposed Well and Boring Locations, Delta Environmental Consultants, May 2002.

Tables

1. Groundwater Analytical Results, Farallon Consulting, June 2000.
2. Summary of Groundwater Elevations and Free Product Thickness, GeoEngineers, September 1999.
3. Summary of Groundwater Chemical Analytical Results, Geo Engineers, May 1993.

Appendix

A. Soil Boring and Well Completion Logs and Assorted Geologic Cross Sections.

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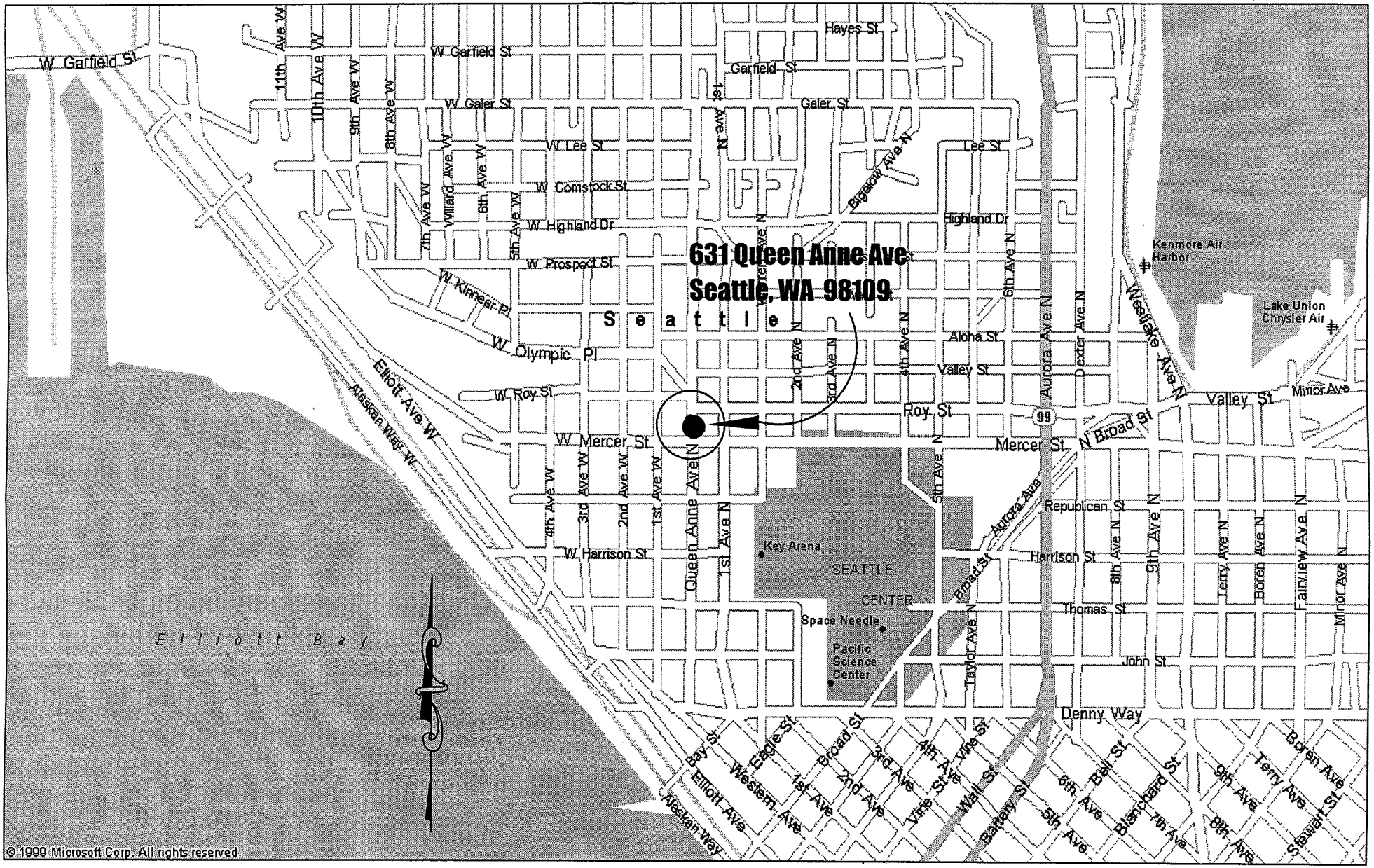


Figure 1

FORMER TEXACO STATION, NO. 21577
SEATTLE, WASHINGTON

PROPERTY LOCATION MAP

Delta Environmental Consultants, Inc.

DESIGNED BY:	CHECKED BY:	PROJECT #	FIGURE #
S. MADISON	S. MADISON	TW21577	1
DRAWN BY:	PROJECT MANAGER:	DATE:	SCALE:
S. MADISON	P.CATTERALL	5/17/2	NTS

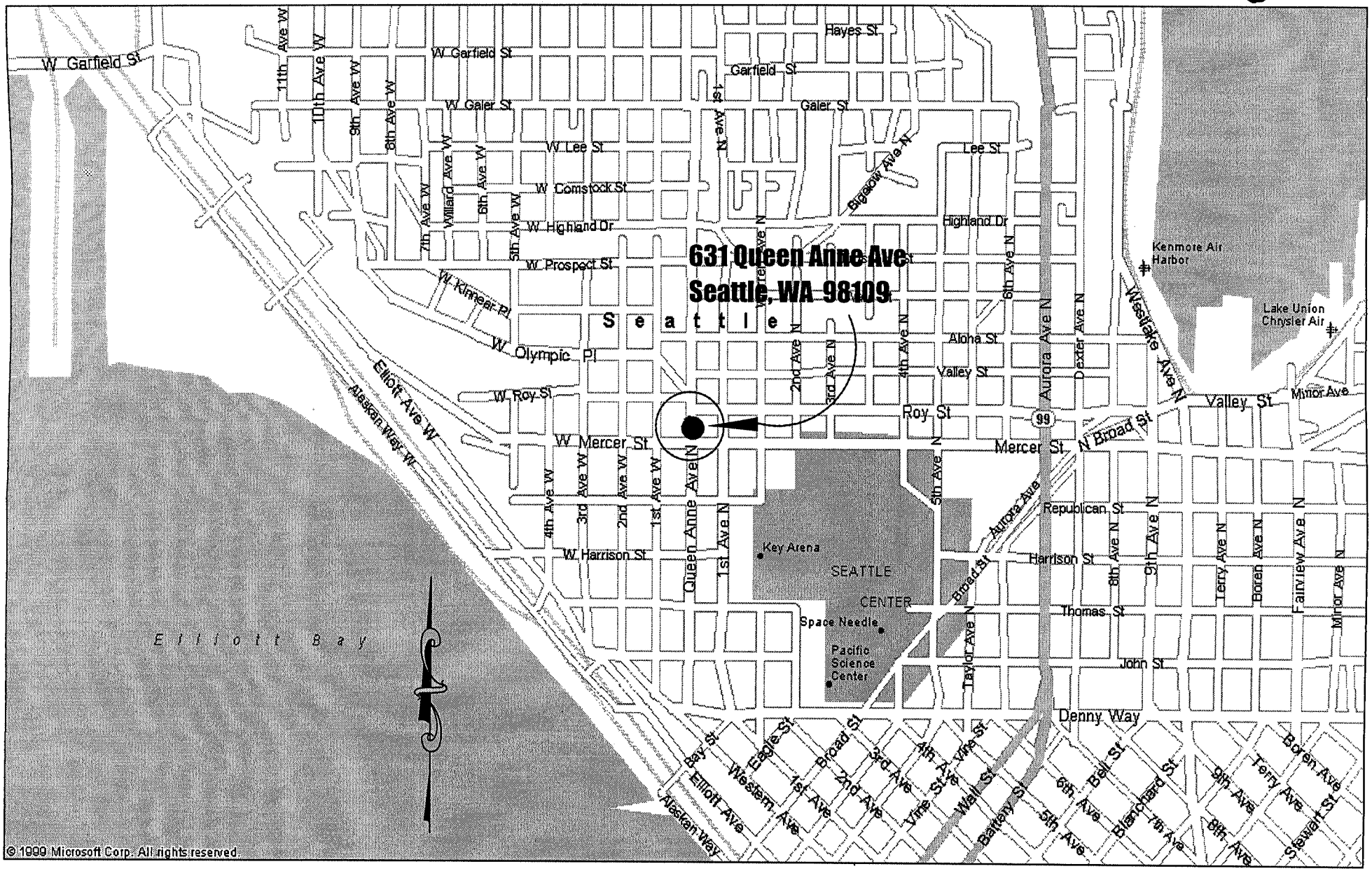


Figure 1

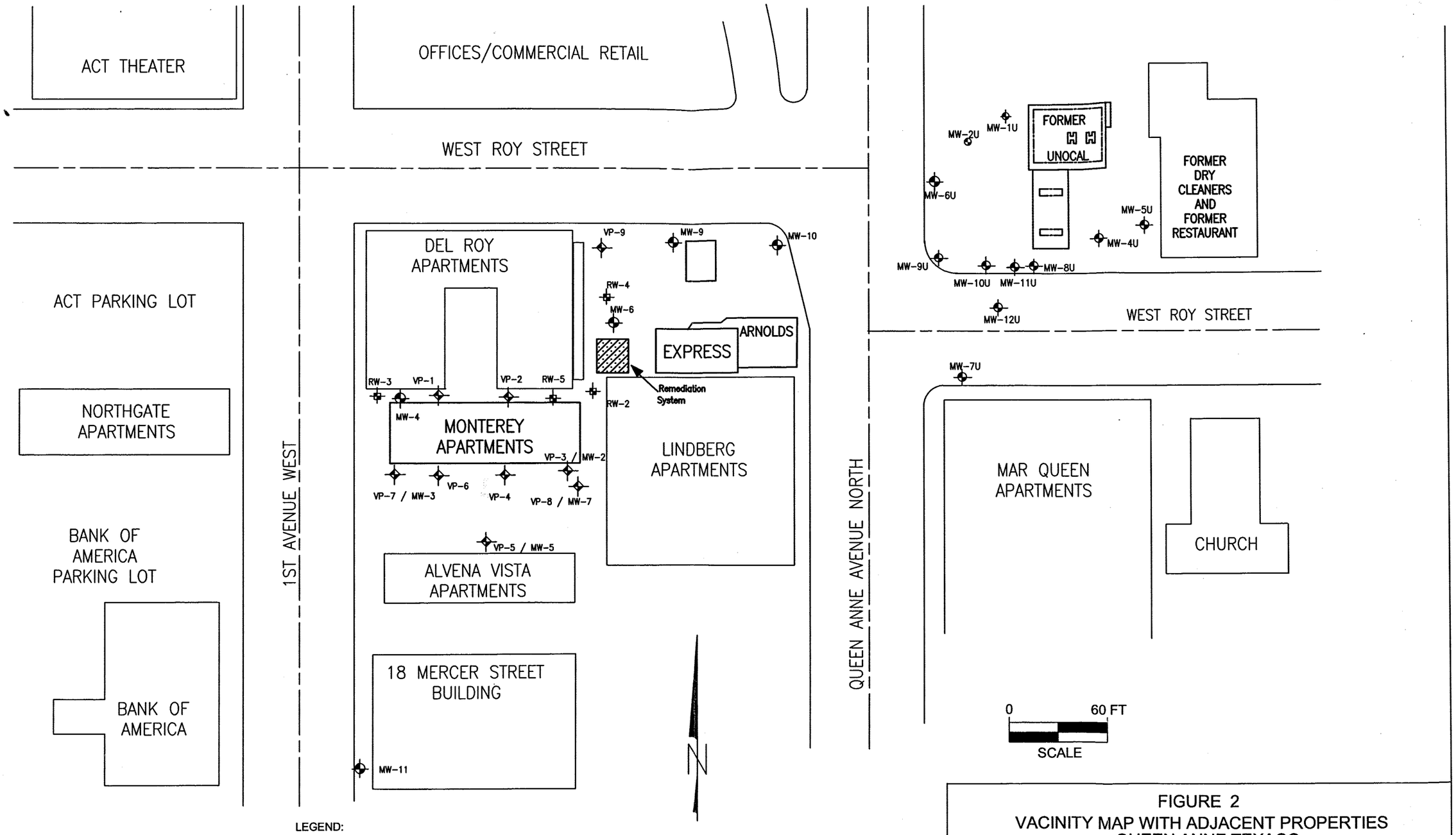
FORMER TEXACO STATION, NO. 21577
SEATTLE, WASHINGTON

PROPERTY LOCATION MAP

Delta Environmental Consultants, Inc.

DESIGNED BY:	CHECKED BY:	PROJECT #	FIGURE #
S. MADISON	S. MADISON	TW21577	1
DRAWN BY:	PROJECT MANAGER:	DATE:	SCALE:
S. MADISON	P.CATTERALL	5/17/2	NTS

Figure 2



LEGEND:

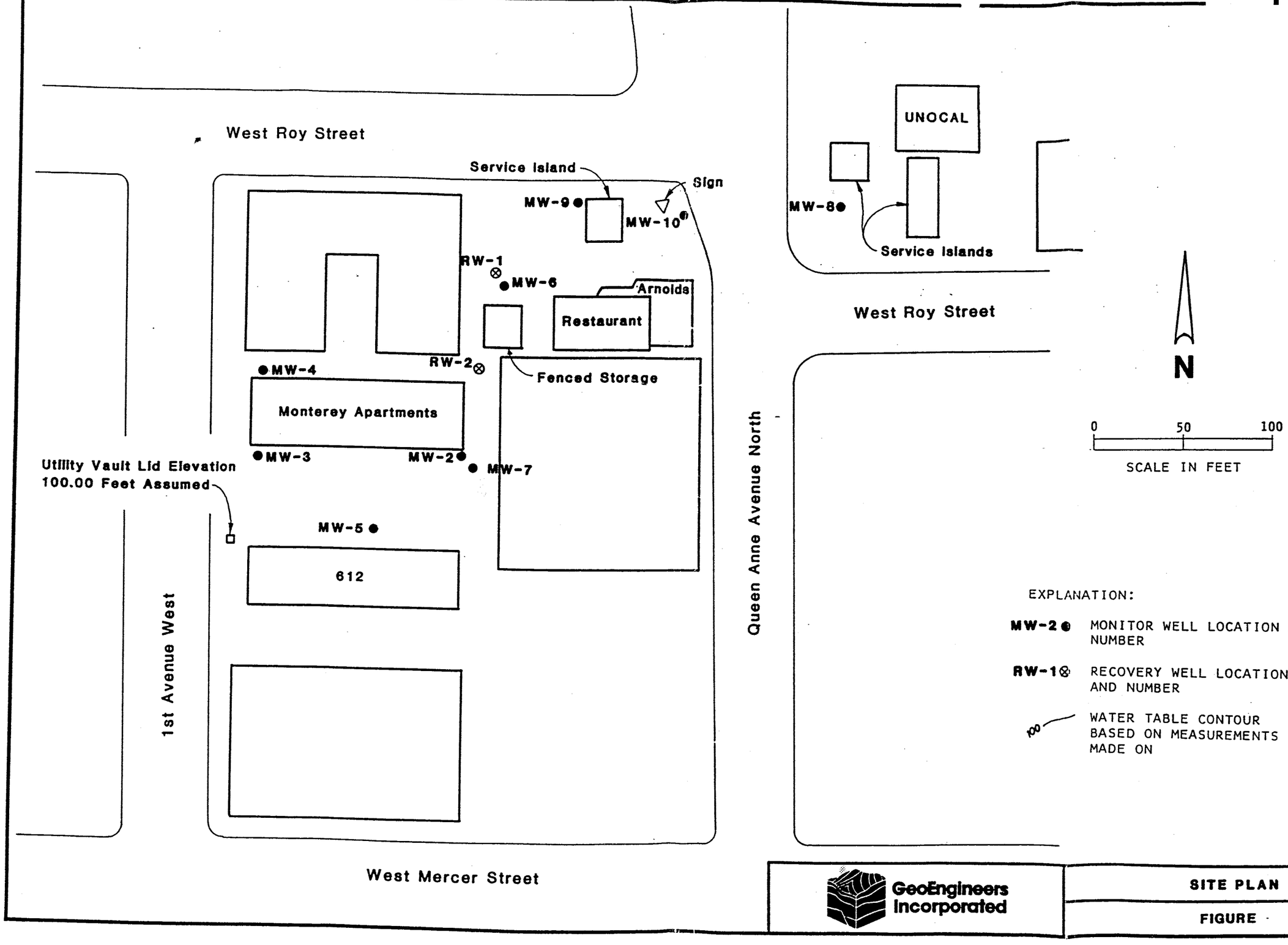
- STREET CENTER LINE
- MW-1 MONITORING WELL LOCATION AND DESIGNATION
- VP-1 VAPOR WELL LOCATION AND DESIGNATION
- RW-1 RECOVERY WELL LOCATION AND DESIGNATION

FIGURE 2
VACINITY MAP WITH ADJACENT PROPERTIES
QUEEN ANNE TEXACO
631 QUEEN ANNE NORTH SEATTLE, WASHINGTON

PROJECT NO. TW21-577	DRAWN BY M.S.M. 5/15/2
FILE NO. 21577	PREPARED BY M.S.M.
REVISION NO. 1	REVIEWED BY M.S.M.

Delta Environmental Consultants, Inc.

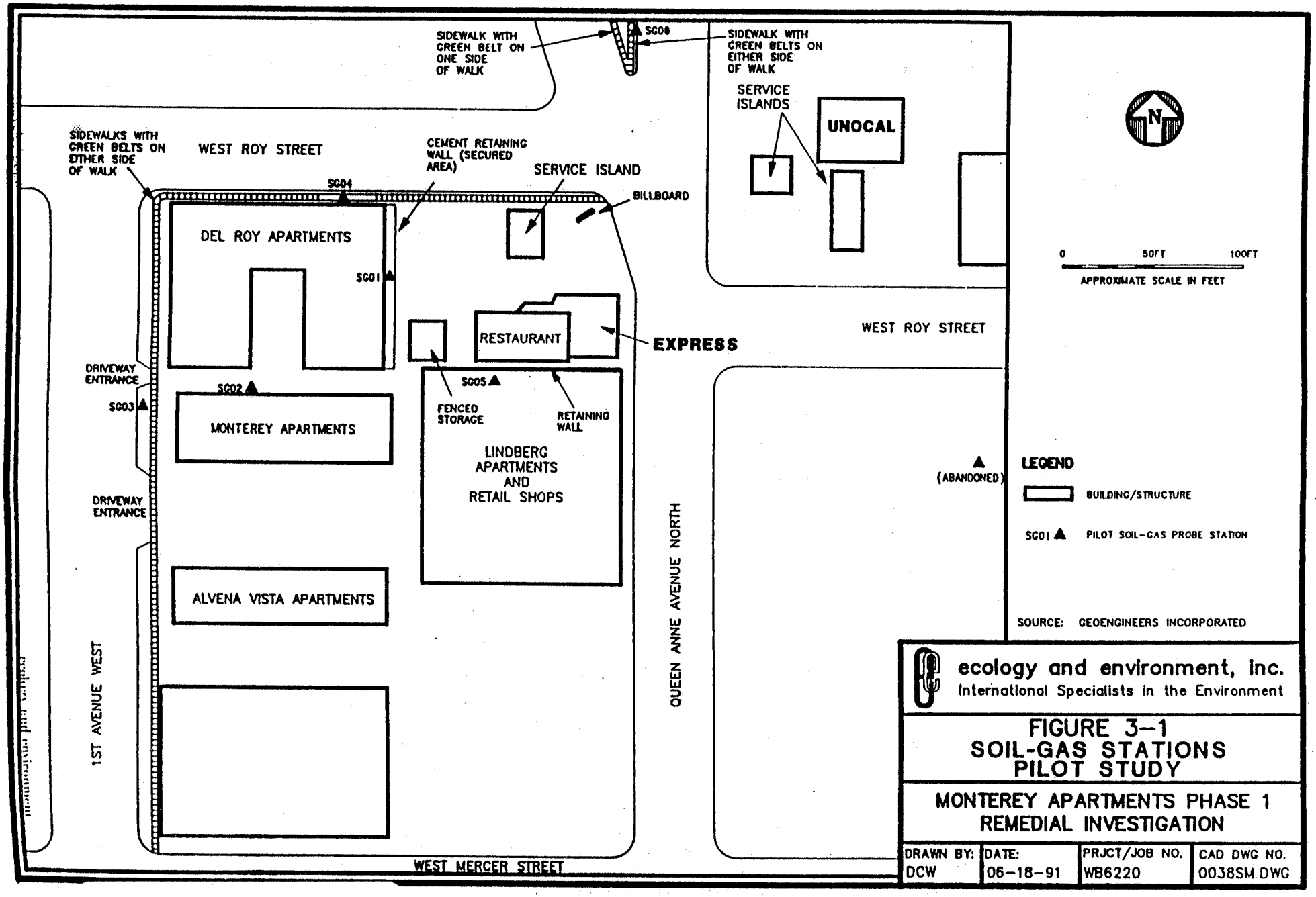
Figure 3



GeoEngineers Incorporated

SITE PLAN

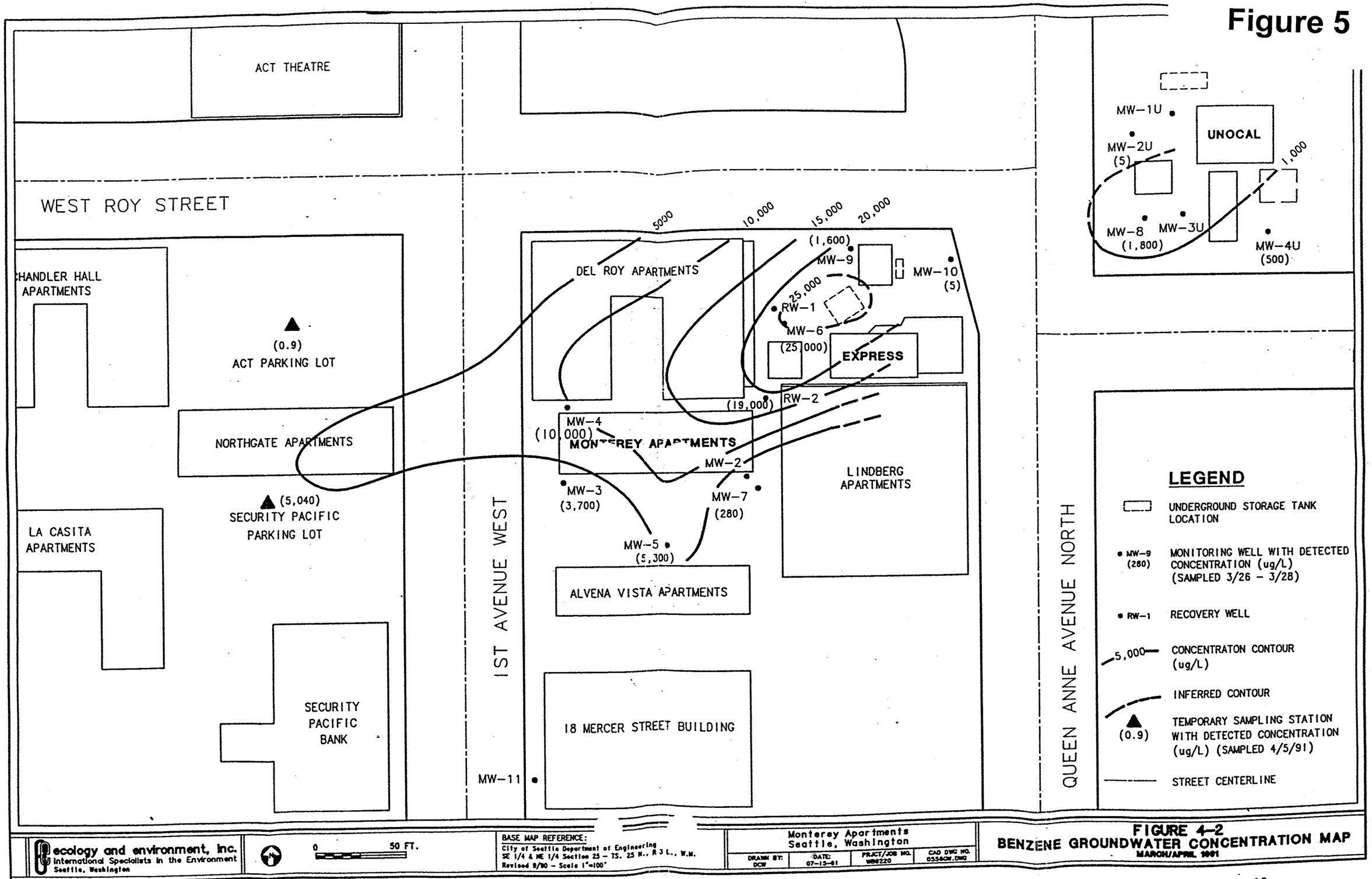
FIGURE

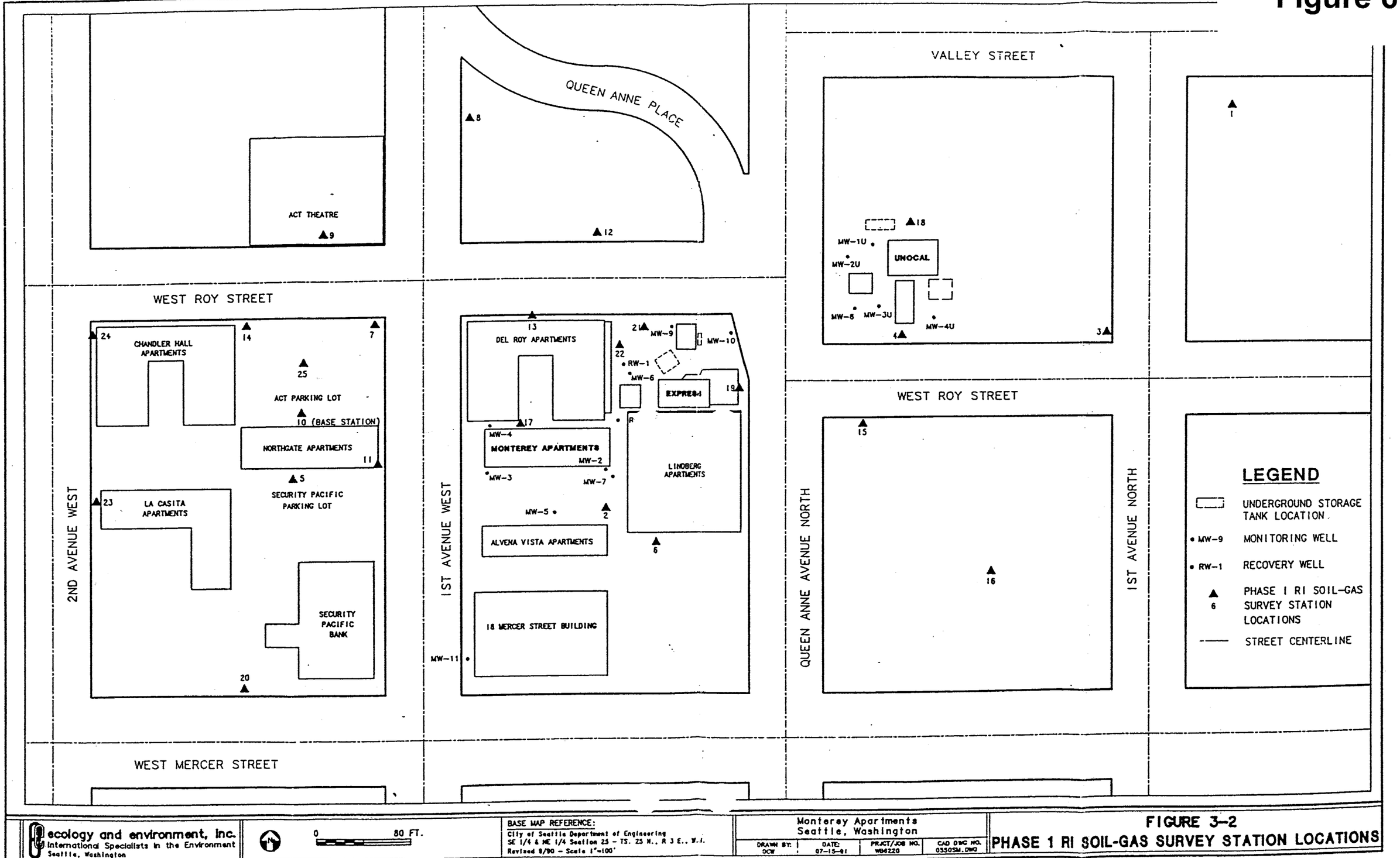

SIDEWALK WITH GREEN BELT ON ONE SIDE OF WALK
SG08
SIDEWALK WITH GREEN BELTS ON EITHER SIDE OF WALK
SERVICE ISLANDS
UNOCAL
SIDEWALKS WITH GREEN BELTS ON EITHER SIDE OF WALK
WEST ROY STREET
CEMENT RETAINING WALL (SECURED AREA)
SERVICE ISLAND
BILLBOARD
SG04
DEL ROY APARTMENTS
SG01
RESTAURANT
EXPRESS
WEST ROY STREET
DRIVEWAY ENTRANCE
SG02
SG03
SG05
FENCED STORAGE
RETAINING WALL
MONTEREY APARTMENTS
LINDBERG APARTMENTS AND RETAIL SHOPS
DRIVEWAY ENTRANCE
ALVENA VISTA APARTMENTS
1ST AVENUE WEST
QUEEN ANNE AVENUE NORTH
WEST MERCER STREET
N
0
50FT
100FT
APPROXIMATE SCALE IN FEET
(ABANDONED)
LEGEND
BUILDING/STRUCTURE
SG01 PILOT SOIL-GAS PROBE STATION
SOURCE: GEOENGINEERS INCORPORATED
ecology and environment, inc.
International Specialists in the Environment
FIGURE 3-1
SOIL-GAS STATIONS
PILOT STUDY
MONTEREY APARTMENTS PHASE 1
REMEDIAL INVESTIGATION
DRAWN BY: DCW
DATE: 06-18-91
PRJCT/JOB NO. WB6220
CAD DWG NO. 0038SM DWG

3-3

Figure 4

Figure 5


ACT THEATRE
WEST ROY STREET
CHANDLER HALL APARTMENTS
(0.9)
ACT PARKING LOT
NORTHGATE APARTMENTS
(5,040)
SECURITY PACIFIC PARKING LOT
LA CASITA APARTMENTS
SECURITY PACIFIC BANK
1ST AVENUE WEST
DEL ROY APARTMENTS
5000
10,000
15,000
20,000
25,000
(1,600)
MW-9
MW-10
(5)
RW-1
MW-6
(25,000)
EXPRESS
(19,000)
RW-2
MW-4
(10,000)
MONTEREY APARTMENTS
MW-2
MW-3
(3,700)
MW-7
(280)
MW-5
(5,300)
LINDBERG APARTMENTS
ALVENA VISTA APARTMENTS
18 MERCER STREET BUILDING
MW-11
QUEEN ANNE AVENUE NORTH
MW-1U
UNOCAL
MW-2U
(5)
1,000
MW-8
(1,800)
MW-3U
MW-4U
(500)
LEGEND
UNDERGROUND STORAGE TANK LOCATION
MW-9 (280) MONITORING WELL WITH DETECTED CONCENTRATION (ug/L) (SAMPLED 3/26 - 3/28)
RW-1 RECOVERY WELL
5,000 CONCENTRATON CONTOUR (ug/L)
INFERRED CONTOUR
(0.9) TEMPORARY SAMPLING STATION WITH DETECTED CONCENTRATION (ug/L) (SAMPLED 4/5/91)
STREET CENTERLINE
ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington
0 50 FT.
BASE MAP REFERENCE:
City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25 - TS. 25 N., R 3 E., W.M.
Revised 9/90 - Scale 1"=100'
Monterey Apartments
Seattle, Washington
DRAWN BY: DCW
DATE: 07-15-91
PROJECT/JOB NO. W66220
CAD DWG NO. 0556CW.DWG
FIGURE 4-2
BENZENE GROUNDWATER CONCENTRATION MAP
MARCH/APRIL 1991



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

0 80 FT.

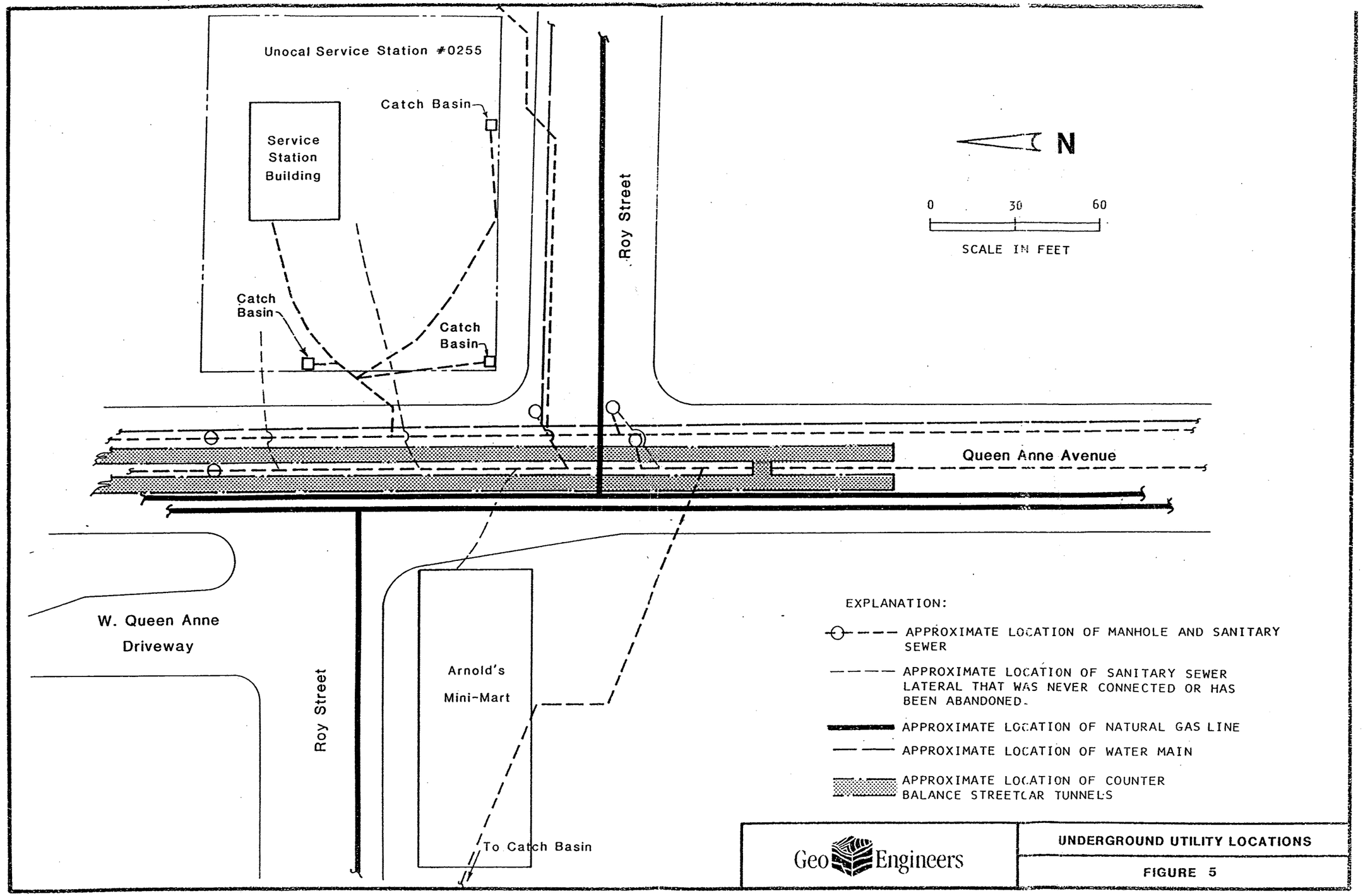
BASE MAP REFERENCE:
City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25 – TS. 25 N., R 3 E., W.M.
Revised 9/90 – Scale 1"=100'

Monterey Apartments
Seattle, Washington

DRAWN BY:	DATE:	PROJECT/JOB NO.	CAD DWG NO.
DCW	07-15-91	W84220	0330SM.DWG

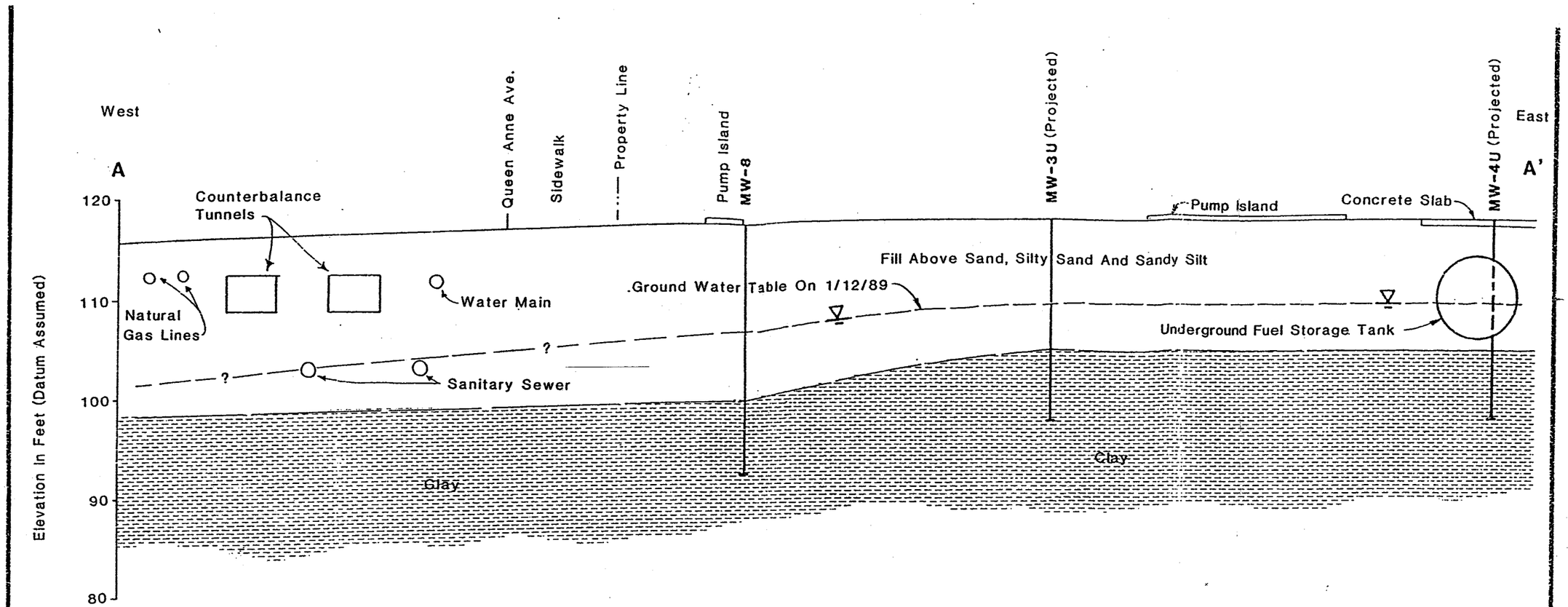
FIGURE 3-2
PHASE 1 RI SOIL-GAS SURVEY STATION LOCATIONS

Figure 7



0161-153-4 JF:KKT 2-13-89

Figure 8



NOTE: THE SUBSURFACE CONDITIONS SHOWN ON THE SECTION ARE BASED ON INTERPOLATION BETWEEN WIDELY SPACED EXPLORATIONS, AND PREVIOUS STUDIES CONDUCTED FOR THE DEPARTMENT OF ECOLOGY. THEY SHOULD BE CONSIDERED TO BE APPROXIMATE.

HORIZONTAL SCALE: 1" = 10'

0161-153-4 TTF:KKT 1-19-89

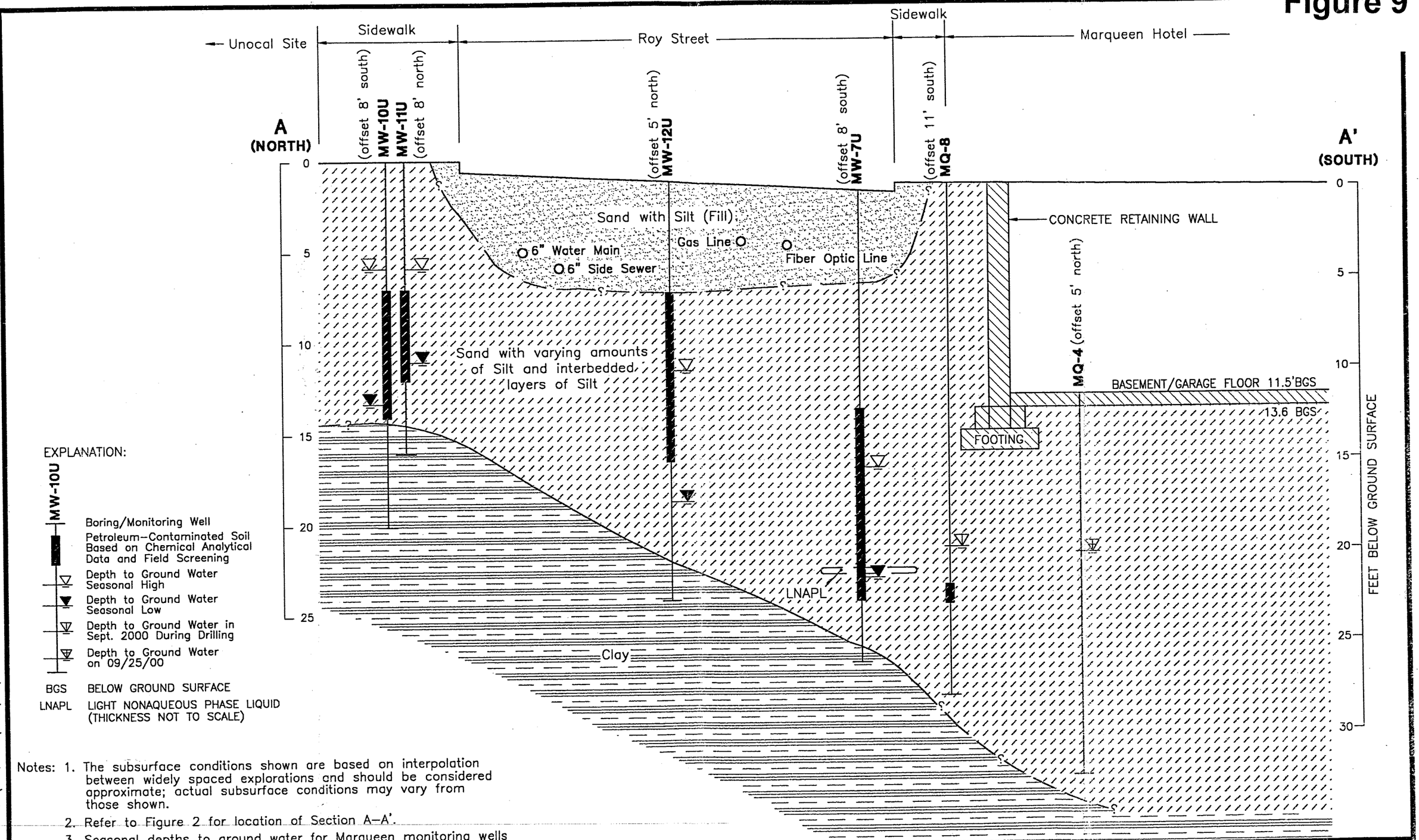
Geo Engineers

SUBSURFACE SECTION

FIGURE 3

ARNOLD

Figure 9



EXPLANATION:

MW-10U — Boring/Monitoring Well

Petroleum-Contaminated Soil Based on Chemical Analytical Data and Field Screening

Depth to Ground Water Seasonal High

Depth to Ground Water Seasonal Low

Depth to Ground Water in Sept. 2000 During Drilling

Depth to Ground Water on 09/25/00

BGS BELOW GROUND SURFACE

LNAPL LIGHT NONAQUEOUS PHASE LIQUID (THICKNESS NOT TO SCALE)

Notes:
1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. Refer to Figure 2 for location of Section A-A'.
3. Seasonal depths to ground water for Marqueen monitoring wells could not be determined based on limited data. Seasonal highs and lows for the remaining wells are based on depth to ground water data from November 1999 to August 2000.
4. Backfill surrounding and beneath basement floor and retaining wall is not shown.

HORIZONTAL SCALE: 1" = 10'
VERTICAL SCALE: 1" = 5'

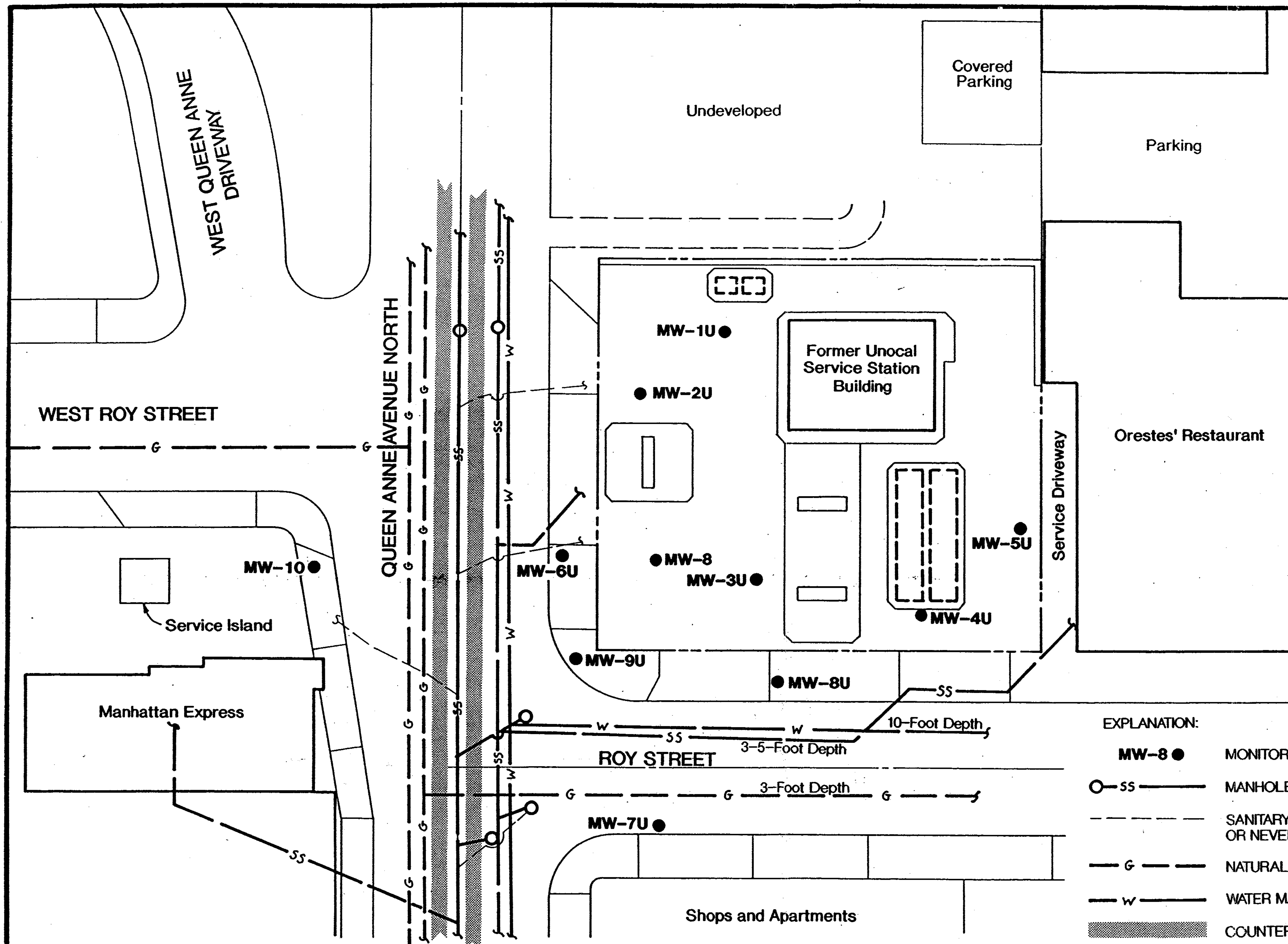
Geo Engineers

CROSS SECTION A-A'

FIGURE 3

02/02/01 P:\0161153\CAD\09\0161153O9C.DWG BPP:HLA

Figure 10



Notes:

1. The service station building and subsurface facilities shown were removed in January 1992.
2. The locations of all features shown are approximate.

Reference: Drawing entitled "Service Station No. 255 @ Queen Anne Avenue & Roy Street, Seattle, Wa.," provided by Union Oil Company of California, undated.

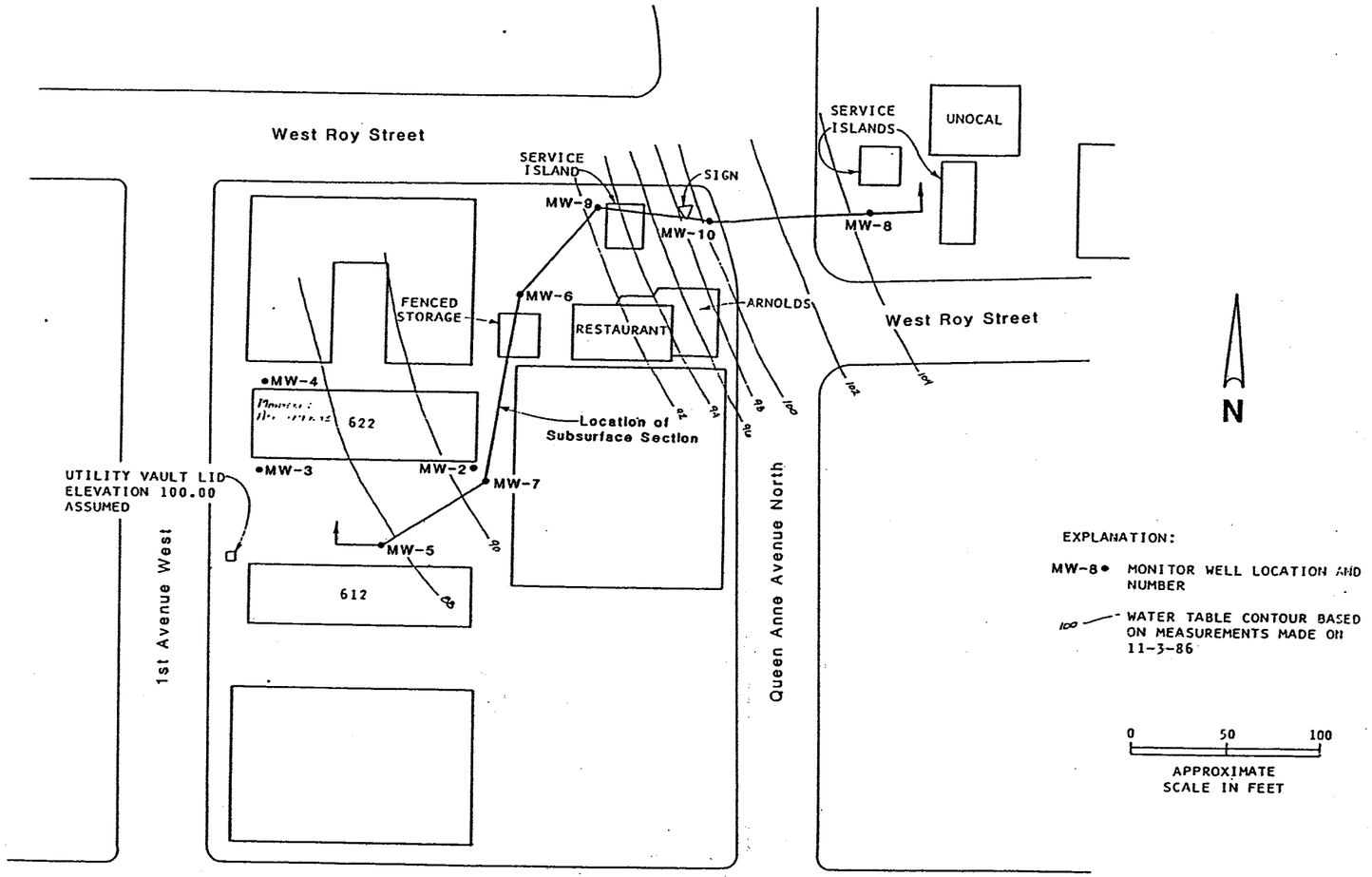
GeoEngineers

SUBSURFACE UTILITIES

FIGURE 2

0161-153-R04 DEH:JJD 7/1/92 (8)
Rev. DEH:KRT 1-13-93

Figure 11



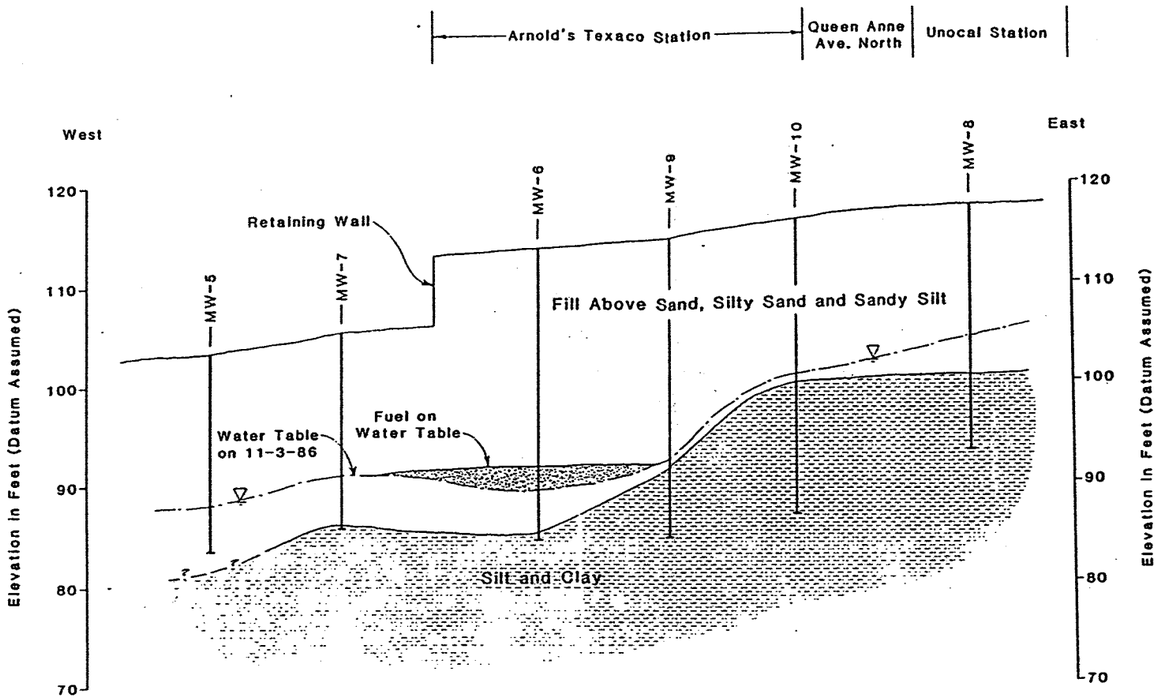
From: Miller, 1986

Monterey Apartments Monitoring Well Locations and Ground-Water Table Contours

WASHINGTON STATE DEPT OF ECOLOGY

Figure : 6

Figure 12



NOTE: THE SUBSURFACE CONDITIONS SHOWN ON THE SECTION ARE BASED ON INTERPOLATION BETWEEN WIDELY SPACED EXPLORATIONS AND SHOULD BE CONSIDERED TO BE APPROXIMATE.

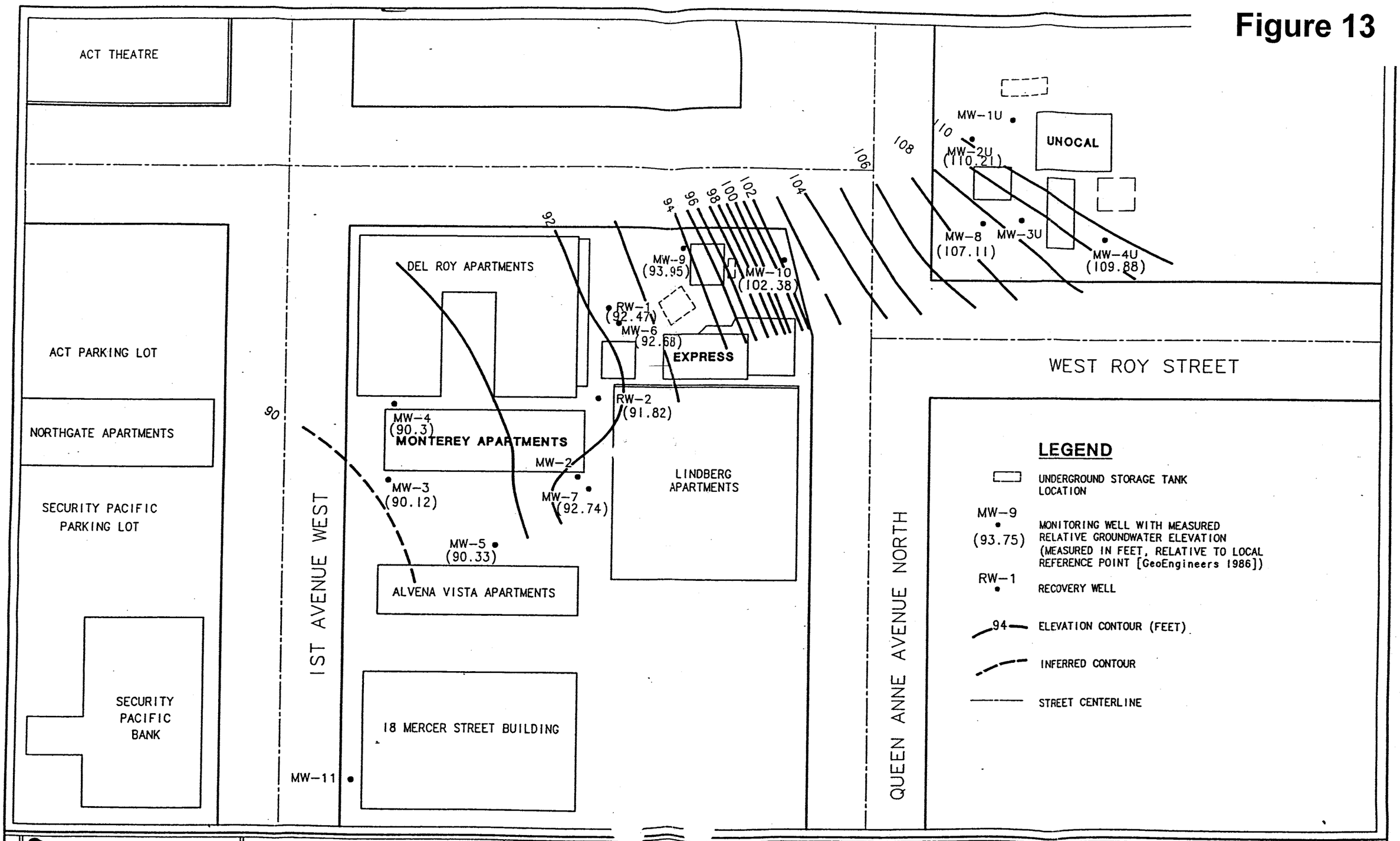
From: Miller, 1986

Monterey Apartments Subsurface Section

WASHINGTON STATE DEPT OF ECOLOGY

Figure : 7

Figure 13



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

0 50 FT.

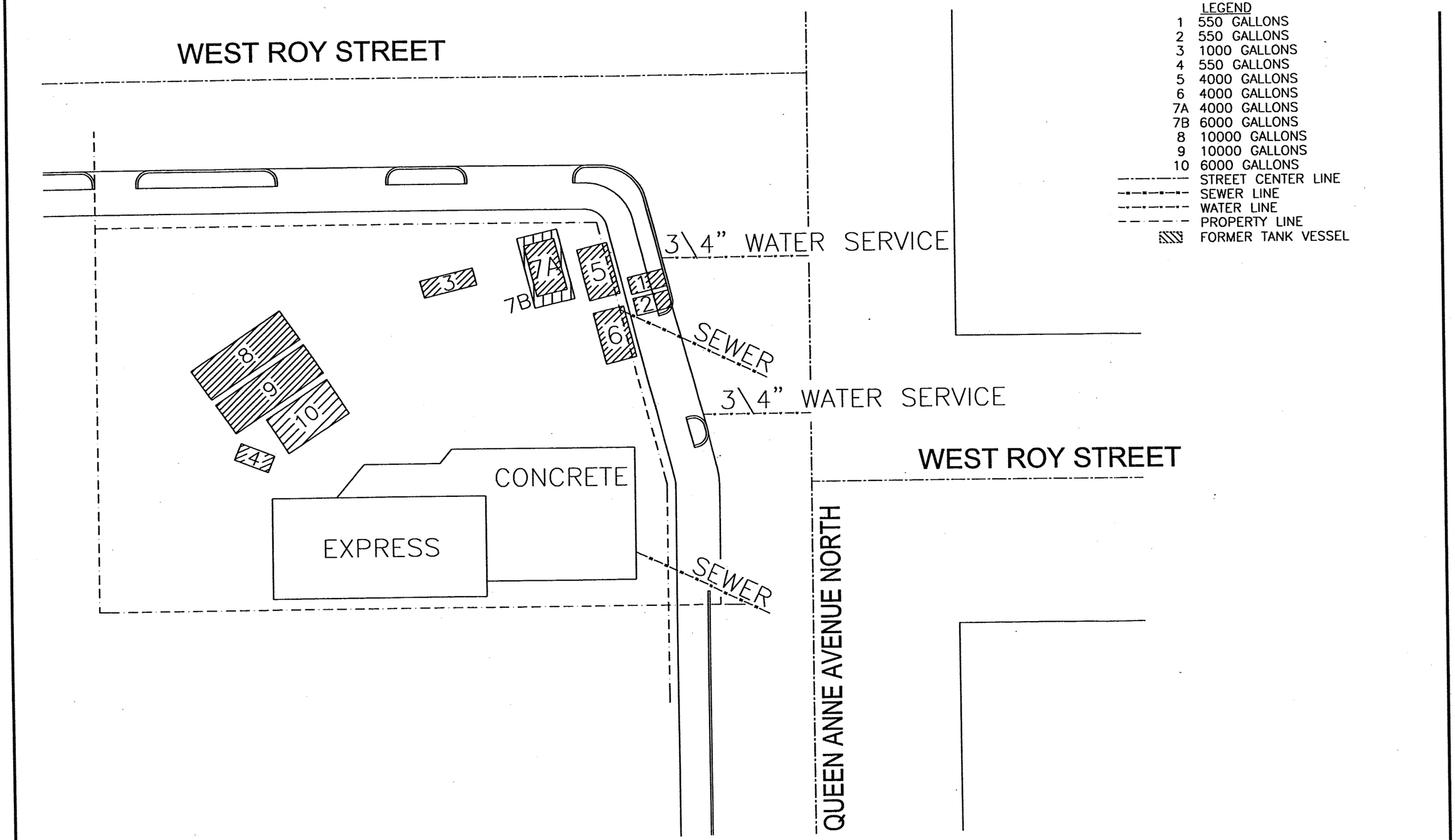
BASE MAP REFERENCE:
City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25 – TS. 25 N., R 3 E., W.M.
Revised 8/90 – Scale 1"=100'

Monterey Apartments
Seattle, Washington

DRAWN BY:	DATE:	PROJECT/JOB NO.	CAD DWG NO.
DCW	07-15-91	WB4220	0551GW.DWG

FIGURE 4-1
WATER TABLE ELEVATION MAP - 3/91

Figure 14



SYM	REVISION RECORD	BY	DATE	SYM	REVISION RECORD	BY	DATE
Ø	ORIGINAL	RHS	Ø8-23-ØØ				
1	CUSTOMER REVISION	RHS	Ø8-24-ØØ				
2	CUSTOMER REVISION	RHS	Ø9-Ø5-ØØ				

Systems Interface Inc.

BOTHELL, WA., U.S.A. 98021-7406 • (425) 481-1225 • FAX (425) 481-2115
www.systems-interface.com

		DATE
DRAWN BY:	SDY	08-23-00
ENGINEER:	RHS	08-23-00
CHECKED:		
APPROVED:		
APPROVED:		

FOCUSED RESOURCES
BURBANK CALIFORNIA
SYSTEM OVERVIEW

APPROXIMATE TANK LOCATION
631 QUEEN ANNE AVE N
SEATTLE, WA 981Ø9

LAST REVISION	DATE
	08-24-00
	SYMBOL
	1

DRAWING NUMBER:
ØØØ826-GGD-Ø15Ø2

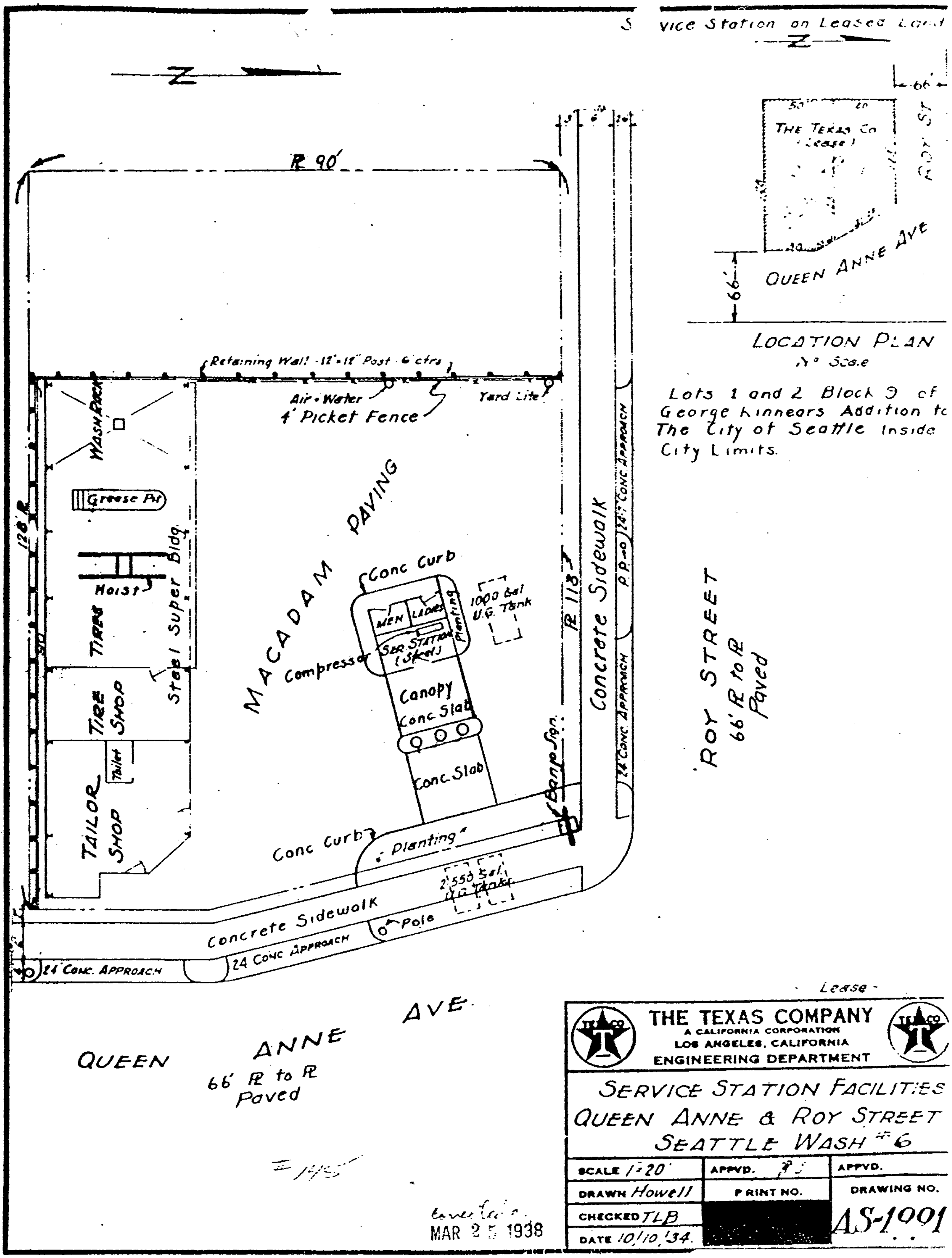
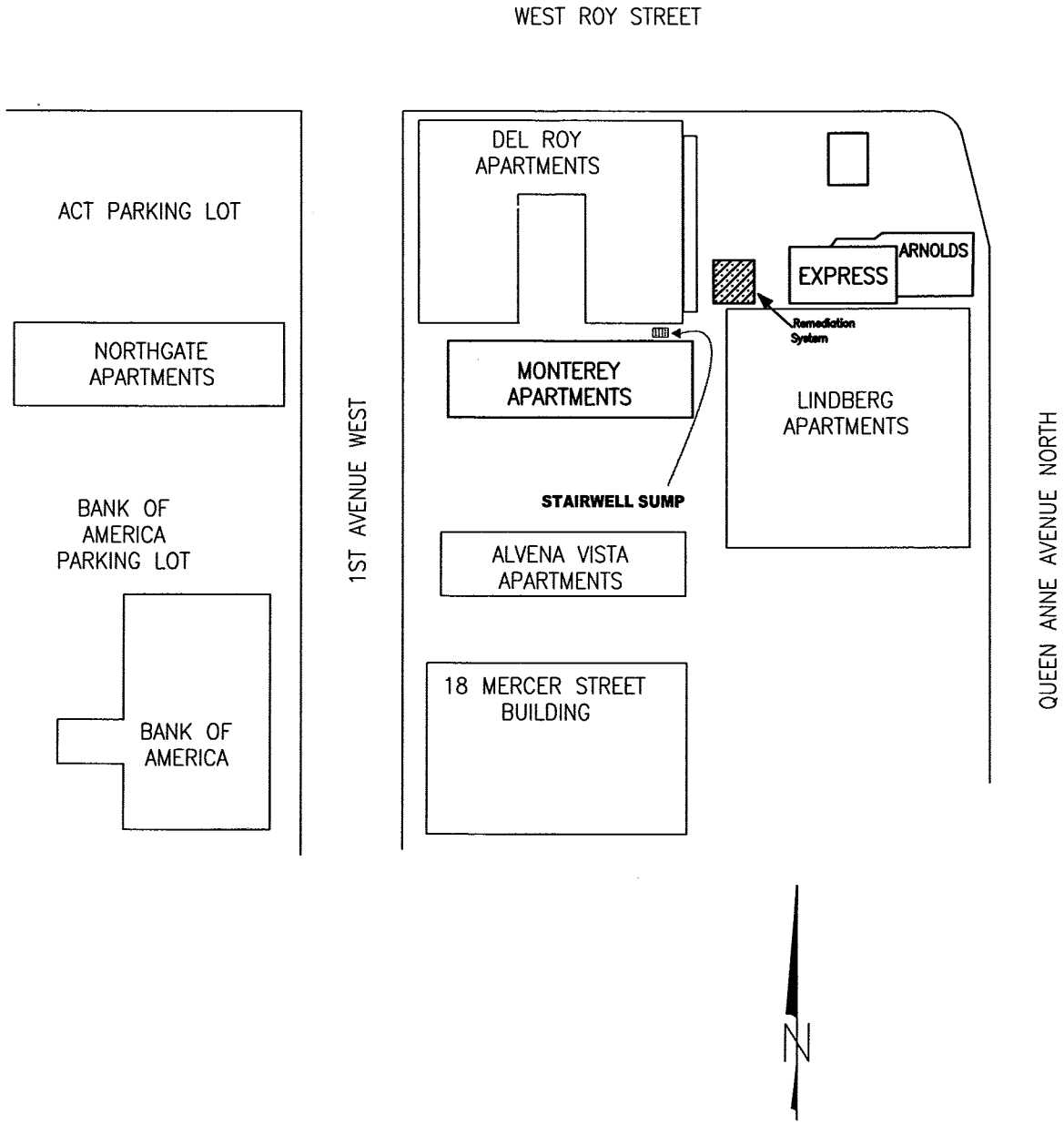

Service Station on Leased Land
Location Plan
No Scale
The Texas Co (Lease)
Roy St
Queen Anne Ave
66'
Lots 1 and 2 Block 9 of George Kinnears Addition to The City of Seattle Inside City Limits.
R 90'
Retaining Wall - 12"x12" Post - 6' ctrs
Air - Water
4' Picket Fence
Yard Lite
Wash Rack
Grease Pit
Hoist
Tires
Tire Shop
Toilet
Tailor Shop
Steel Super Bldg.
128' R
Macadam Paving
Compressor
Conc Curb
Men
Ladies
Planting
Ser. Station (Steel)
1000 Gal U.G. Tank
Canopy
Conc Slab
Conc. Slab
R 118'
Concrete Sidewalk
24' Conc. Approach
Banjo Sign
Roy Street
66' R to R
Paved
Conc Curb
Planting
2-550 Gal. U.G. Tanks
Pole
Concrete Sidewalk
24 Conc. Approach
24' Conc. Approach
Queen Anne Ave
66' R to R
Paved
Lease
THE TEXAS COMPANY
A CALIFORNIA CORPORATION
LOS ANGELES, CALIFORNIA
ENGINEERING DEPARTMENT
Service Station Facilities
Queen Anne & Roy Street
Seattle Wash #6
SCALE 1"=20'
APPVD.
APPVD.
DRAWN Howell
PRINT NO.
DRAWING NO.
CHECKED TLB
DATE 10/10/34
AS-1991
MAR 25 1938

Figure 15



LEGEND

STAIRWELL SUMP

FIGURE 16
STAIRWELL SUMP AT MONTEREY APPTS.
QUEEN ANNE TEXACO
631 QUEEN ANNE NORTH SEATTLE, WASHINGTON

PROJECT NO. TW21-577	DRAWN BY M.S.M. 5/15/2
FILE NO. 21577	PREPARED BY M.S.M.
REVISION NO. 1	REVIEWED BY M.S.M.

Delta Environmental Consultants, Inc.

Figure 16

Exhibit D - Page 1 of 2

Figure 17

WEST ROY STREET

Discharge to Street

15T AVENUE WEST

QUEEN ANNE AVENUE NORTH

DEL ROY APARTMENTS

REMEDIATION SYSTEM EQUIPMENT LAYOUT (UNDER CANOPY), SEE PLAN 1/4

RETAINING WALL

VP-8

Yard drain

Existing system

ASPHALT

MW-8

CONCRETE

MW-10

1/5 HORIZONTAL EXTRACTION SCREENS, SEE PLAN

ASPHALT

RW-4

MW-6

CANOPY

Canopy roof drain

CONCRETE

EXPRESS

STORAGE

SAN

RW-6

RETAINING WALL

RW-8

VP-1

VP-2

R

SD

SAN

MW-4

DOWN

DOWN

SYSTEM DISCHARGE LINE ALIGNMENT TO AVOID ABANDONDED UST

Boiler Rm

MONTEREY APARTMENTS

LINDBERG APARTMENTS

MW-9

VP-7

VP-6

PARKING

VP-4

MW-7

MW-2

VP-5

ASPHALT SURFACE

MW-5

VP-3

PARKING

RETAINING WALL

ALVENA VISTA APARTMENTS

LEGEND

NEW CONSTRUCTION

- LIMITS OF CONSTRUCTION
- RECOVERY WELL, SEE DETAIL 1/6
- R — GROUNDWATER RECOVERY PIPING, SEE DRAWING NUMBER 7 of 10.
- VAPOR EXTRACTION PORT, SEE DETAIL 2/6
- VAPOR EXTRACTION PIPING CONNECTION TO EXIST. MONITORING WELL, SEE DETAIL 2/6
- V — VAPOR EXTRACTION PIPING, SEE PROFILE 3/8
- VAPOR EXTRACTION SCREEN
- SD — SYSTEM DISCHARGE PIPING, SEE PROFILE 4/7

NOTES:

1. NOTIFY LOCAL UTILITY OPERATORS TO LOCATE ALL UTILITIES BEFORE STARTING ANY SUBSURFACE CONSTRUCTION.
2. ALL FENCE DISTURBED DURING CONSTRUCTION IS TO BE REPLACED.
3. CONTRACTOR SHOULD PROVIDE VAPOR EXTRACTION SYSTEM FOR DIESEL TANK PIT, SHOWN ON ALL DRAWINGS IN GREEN, AS A SEPARATE BID ITEM. (OPTIONAL CONSTRUCTION ITEM.)

1/8 RECOVERY SYSTEM PLAN

0 20' 40'

SCALE IN FEET

REV.	REVISION	DRAWN	CHECKED	DATE
1	ORIGINAL DRAWING	BJR	MCB	1/7/98
2	BOTS	BJR	MCB	1/7/98
3	SYSTEM DISCHARGE	DJH	RTHS	DJH

RECOVERY SYSTEM CONSTRUCTION PLAN

MONTEREY APARTMENTS BEATTLE, WASHINGTON

DATE: MARCH 6, 1998

DRAWING NUMBER: 3 of 10

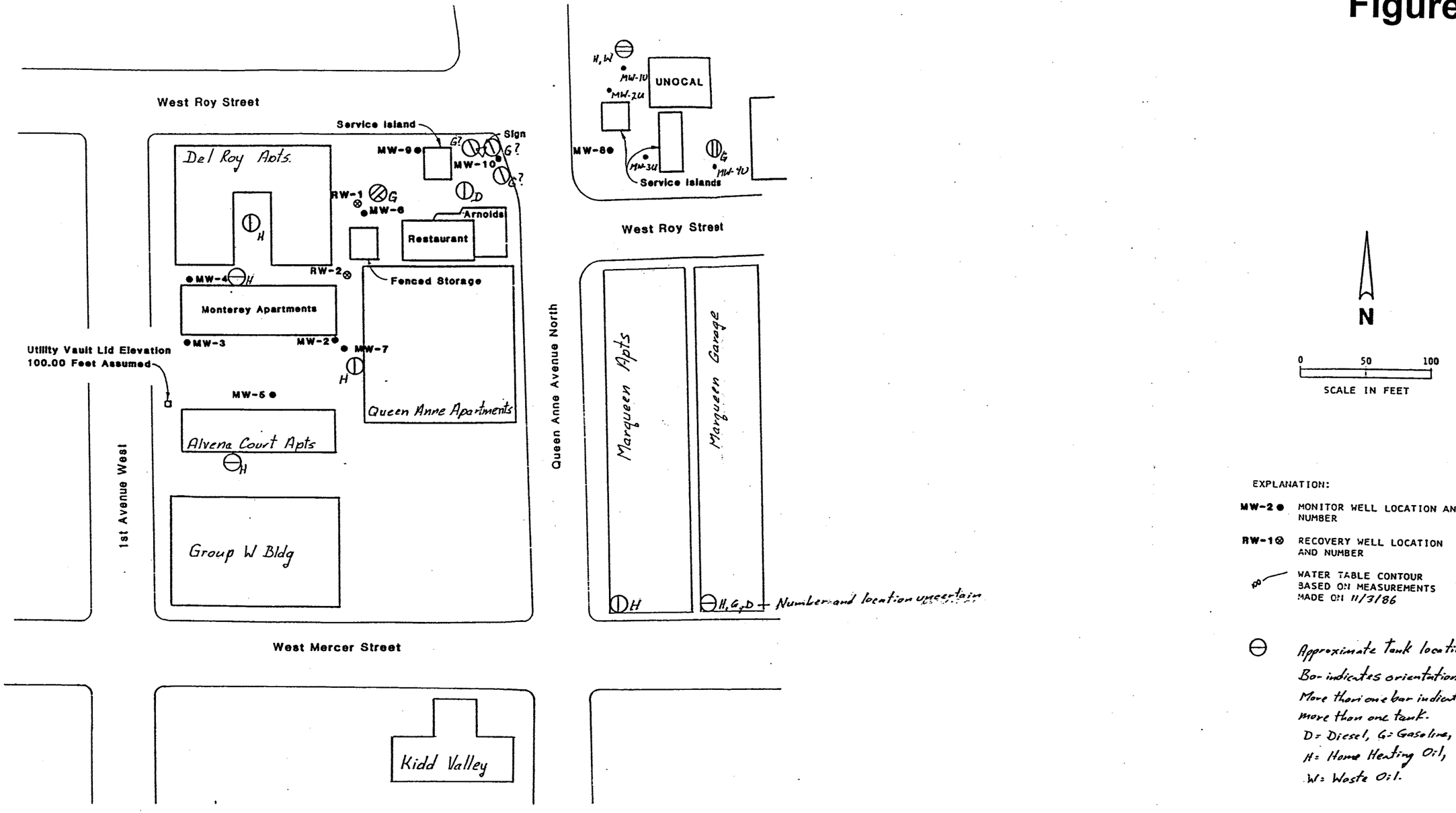
SAIC

DPRA

PROJECT NUMBER: 6751.013

ARNOLD

Figure 18



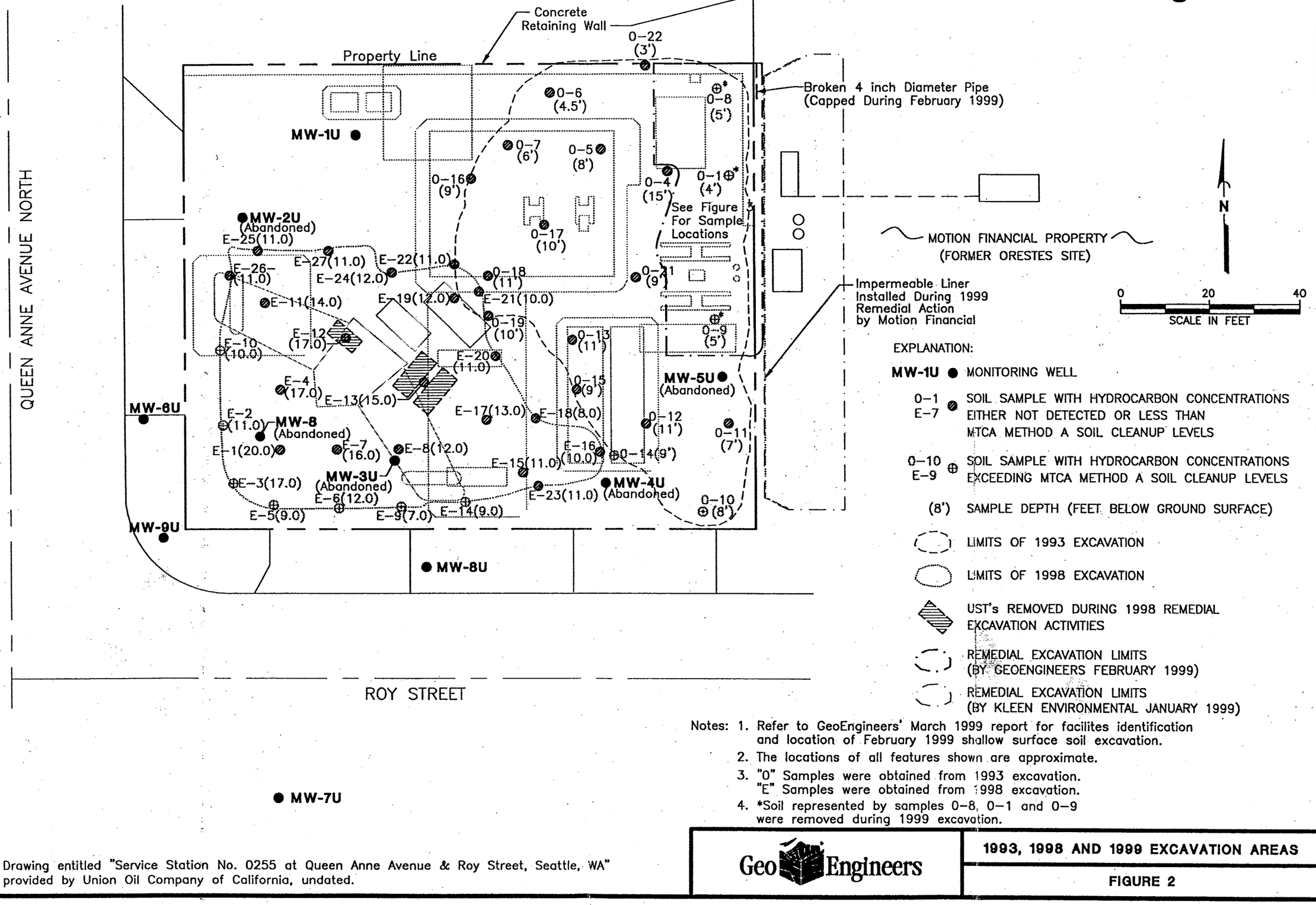
Adapted from Miller, 1986.

Monterey Apartments Vicinity Map

WASHINGTON STATE DEPT OF ECOLOGY

Figure : 2

Figure 19



EXPLANATION:

- **MW-1U** ● MONITORING WELL
- 0-1, E-7 ⊘ SOIL SAMPLE WITH HYDROCARBON CONCENTRATIONS EITHER NOT DETECTED OR LESS THAN MTCA METHOD A SOIL CLEANUP LEVELS
- 0-10, E-9 ⊕ SOIL SAMPLE WITH HYDROCARBON CONCENTRATIONS EXCEEDING MTCA METHOD A SOIL CLEANUP LEVELS
- (8') SAMPLE DEPTH (FEET BELOW GROUND SURFACE)
- LIMITS OF 1993 EXCAVATION
- LIMITS OF 1998 EXCAVATION
- UST's REMOVED DURING 1998 REMEDIAL EXCAVATION ACTIVITIES
- REMEDIAL EXCAVATION LIMITS (BY GEOENGINEERS FEBRUARY 1999)
- REMEDIAL EXCAVATION LIMITS (BY KLEEN ENVIRONMENTAL JANUARY 1999)

Notes:
1. Refer to GeoEngineers' March 1999 report for facilites identification and location of February 1999 shallow surface soil excavation.
2. The locations of all features shown are approximate.
3. "0" Samples were obtained from 1993 excavation. "E" Samples were obtained from 1998 excavation.
4. *Soil represented by samples 0-8, 0-1 and 0-9 were removed during 1999 excavation.

Reference: Drawing entitled "Service Station No. 0255 at Queen Anne Avenue & Roy Street, Seattle, WA" provided by Union Oil Company of California, undated.

GeoEngineers

1993, 1998 AND 1999 EXCAVATION AREAS

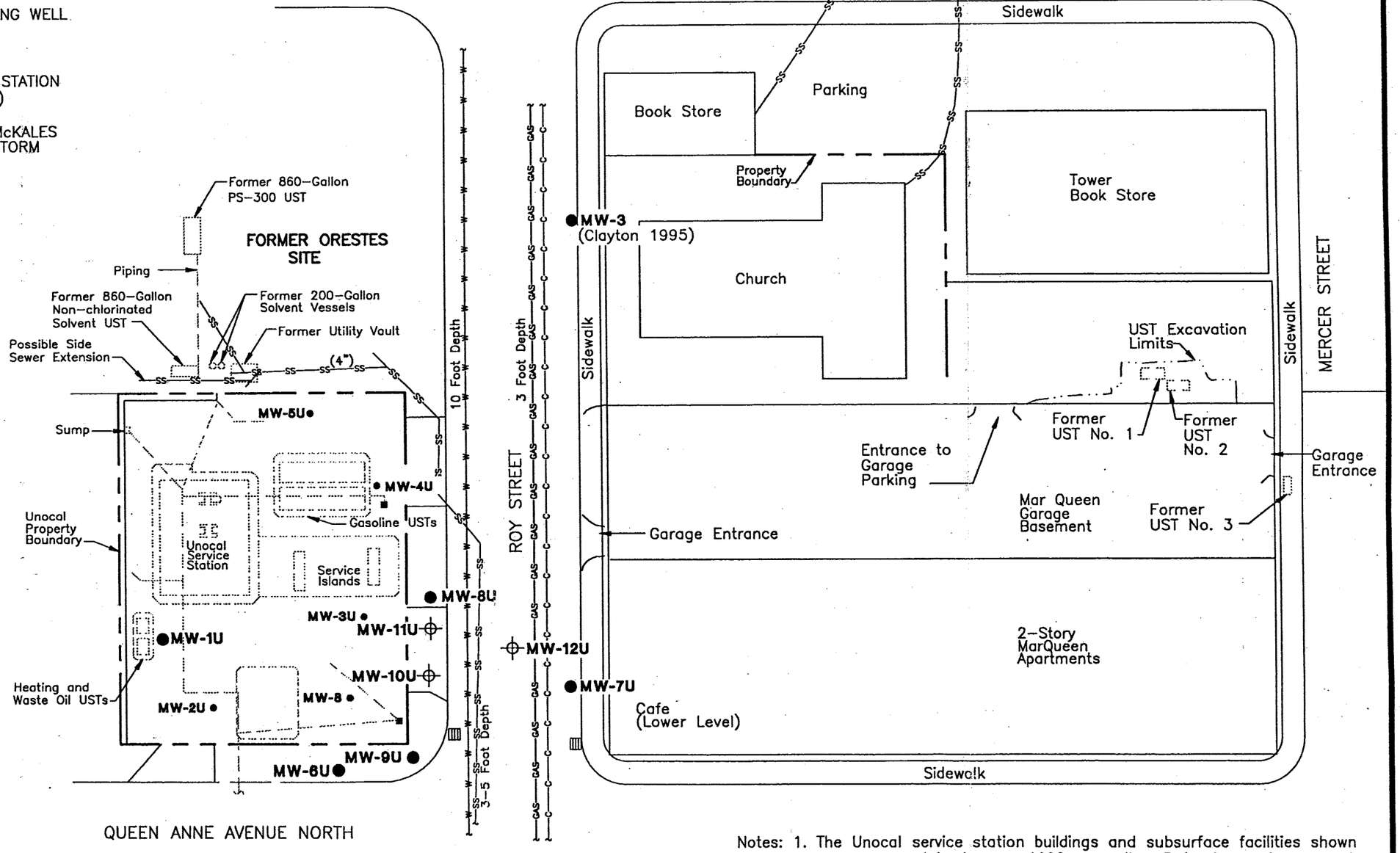
FIGURE 2

11/15/99 P:\0161\153\CAD\0161153065.DWG TMK:SYF

Figure 20

EXPLANATION:

- **MW-10U** ⊕ NEW MONITORING WELL (AUGUST 1999)
- **MW-2U** • DECOMMISSIONED MONITORING WELL
- **MW-8U** ● MONITORING WELL
- FORMER UNOCAL SERVICE STATION FACILITIES (1964 TO 1991)
- FORMER OR ABANDONED McKALES OR UNOCAL SEWER AND STORM DRAIN PIPING
- —W—W— WATER MAIN
- —GAS—GAS— NATURAL GAS LINE
- —SS—SS— 6-INCH ø SANITARY SEWER
- —C—C— FIBER OPTIC CABLE
- CATCH BASIN



N

0 40 80

SCALE IN FEET

Notes:
1. The Unocal service station buildings and subsurface facilities shown were removed in January 1992 or earlier. Refer to previous reports for McKales service station features.
2. The locations of all features shown are approximate.
3. Sewer locations per City of Seattle sewer cards.

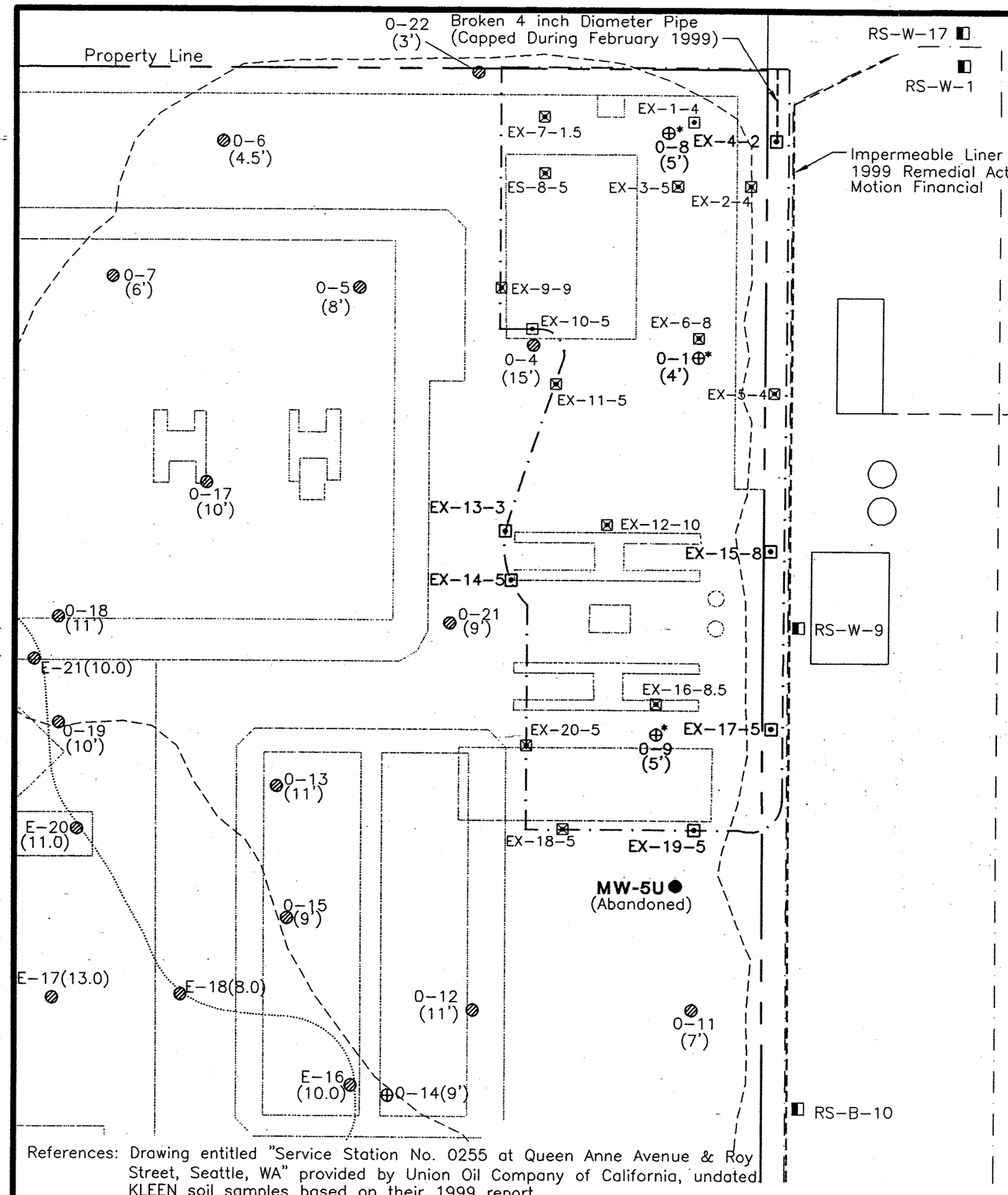
Reference: Drawing entitled "Underground Storage Tank Removal Summary Report, 10 Mercer Street Property" by RZA AGRA Inc., dated 10/11/93, and "Results of Underground Storage Tank Removal at 14 Roy Street" by QUEST dated 05/15/98.

Geo Engineers

LAYOUT OF SITE & SURROUNDING PROPERTIES

FIGURE 1

DLC:HLA P:\0161153\CAD\ROY\0161153O8P.DWG 10/13/99



References: Drawing entitled "Service Station No. 0255 at Queen Anne Avenue & Roy Street, Seattle, WA" provided by Union Oil Company of California, undated KLEEN soil samples based on their 1999 report.

Notes:
1. The service station buildings and subsurface facilities shown were removed in January 1992 or earlier.
2. The locations of all features shown are approximate.
3. "0" Samples were obtained from 1993 excavation. "E" Samples were obtained from 1998 excavation. "EX" Samples were obtained from 1999 excavation.
4. *Soil represented by samples 0-8, 0-1 and 0-9 were removed during 1999 excavation.

Figure 21

N

0 10 20
SCALE IN FEET

EXPLANATION:

MW-1U ● MONITORING WELL

0-1 / E-7 ⊘ SOIL SAMPLE WITH HYDROCARBON CONCENTRATIONS EITHER NOT DETECTED OR LESS THAN MTCA METHOD A SOIL CLEANUP LEVELS (SEE NOTES 3 AND 4)

0-10 / E-9 ⊕ SOIL SAMPLE WITH HYDROCARBON CONCENTRATIONS EXCEEDING MTCA METHOD A SOIL CLEANUP LEVELS (SEE NOTES 3 AND 4)

(8') SAMPLE DEPTH (FEET BELOW GROUND SURFACE)

EX-4-2 ⊡ SOIL SAMPLE BY GEOENGINEERS WITH HYDROCARBON CONCENTRATIONS EXCEEDING MTCA METHOD A SOIL CLEANUP LEVELS. LAST NUMBER REPRESENTS SAMPLE DEPTH IN FEET BGS

EX-12-10 ⊠ SOIL SAMPLE BY GEOENGINEERS WITH HYDROCARBON CONCENTRATIONS EITHER NOT DETECTED OR LESS THAN MTCA METHOD A SOIL CLEANUP LEVELS

RS-W-1 ◧ 1999 SOIL SAMPLE BY KLEEN ENVIRONMENTAL WITH HYDROCARBON CONCENTRATIONS GREATER THAN MTCA METHOD A CLEANUP LEVEL

LIMITS OF 1993 EXCAVATION

LIMITS OF 1998 EXCAVATION

REMEDIAL EXCAVATION LIMITS (BY GEOENGINEERS FEBRUARY 1999)

REMEDIAL EXCAVATION LIMITS (BY KLEEN ENVIRONMENTAL JANUARY 1999)

GeoEngineers

SOIL SAMPLE LOCATIONS 1999 EXCAVATIONS

FIGURE 5

Figure 22

Sample			
MW-13U	Depth(ft)	B	G
09/23/99	8.0	<1.00	1,140
MTCA	NA	0.5	100

UNOCAL SITE

Sample			
MW-12U	Depth(ft)	B	G
08/28/00	9.0	<10.0	5,290
08/28/00	11.0	<10.0	2,570
08/28/00	13.5	<0.0500	7.09
08/28/00	15.5	<25.0	9,150
MTCA	NA	0.5	100

MW-8U ●

Sample			
MW-11U	Depth(ft)	B	G
08/28/00	6.0	<0.0500	<5.00
08/28/00	8.5	<12.5	9,000
08/28/00	10.5	<5.00	2,190
08/28/00	13.0	<1.00	809
MTCA	NA	0.5	100

Sample			
MW-10U	Depth(ft)	B	G
08/28/99	8.5	<5.00	3,370
08/28/99	11.0	<15.0	7,810
08/28/99	12.5	<12.5	6,760
08/28/99	16.0	<0.0500	<5.00
MTCA	NA	0.5	100

MW-9U ●

MW-6U ●

Sample			
MQ-9	Depth(ft)	B	G
09/08/00	22.0	<2.50	3,480
09/08/00	26.0	<0.0500	<5.00
MTCA	NA	0.5	100

ROY STREET

Sample			
MQ-2	Depth(ft)	B	G
09/05/00	22.0	<0.500	1,050
09/05/00	26.0	<0.0500	14.4
MTCA	NA	0.5	100

MARQUEEN PROPERTY

Sample			
MQ-7	Depth(ft)	B	G
09/08/00	16.0	<0.900	3,300
09/08/00	18.0	<0.0500	<5.00
09/08/00	22.0	<0.100	215
09/08/00	24.0	<0.0500	<5.00
MTCA	NA	0.5	100

Sample			
MQ-1	Depth(ft)	B	G
09/05/00	8.0	<0.0500	<5.00
09/05/00	16.0	<0.600	1,050
09/05/00	22.0	<2.20	3,150
MTCA	NA	0.5	100

Sample			
MQ-4	Depth(ft)	B	G
09/06/00	13*	<0.0500	<5.00
09/06/00	21*	<0.0500	29.5
MTCA	NA	0.5	100

Sample			
MQ-5	Depth(ft)	B	G
09/06/00	21*	<0.500	1,200
09/06/00	23*	<0.0500	<5.00
MTCA	NA	0.5	100

Sample			
MQ-6	Depth(ft)	B	G
09/06/00	21*	<0.0500	<5.00
MTCA	NA	0.5	100

MW-7U ●

Sample			
MQ-8	Depth(ft)	B	G
09/08/00	8.0	<0.0500	83.4
09/08/00	22.0	<0.500	779
09/08/00	24.0	<0.0500	<5.00
MTCA	NA	0.5	100

Sample			
MQ-3	Depth(ft)	B	G
09/06/00	18.0	<0.250	420
09/06/00	22.0	<0.0500	73.3
MTCA	NA	0.5	100

QUEEN ANNE AVENUE NORTH

N

0 20 40

SCALE IN FEET

EXPLANATION:

- **MW-1U** ● MONITORING WELL
- **MQ-9** ⊕ SOIL BORING DRILLED IN SEPTEMBER 2000
- **MQ-3** ○ MONITORING WELL INSTALLED IN SEPTEMBER 2000
- B BENZENE (mg/kg) BY EPA METHOD 8021B
- G GASOLINE-RANGE HYDROCARBONS (mg/kg) BY EPA METHOD 8021B
- mg/kg MILLIGRAMS PER KILOGRAM
- NA NOT APPLICABLE
- MTCA MODEL TOXICS CONTROL ACT METHOD A CLEANUP LEVELS
- * DEPTH BELOW ROY STREET

Notes:
1. The locations of all features shown are approximate.
2. Diesel- and oil-range hydrocarbons either were not detected or were detected at concentrations less than MTCA Method A cleanup levels. VOCs were not detected in any of the soil samples tested. See the chemcial analytical tables for additional details; including ETX results.
3. Refer to Figure 1 for identification of facilities.

Reference: Drawing entitled "Underground Storage Tank Removal Summary Report, 10 Mercer Street Property" by RZA AGRA Inc., dated 10/11/93, and "Results of Underground Storage Tank Removal at 14 Roy Street" by QUEST dated 05/15/98.

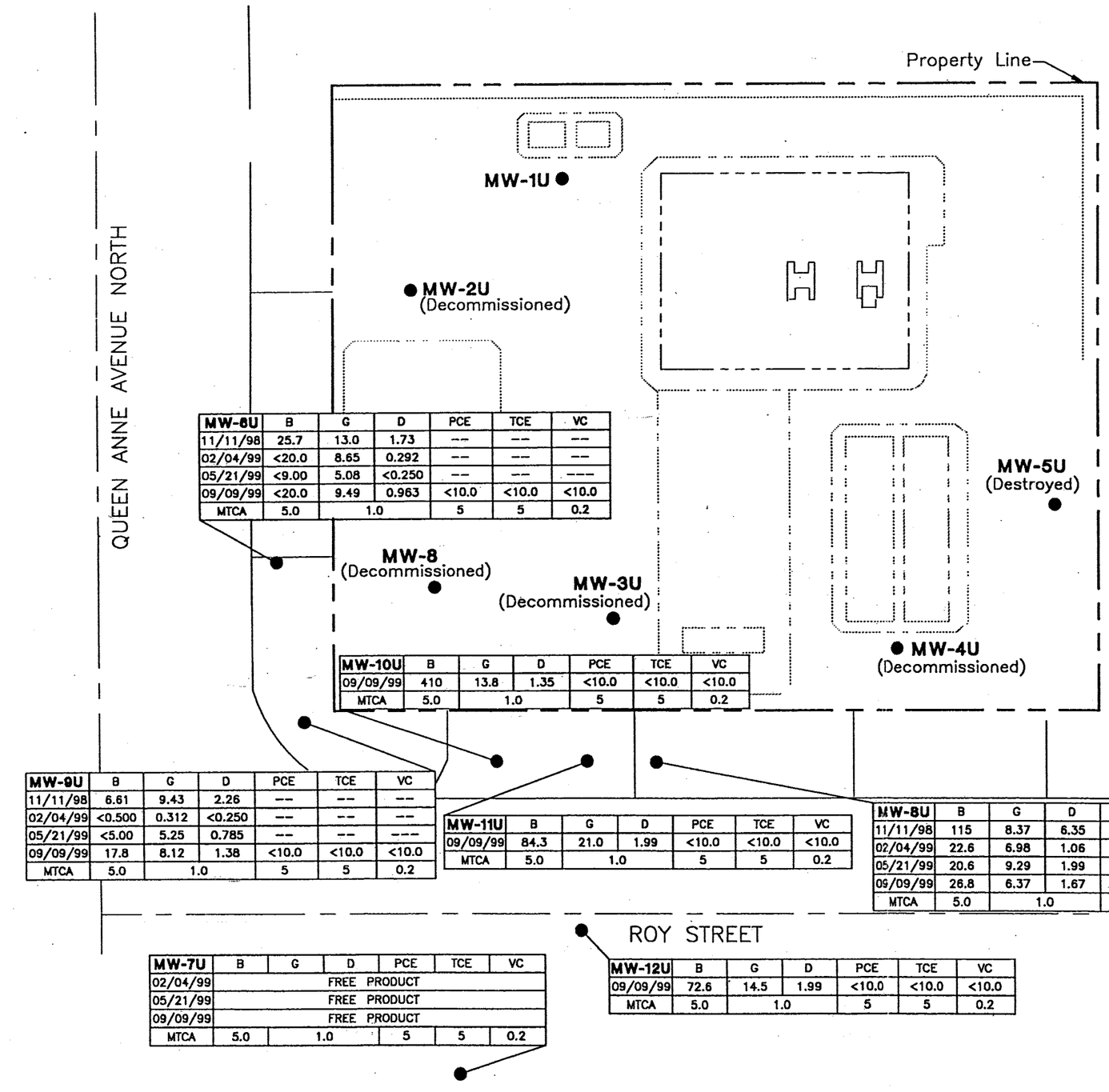
Geo Engineers

SOIL CHEMICAL ANALYTICAL RESULTS

FIGURE 5

TMK:PB P:\0161153\CAD\09\0161153O9E.DWG 11/03/00

Figure 23



MW-8U	B	G	D	PCE	TCE	VC
11/11/98	25.7	13.0	1.73	--	--	--
02/04/99	<20.0	8.65	0.292	--	--	--
05/21/99	<9.00	5.08	<0.250	--	--	---
09/09/99	<20.0	9.49	0.963	<10.0	<10.0	<10.0
MTCA	5.0	1.0		5	5	0.2

MW-10U	B	G	D	PCE	TCE	VC
09/09/99	410	13.8	1.35	<10.0	<10.0	<10.0
MTCA	5.0	1.0		5	5	0.2

MW-9U	B	G	D	PCE	TCE	VC
11/11/98	6.61	9.43	2.26	--	--	--
02/04/99	<0.500	0.312	<0.250	--	--	--
05/21/99	<5.00	5.25	0.785	--	--	---
09/09/99	17.8	8.12	1.38	<10.0	<10.0	<10.0
MTCA	5.0	1.0		5	5	0.2

MW-11U	B	G	D	PCE	TCE	VC
09/09/99	84.3	21.0	1.99	<10.0	<10.0	<10.0
MTCA	5.0	1.0		5	5	0.2

MW-8U	B	G	D	PCE	TCE	VC
11/11/98	115	8.37	6.35	--	--	--
02/04/99	22.6	6.98	1.06	--	--	--
05/21/99	20.6	9.29	1.99	--	--	---
09/09/99	26.8	6.37	1.67	<10.0	<10.0	<10.0
MTCA	5.0	1.0		5	5	0.2

MW-7U	B	G	D	PCE	TCE	VC
02/04/99	FREE PRODUCT					
05/21/99	FREE PRODUCT					
09/09/99	FREE PRODUCT					
MTCA	5.0	1.0		5	5	0.2

MW-12U	B	G	D	PCE	TCE	VC
09/09/99	72.6	14.5	1.99	<10.0	<10.0	<10.0
MTCA	5.0	1.0		5	5	0.2

N

0 20 40

SCALE IN FEET

EXPLANATION:

- MW-1U ● MONITORING WELL
- B BENZENE (µg/l)
- G GASOLINE-RANGE HYDROCARBONS (mg/l)
- D DIESEL-RANGE HYDROCARBONS (mg/l)
- PCE TETRACHLOROETHYLENE (µg/l)
- TCE TRICHLOROETHYLENE (µg/l)
- VC VINYL CHLORIDE (µg/l)
- -- NOT TESTED
- MTCA MODEL TOXICS CONTROL ACT METHOD A GROUND WATER CLEANUP LEVELS
- µg/l MICROGRAMS PER LITER
- mg/l MILLIGRAMS PER LITER

Note: 1. The service station building and subsurface facilities shown were removed in January 1992.
2. The locations of all features shown are approximate.
3. MW-2U, MW-3U, MW-4U, and MW-8 were abandoned prior to Unocal's May 1998 remedial action. MW-5U was destroyed by others during March 1998.

Reference: Drawing entitled "Service Station No. 255 at Queen Anne Avenue & Roy Street, Seattle, WA," provided by Union Oil Company of California, undated.

Geo Engineers

SUMMARY OF GROUND WATER ANALYTICAL DATA

FIGURE 3

10/13/99 P:\0161153\CAD\ROY\0161153088.DWG LJB:HLA

Figure 24

MW-13U	B	G	PCE	TCE	VC
08/10/00	<2.50	2.76	<1.00	20	1,050
MTCA	5	1.0	5	5	0.2

UNOCAL SITE

MW-12U	B	G	PCE	TCE	VC
08/10/00	90.8	18.6	--	--	-
MTCA	5	1.0	5	5	0.2

MW-8U	B	G	PCE	TCE	VC
08/10/00	10.5	6.08	--	--	--
MTCA	5	1.0	5	5	0.2

MW-11U	B	G	PCE	TCE	VC
08/10/00	32.5	19.9	--	--	--
MTCA	5	1.0	5	5	0.2

MW-10U	B	G	PCE	TCE	VC
08/10/00	164	16.6	--	--	--
MTCA	5	1.0	5	5	0.2

MW-9U	B	G	PCE	TCE	VC
08/10/00	28.3	9.39	--	--	--
MTCA	5	1.0	5	5	0.2

ROY STREET

MW-7U	B	G	PCE	TCE	VC
08/10/00	FREE PRODUCT				
MTCA	5	1.0	5	5	0.2

MARQUEEN PROPERTY

MQ-9	B	G	PCE	TCE	VC
09/08/00	2.16	0.107	11.8	14.8	<1.00
MTCA	5	1.0	5	5	0.2

MQ-7	B	G	PCE	TCE	VC
09/08/00	108	26.1	<1.00	<1.00	<1.00
MTCA	5	1.0	5	5	0.2

MQ-2	B	G	PCE	TCE	VC
09/08/00	848	23.4	<1.00	<1.00	<1.00
MTCA	5	1.0	5	5	0.2

MQ-1

MQ-4	B	G	PCE	TCE	VC
09/08/00	6.09	0.516	<1.00	<1.00	9.93
MTCA	5	1.0	5	5	0.2

MQ-5	B	G	PCE	TCE	VC
09/08/00	244	2.76	<1.00	<1.00	25.3
MTCA	5	1.0	5	5	0.2

MQ-6	B	G	PCE	TCE	VC
09/08/00	117	5.25	<1.00	6.71	<1.00
MTCA	5	1.0	5	5	0.2

MW-6U	B	G	PCE	TCE	VC
08/10/00	4.49	9.40	--	--	--
MTCA	5	1.0	5	5	0.2

MQ-8	B	G	PCE	TCE	VC
09/08/00	833	9.10	<1.00	<1.00	<1.00
MTCA	5	1.0	5	5	0.2

MQ-3	B	G	PCE	TCE	VC
09/08/00	1,070	25.3	<1.00	<1.0	<1.0
MTCA	5	1.0	5	5	0.2

QUEEN ANNE AVENUE NORTH

N

0 20 40

SCALE IN FEET

EXPLANATION:

- **MW-1U** ● MONITORING WELL
- **MQ-9** ⊕ SOIL BORING DRILLED IN SEPTEMBER 2000
- **MQ-3** ○ MONITORING WELL INSTALLED IN SEPTEMBER 2000
- B BENZENE (µg/l)
- G GASOLINE (mg/l)
- PCE TETRACHLOROETHENE (µg/l)
- TCE TRICHLOROETHENE (µg/l)
- VC VINYL CHLORIDE (µg/l)
- MTCA MODEL TOXICS CONTROL ACT METHOD A OR B CLEANUP LEVEL
- µg/l MICROGRAMS PER LITER
- mg/l MILLIGRAMS PER LITER
- -- NOT ANALYZED

Notes: 1. The locations of all features shown are approximate.
2. See chemical analytical tables for additional details.
3. Refer to Figure 1 for identification of facilities.

Reference: Drawing entitled "Underground Storage Tank Removal Summary Report, 10 Mercer Street Property" by RZA AGRA Inc., dated 10/11/93, and "Results of Underground Storage Tank Removal at 14 Roy Street" by QUEST dated 05/15/98.

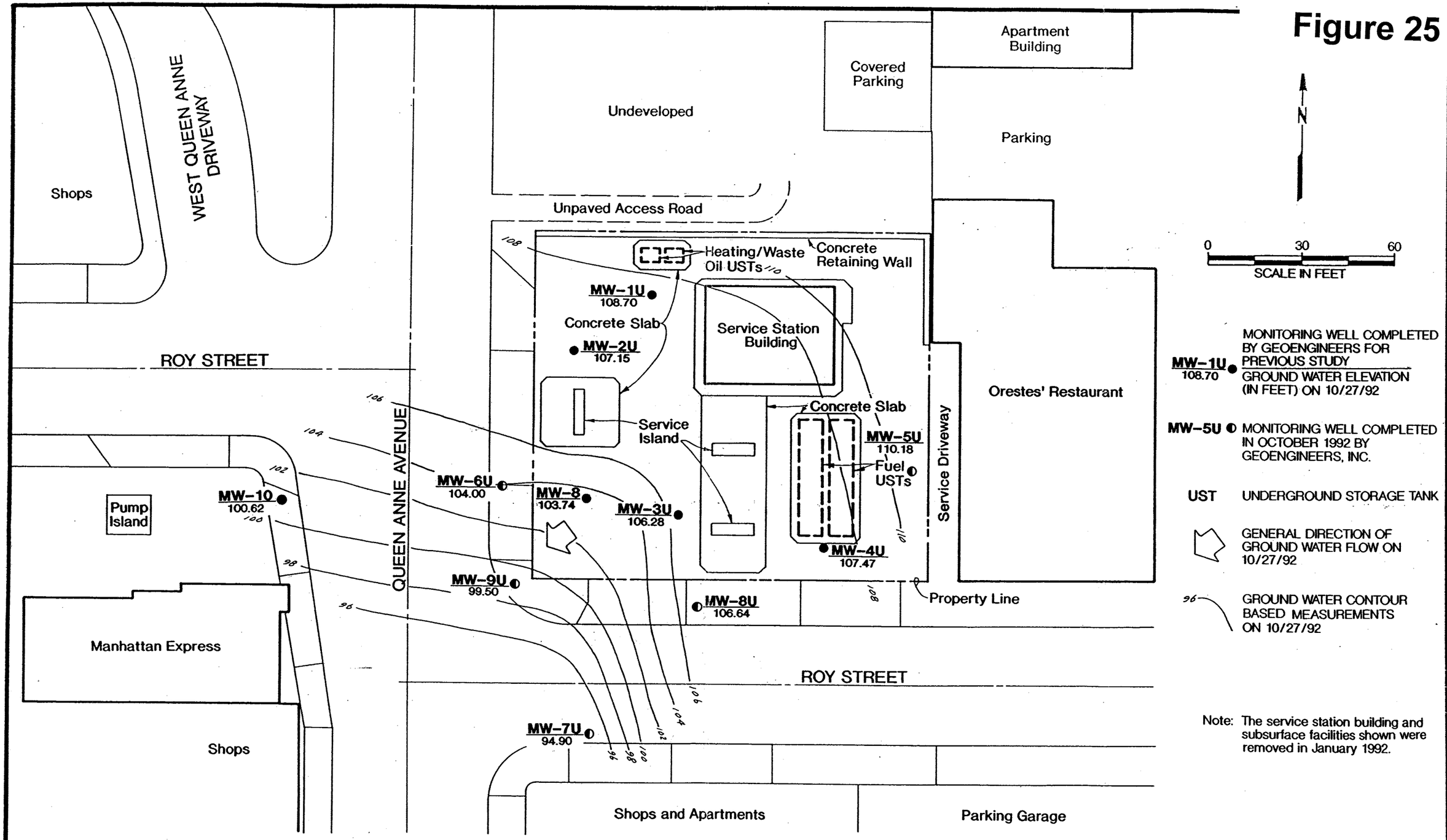
Geo Engineers

GROUND WATER CHEMICAL ANALYTICAL RESULTS

FIGURE 7

TMK:HLA P:\0161153\CAD\09\0161153309F.DWG 10/20/00

Figure 25



Note: The service station building and subsurface facilities shown were removed in January 1992.

Reference: Drawing entitled "Service Station No. 255 @ Queen Anne Avenue & Roy Street, Seattle, Wa.," provided by Union Oil Company of California, undated.

GeoEngineers

SITE PLAN

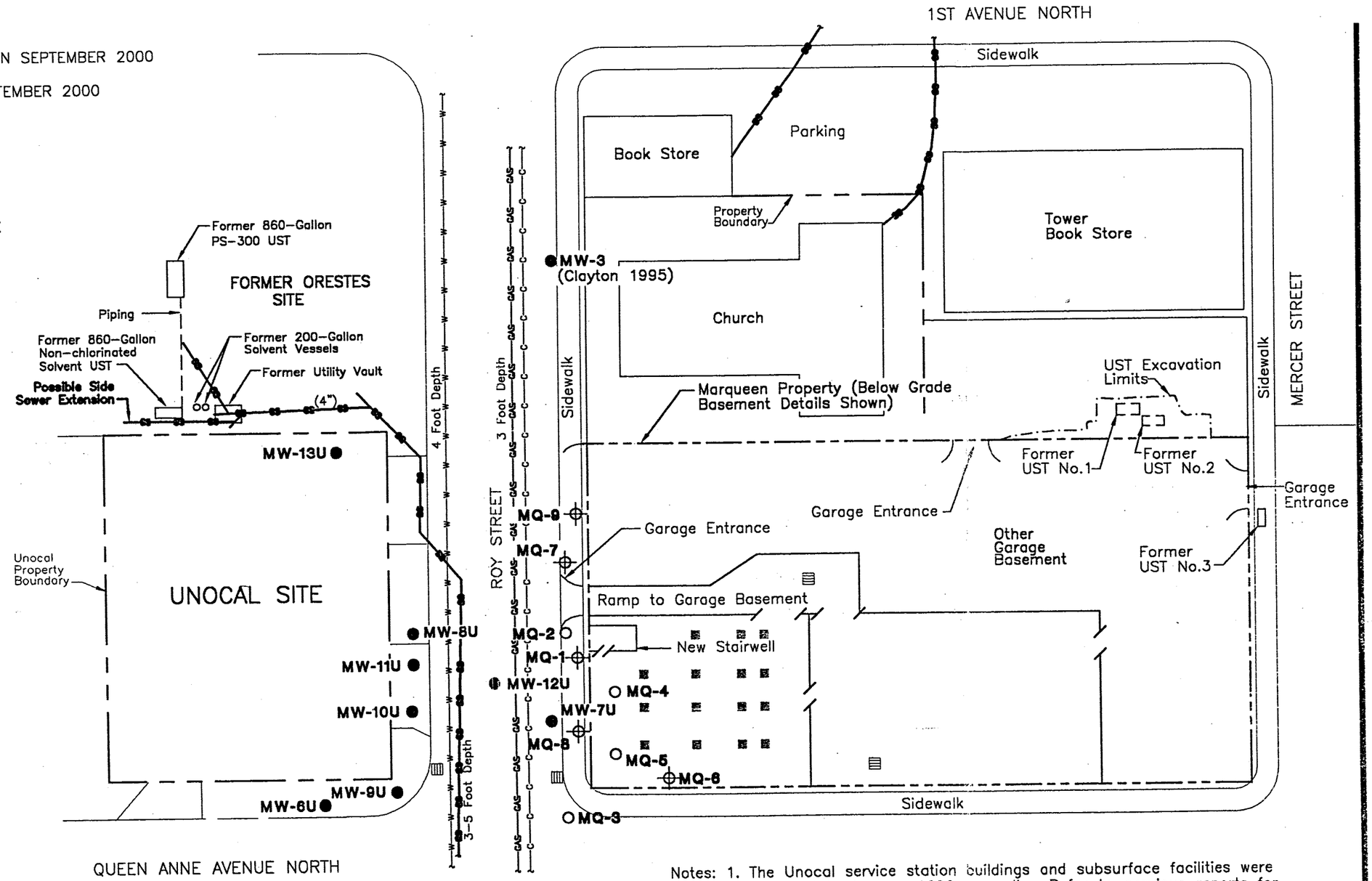
FIGURE 1

0181-153-20 DFH:KJD 1/11/93 (2) Rev. 1/93

Figure 26

EXPLANATION:

- **MQ-3** ○ MONITORING WELL INSTALLED IN SEPTEMBER 2000
- **MQ-8** ⊕ SOIL BORING DRILLED IN SEPTEMBER 2000
- **MW-8U** ● MONITORING WELL
- BASEMENT COLUMN
- CATCH BASIN
- UST UNDERGROUND STORAGE TANK
- W—W 6-INCH WATER MAIN
- GAS—GAS NATURAL GAS LINE
- SS—SS 6-INCH SANITARY SEWER
- C—C FIBER OPTIC CABLE



Notes:
1. The Unocal service station buildings and subsurface facilities were removed in January 1992 or earlier. Refer to previous reports for McKales service station features.
2. The locations of all features shown are approximate.
3. Sewer locations per City of Seattle sewer cards. Private utilities on Marqueen property not shown.

Reference: Drawing entitled "Underground Storage Tank Removal Summary Report, 10 Mercer Street Property" by RZA AGRA Inc., dated 10/11/93, and "Results of Underground Storage Tank Removal at 14 Roy Street" by QUEST dated 05/15/98.

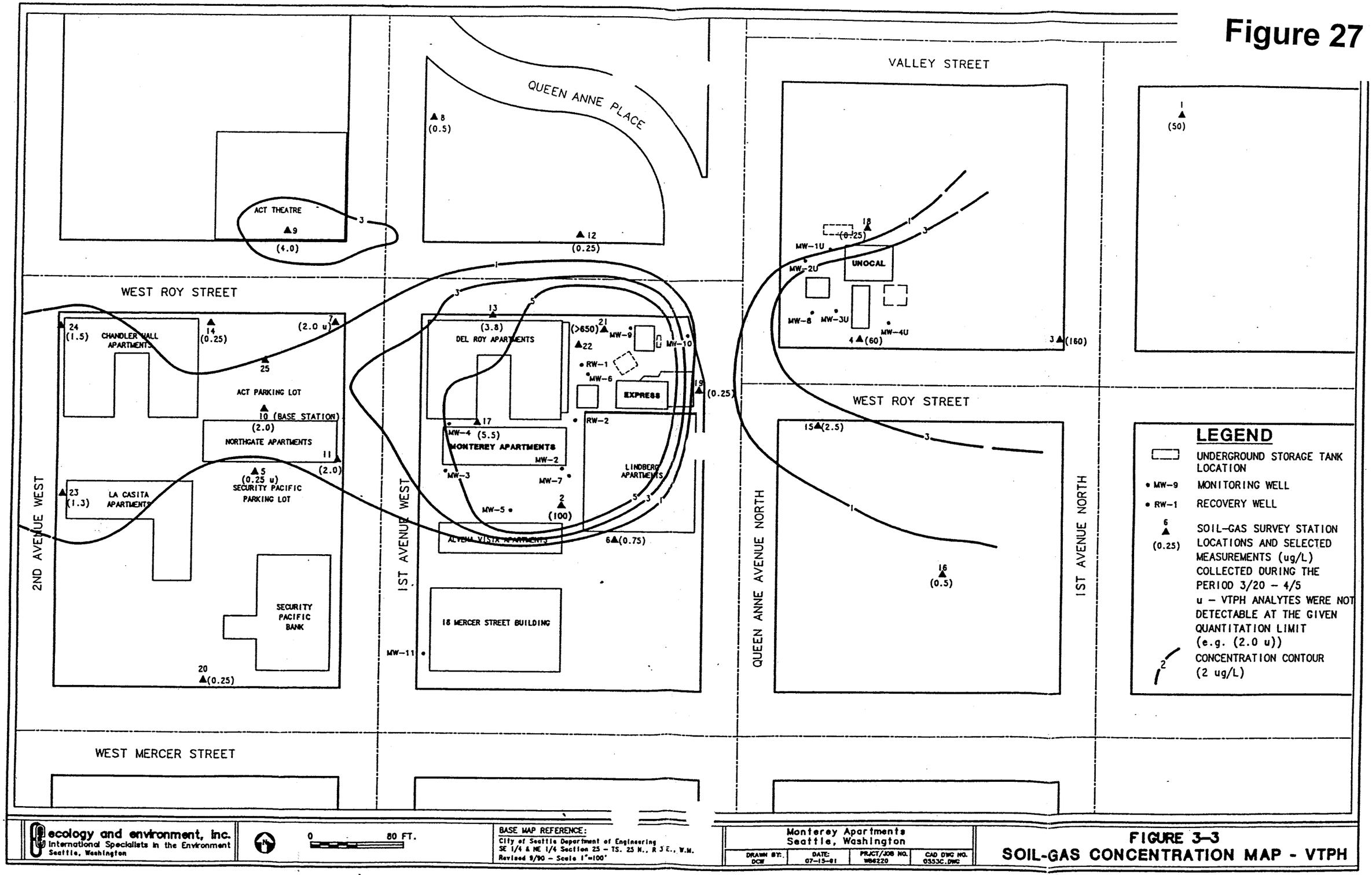
Geo Engineers

LAYOUT OF SITE & SURROUNDING PROPERTIES

FIGURE 1

TMK:HLA P:\0161153\CAD\09\0161153309A.DWG 10/20/00

Figure 27



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International Specialists in the Environment
Seattle, Washington

0 80 FT.

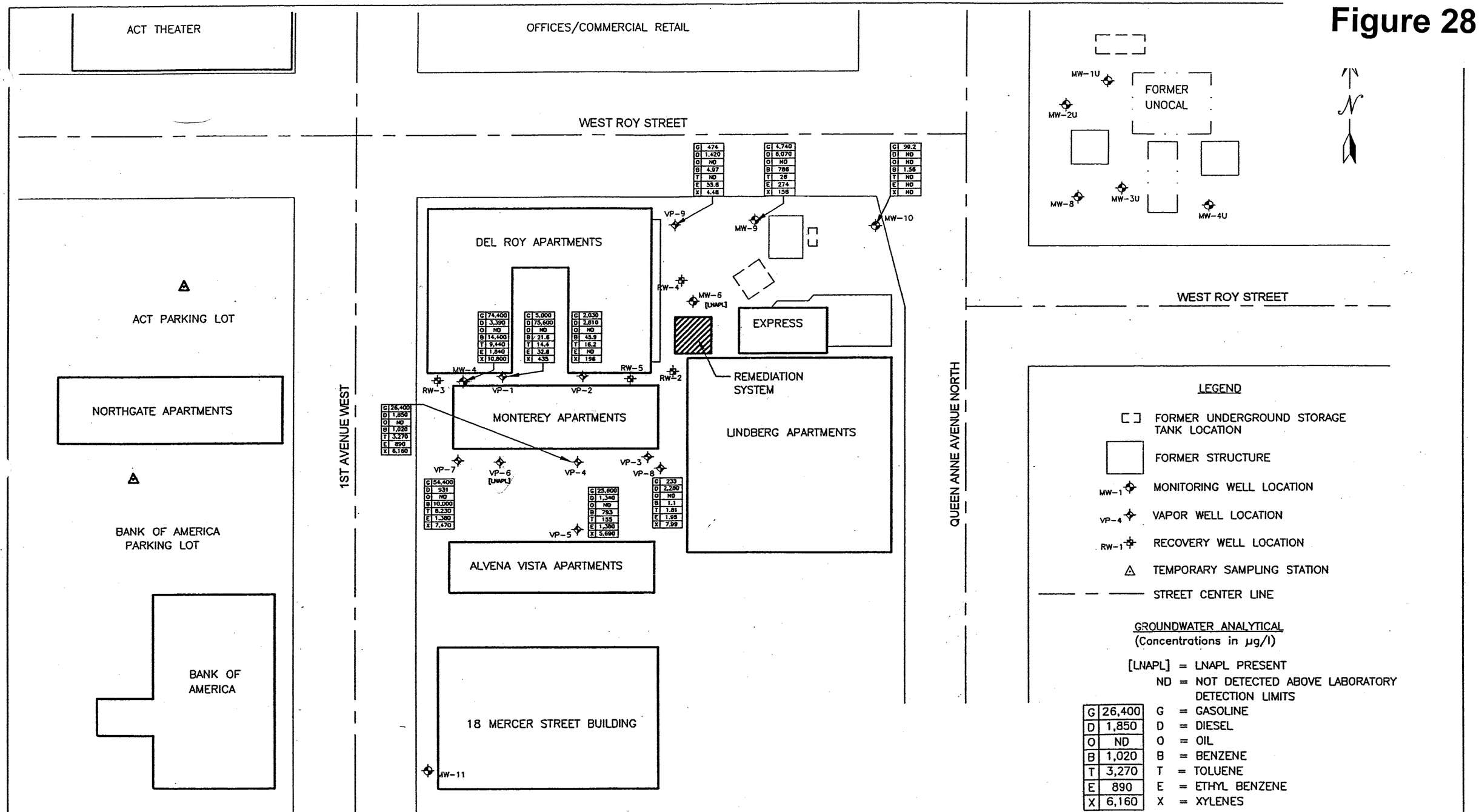
BASE MAP REFERENCE:
City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25 – TS. 25 N., R 3 E., W.M.
Revised 9/90 – Scale 1"=100'

Monterey Apartments
Seattle, Washington

DRAWN BY:	DATE:	PROJT/JOB NO.	CAD DWG NO.
DCW	07-15-91	W86220	0353C.DWG

FIGURE 3-3
SOIL-GAS CONCENTRATION MAP - VTPH

Figure 28



BASE MAP REFERENCE: City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25–TS. 25 N., R 3 I., W.M.
Revised 9/90

FARALLON CONSULTING
320 3rd Avenue NE, Suite 200
Issaquah, WA 98027

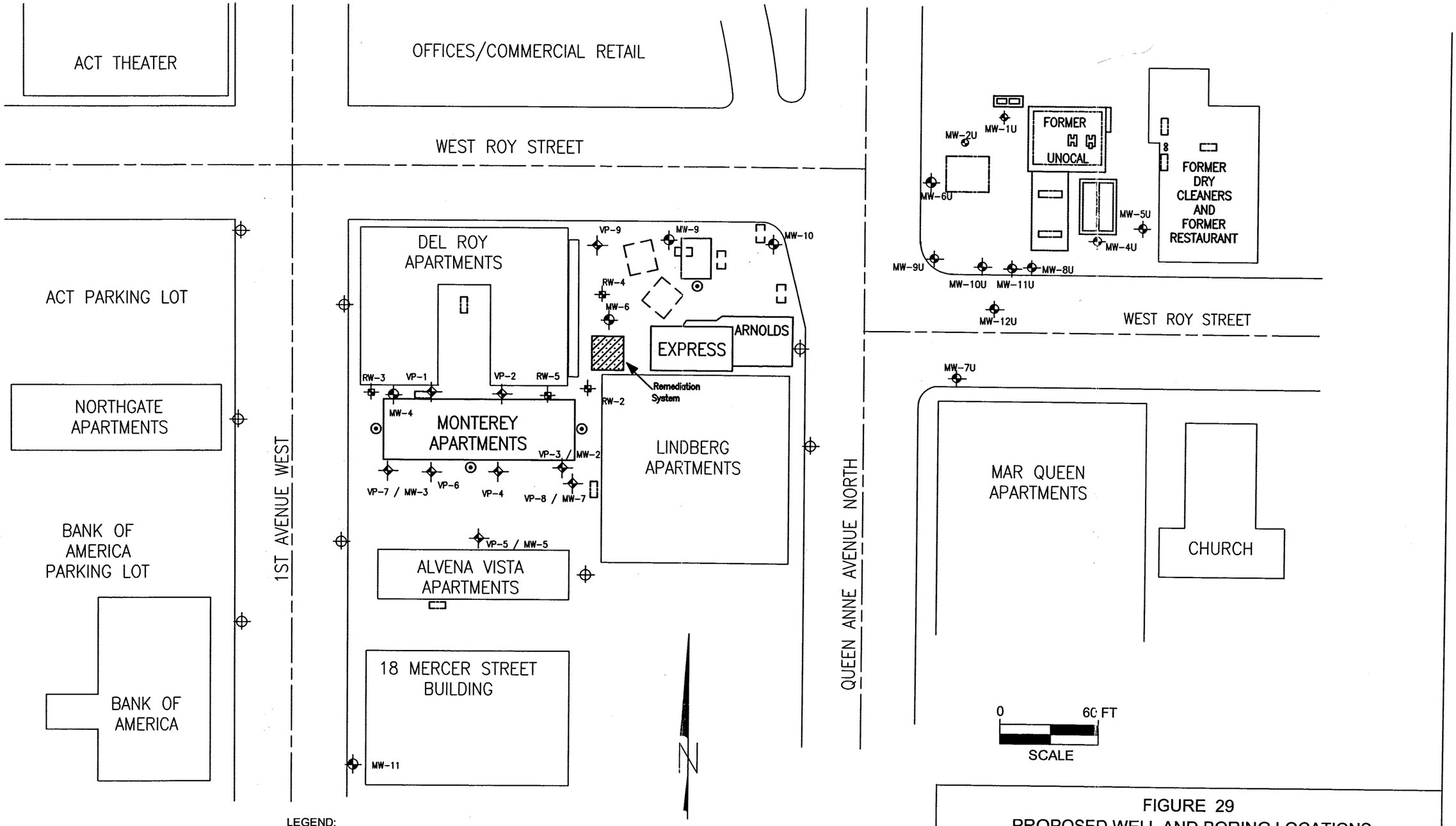
FIGURE 3

GROUNDWATER ANALYTICAL CONCENTRATIONS
JUNE 2000 SAMPLE EVENT
QUEEN ANNE TEXACO
631 QUEEN ANNE AVE. NORTH
SEATTLE, WASHINGTON

FARALLON PN: 619–010

Drawn By: QDD	Checked By: PJ	Date: 7/18/00	Disk Reference: 61901001

Figure 29



LEGEND:

- STREET CENTER LINE
- MW-1 MONITORING WELL LOCATION AND DESIGNATION
- VP-1 VAPOR WELL LOCATION AND DESIGNATION
- RW-1 RECOVERY WELL LOCATION AND DESIGNATION
- PROPOSED GROUNDWATER WELL LOCATION
- PROPOSED BORING LOCATION

FIGURE 29
PROPOSED WELL AND BORING LOCATIONS
QUEEN ANNE TEXACO
631 QUEEN ANNE NORTH SEATTLE, WASHINGTON

PROJECT NO. TW21-577	DRAWN BY M.S.M. 5/15/2
FILE NO. 21577	PREPARED BY M.S.M.
REVISION NO. 1	REVIEWED BY M.S.M.

Delta Environmental Consultants, Inc.

TABLE 1

Groundwater Analytical Results

Farallon Consulting, June 2000

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
March 1991 through June 2000
QUEEN ANN TEXACO
FARALLON PN: 619-010

Monitoring Well	VP-1[1]								VP-2							
	Mar-91[2]	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00
micrograms/liter (µg/L)																
Gasoline Range Hydrocarbons	-[3]	-	-	-	-	-	-	5,000	-	-	-	-	-	-	5,980	2,030
Benzene	-	-	-	-	-	-	-	21.6	-	-	-	-	-	-	935	45.9
Toluene	-	-	-	-	-	-	-	14.4	-	-	-	-	-	-	345	16.2
Ethyl benzene	-	-	-	-	-	-	-	32.8	-	-	-	-	-	-	43.8	ND
Xylenes	-	-	-	-	-	-	-	435	-	-	-	-	-	-	305	196
m&p - xylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-xylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Hydrocarbons	-	-	-	-	-	-	-	75,600	-	-	-	-	-	-	29,900	2,810
milligrams/liter (mg/l)																
Oil Range Hydrocarbons	-	-	-	-	-	-	-	ND[4]	-	-	-	-	-	-	ND	ND
Lead (total)	-	-	-	-	-	-	-	0.334	-	-	-	-	-	-	0.262	0.0378
Lead (dissolved)	-	-	-	-	-	-	-	0.0339	-	-	-	-	-	-	0.0617	0.00987
Maganese	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ferrous Iron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate-Nitrogen (mg/l as N)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1 - Well designations have historically varied. The designations used here are consistent with the designations shown on Figure 1, (well designations in ( ) indicate previous labeling).

2 - Date groundwater samples were collected. Mar-91 from Ecology and Environment, Oct-95 through Nov-97 from Ecology, Dec-99 - Jun-00 from Farallon.

3 - (-) = sample not analyzed.

4 - ND = not detected above laboratory detection limits.

E - The analyte was not detected at or above the report value.

J - The analyte was positively identified. The associated numerical result is an estimate.

P - The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

U - The analyte was not detected at or above the reported value.

RA - Reported as m&p xylene and o-xylene, total xylene not reported.

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TABLE 1
GROUNDWATER ANALYTICAL RESULTS
March 1991 through June 2000
QUEEN ANN TEXACO
FARALLON PN: 619-010

Monitoring Well	VP-4								VP-5 (MW-5)							
	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00
(ug/l)																
Gasoline Range Hydrocarbons	-	-	-	-	-	-	-	26,400	-	-	-	-	-	-	23,400	25,600
Benzene	-	-	-	-	-	-	-	1,020	5,300	-	-	-	-	-	841	793
Toluene	-	-	-	-	-	-	-	3,270	1,300	-	-	-	-	-	191	155
Ethyl benzene	-	-	-	-	-	-	-	890	900	-	-	-	-	-	1,480	1,380
Xylenes	-	-	-	-	-	-	-	6,160	4,600	-	-	-	-	-	7,720	5,690
m&p - xylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-xylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Hydrocarbons	-	-	-	-	-	-	-	1,850	-	-	-	-	-	-	2,490	1,340
(mg/l)																
Oil Range Hydrocarbons	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	ND	ND
Lead (total)	-	-	-	-	-	-	-	0.00912	-	-	-	-	-	-	0.00676	0.00375
Lead (dissolved)	-	-	-	-	-	-	-	0.00466	-	-	-	-	-	-	0.00275	0.00266
Maganese	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ferrous Iron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate-Nitrogen (mg/l as N)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
March 1991 through June 2000
QUEEN ANN TEXACO
FARALLON PN: 619-010

Monitoring Well	VP-7 (MW-3)								VP-8 (MW-7)							
	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00
(ug/l)																
Gasoline Range Hydrocarbons	-	33,000	51,000	53,000	37,000	34,000	73,400	54,400	-	3,100	8,000	18,000	9,100J	830J	7,640	233
Benzene	3,700	11,700	12,400	11,100	11,000	15,900	16,800	10,000	280	2.5	816	605	96	5.6	540	1.1
Toluene	1,600	2,330	5,200	4,800	3,700	3,600	9,670	8,230	510	1.2	824	786	246	7	927	1.81
Ethyl benzene	740	1,070	990	1,400	1,500	1,500	1,890	1,380	130	3	26	119	52	11	201	1.95
Xylenes	3,500	4,130	RA	RA	RA	RA	10,500	7,470	1,100	16	RA	RA	RA	RA	1,430	7.99
m&p - xylene	-	-	3,700	5,400	5,200	4,800	-	-	-	-	412	1,260	706	23	-	-
o-xylene	-	-	1,500	2,200	1,900	1,800	-	-	-	-	182	514	274	9.6	-	-
Diesel Range Hydrocarbons	-	-	-	-	-	-	3,310	931	-	-	-	-	-	-	2,780	2,280
(mg/l)																
Oil Range Hydrocarbons	-	-	-	-	-	-	ND	ND	-	-	-	-	-	-	ND	ND
Lead (total)	-	0.0056P	0.0099	0.0034	0.0043J	0.005	0.00591	-	-	0.0034P	0.037	0.0246	0.023	0.0127	0.0406	0.0177
Lead (dissolved)	-	-	-	-	-	-	0.00211	0.00213	-	-	-	-	-	-	0.00502	0.00795
Maganese	-	-	-	-	-	-	7.76	-	-	-	-	-	-	-	-	-
Ferrous Iron	-	-	-	-	-	-	11.7	-	-	-	-	-	-	-	-	-
Nitrate-Nitrogen (mg/l as N)	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
Sulfate	-	-	-	-	-	-	13.4	-	-	-	-	-	-	-	-	-

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TABLE 1
GROUNDWATER ANALYTICAL RESULTS
March 1991 through June 2000
QUEEN ANN TEXACO
FARALLON PN: 619-010

Monitoring Well	VP-9								MW-4							
	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00
(ug/l)																
Gasoline Range Hydrocarbons	-	-	-	-	-	-	118	474	-	95,000	88,000	100,000	120,000	89,000	73,300	74,400
Benzene	-	-	-	-	-	-	ND	4.97	10,000	19,600E	12,900	14,300	19,600	17,500	13,700	14,400
Toluene	-	-	-	-	-	-	ND	ND	12, 000	12,000	12,400	14,500	19,700	16,000	13,500	9,440
Ethyl benzene	-	-	-	-	-	-	ND	55.6	500	2,070	1,400	1,700	2,100	1,900	1,830	1,840
Xylenes	-	-	-	-	-	-	ND	4.48	9,800	10,800	RA	RA	RA	RA	11,000	10,800
m&p - xylene	-	-	-	-	-	-	-	-	-	-	7,500	7.8	9,300	8,800	-	-
o-xylene	-	-	-	-	-	-	-	-	-	-	3,100	3,200	3,800	3,400	-	-
Diesel Range Hydrocarbons	-	-	-	-	-	-	ND	1,420	-	-	-	-	-	-	3,340	3,390
(mg/l)																
Oil Range Hydrocarbons	-	-	-	-	-	-	ND	ND	-	-	-	-	-	-	ND	ND
Lead (total)	-	-	-	-	-	-	0.00572	0.0152	-	0.0306	0.0365	0.0207	0.0195	0.0162	0.0198	0.0214
Lead (dissolved)	-	-	-	-	-	-	ND	ND	-	-	-	-	-	-	0.00986	0.00972
Maganese	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.5	-
Ferrous Iron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.15	-
Nitrate-Nitrogen (mg/l as N)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-
Sulfate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
March 1991 through June 2000
QUEEN ANN TEXACO
FARALLON PN: 619-010

Monitoring Well	MW-6								MW-9							
	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00
(ug/l)																
Gasoline Range Hydrocarbons	-	-	-	-	-	-	-	-	-	3,400	4,400	9,100	2,200J	5,000	4,460	4,740
Benzene	25,000	12,000E	7,290	-	-	-	-	-	1,600	3,520	2,600	2,980	2,680	2,010	831	786
Toluene	29,000	13,800E	12,400	-	-	-	-	-	2,900	70J	53	173	127	80	22.4	26
Ethyl benzene	2,500	920	2,340	-	-	-	-	-	250	200U	310	413	460	334	274	274
Xylenes	19,000	5,690	-	-	-	-	-	-	3,100	10,800	RA	RA	RA	RA	138	156
m&p - xylene	-	4,170	14,200	-	-	-	-	-	-	-	7,500	7,800	9,300	8,800	-	-
o-xylene	-	1,520	5,600	-	-	-	-	-	-	-	3,100	3,200	3,800	3,400	-	-
Diesel Range Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,510	6,070
(mg/l)																
Oil Range Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND
Lead (total)	-	-	-	-	-	-	-	-	-	0.0046P	-	0.0068	0.0086J	0.0033	0.015	0.00786
Lead (dissolved)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00103	0.00159
Maganese	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.5	-
Ferrous Iron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.15	-
Nitrate-Nitrogen (mg/l as N)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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TABLE 1
GROUNDWATER ANALYTICAL RESULTS
March 1991 through June 2000
QUEEN ANN TEXACO
FARALLON PN: 619-010

Monitoring Well	MW-10								RW-2							
	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00	Mar-91	Oct-95	Jan-97	Apr-97	Jul-97	Nov-97	Dec-99	Jun-00
(ug/l)																
Gasoline Range Hydrocarbons	-	780	180	420	1,100	1,000	618	99.2	-	-	390	11,000	24,000	4,400	-	-
Benzene	5U	1.8	1.5	5.1	10	4.2	7.02	1.56	19,000	-	31	189	4,230	3,140	-	-
Toluene	5U	2.9	1U	1	2.1	2	ND	ND	46,000	-	14	243	2,490	1,200	-	-
Ethyl benzene	5U	0.82J	1U	1U	2.4	4.8	ND	ND	2,500	-	6	99	398	338	-	-
Xylenes	5U	5.6	RA	RA	RA	RA	ND	ND	120,000	-	RA	RA	RA	RA	-	-
m&p - xylene	-	-	2U	2.0J	3.8	1.6	-	-	-	-	31	540	1,960	1,670	-	-
o-xylene	-	-	1U	1.4U	0.54J	0.6J	-	-	-	-	18	203	772	595	-	-
Diesel Range Hydrocarbons	-	-	-	-	-	-	353	ND	-	-	-	-	-	-	-	-
(mg/l)																
Oil Range Hydrocarbons	-	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
Lead (total)	-	0.001U	-	0.001U	0.0012J	0.0049	ND	ND	-	-	-	-	-	-	-	-
Lead (dissolved)	-	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
Maganese	-	-	-	-	-	-	5.12	-	-	-	-	-	-	-	-	-
Ferrous Iron	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-
Nitrate-Nitrogen (mg/l as N)	-	-	-	-	-	-	0.72	-	-	-	-	-	-	-	-	-
Sulfate	-	-	-	-	-	-	70.6	-	-	-	-	-	-	-	-	-

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TABLE 2

Summary of Groundwater Elevations and Free Product Thickness

GeoEngineers, September 1999

TABLE 3
SUMMARY OF GROUND WATER ELEVATIONS AND FREE PRODUCT THICKNESSES
FORMER UNOCAL SERVICE STATION 0255
SEATTLE, WASHINGTON

Monitoring Well[1] (Casing Elevation)	Date Measured	Water Depth from Top of Casing (feet)	Ground Water Elevation[2] (feet)	Product Thickness (feet)
MW-6U (116.55)	11/11/98	9.49	107.06	ND
	02/04/99	7.03	109.52	ND
	05/21/99	8.95	107.60	ND
	09/09/99	10.01	106.54	ND
MW-7U (115.74)	11/11/98	NOTE 3	NOTE 3	NOTE 3
	02/04/99	16.24	100.52[4]	1.20
	05/21/99	17.44	98.35[4]	0.66
	09/09/99	19.22	96.61[4]	0.11
MW-8U (116.81)	11/11/98	9.70	106.61	ND
	02/04/99	5.40	111.41	ND
	05/21/99	8.60	108.21	ND
	09/09/99	10.46	106.35	ND
MW-9U (115.76)	11/11/98	11.37	104.39	ND
	02/04/99	6.98	108.78	ND
	05/21/99	9.44	106.32	ND
	09/09/99	11.14	104.62	ND
MW-10U (116.01)	09/09/99	13.36	102.65	ND
MW-11U (116.21)	09/09/99	9.96	106.25	ND
MW-12U (115.93)	09/09/99	17.50	98.43	ND

Notes:

[1]Approximate monitoring well locations are shown in Figures 1, 2 and 3.

[2]Elevations are measured relative to a temporary benchmark established during GeoEngineers' 1986 Ecology Study. Details are presented in our report dated 12/10/93 (copy on file at Unocal). The benchmark has an assumed elevation of 100.00 feet.

[3]MW-7U was inaccessible on November 11, 1998.

[4]Ground water elevation corrected for apparent thickness of free product observed. A specific gravity of 0.85 was assumed for the product.

MW-5U was destroyed by others during March 1998. MW-2U, MW-3U, MW-4U and MW-8 were decommissioned prior to Unocal's May 1998 remedial action. MW-1U is inaccessible.

ND = not detected

Bolding indicates a measurement obtained during the current reporting period. Refer to previous reports for historical data.

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TABLE 3

Summary of Groundwater Chemical Analytical Results

Geo Engineers, May 1993

TABLE 3 (Page 1 of 2)
SUMMARY OF GROUND WATER CHEMICAL ANALYTICAL RESULTS[1]

Monitoring Well Number	Date Sampled	BETX[2] (EPA Method 8020) (µg/l)				WTPH[3] (mg/l)			TPH[4] (mg/l)	Dissolved Lead[5] (mg/l)	HVOCs[6] (EPA Method 8010) (µg/l)			
		B	E	T	X	Gasoline (WTPH-G)	Diesel (WTPH-D)	Heavy Oil (WTPH-D Extended)			PCE	TCE	DCE	DCP
MW-1U[7]	12/16/91	<0.5	<0.5	<0.5	<0.5	<1	<1	--	--	<0.0030	--	--	--	--
	10/27/92	<0.5	<0.5	<0.5	<0.5	<0.1	<0.5	--	<0.5	--	--	--	--	--
MW-2U[7]	12/16/91	<0.5	<0.5	<0.5	<0.5	<1	<1	--	--	<0.0030	--	--	--	--
	10/27/92	<0.5	<0.5	<0.5	<0.5	<0.1	--	--	--	--	--	--	--	--
MW-3U	04/03/92[8]	430	1,500	<0.5	710	19	12	--	--	--	--	--	--	--
	10/27/92	220	1,100	33	170	14	5.2	--	--	<0.0030	--	--	--	--
	05/12/93	240	1,500	80	390	12	16	1.3	--	--	--	--	--	--
MW-4U	12/16/91	180	450	5.7	210	5	<1	--	--	<0.0030	--	--	--	--
	10/27/92	120	190	1.6	6.1	2.4	<0.5	--	0.6	<0.0030	--	--	--	--
	05/12/93[9]	7.1	57	2.3	7.6	4.4	1.1	1.1	--	0.0055	1.0	4.0	1.4	<0.2
MW-5U	10/27/92[10]	<0.5	<0.5	<0.5	<0.5	<0.1	<1	--	91	<0.0030	20	22	75	6.8
	05/12/93	<0.5	<0.5	<0.5	<0.5	0.110	<0.25	<0.75	<1	0.019	16	9.0	26	3.1
MW-6U	10/27/92	300	730	710	4,000	24	--	--	--	<0.0030	--	--	--	--
	05/12/93	240	780	140	3,500	26	0.51	<0.75	--	--	--	--	--	--
MW-7U[11]	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-8U	10/27/92	32	230	14	220	11	--	--	230	0.016	--	--	--	--
	05/12/93	12	<5.0	7.1	33	3.7	3.2	<0.75		0.0062	--	--	--	--
MW-9U	10/27/92	130	200	11	580	9.8	1.6	--	--	0.0067	--	--	--	--
	05/12/93	110	130	13	350	5.4	0.58	<0.75	--	0.0054	--	--	--	--
MW-8[11]	12/16/91	1,000	960	160	1,100	82	16	--	--	<0.0030	--	--	--	--
MW-Dup[12]	05/12/93	260	1,500	77	430	--	--	--	--	--	--	--	--	--
MTCA[13] Method A Cleanup Levels		5	30	40	20	1.0[14]			1.0	0.005	5.0	5.0	Note[15]	Note[15]

Notes appear on page 2 of 2.

TABLE 3 (Page 2 of 2)

Notes:

[1]Chemical analyses conducted by Analytical Technologies, Inc. with exceptions as noted. Analytical laboratory reports, analytical detection limits, chromatograms and our QC review are presented in Appendix B.

[2]B = benzene, E = ethylbenzene, T = toluene, X = xylenes.

[3]Ecology-specified methods.

[4]Total petroleum hydrocarbons by EPA Method 418.1.

[5]Dissolved lead by EPA Method 7421. Samples collected for dissolved lead were filtered in the field.

[6]Halogenated volatile organic compounds. Only the HVOCs detected are listed. PCE = tetrachloroethene, TCE = trichloroethene, DCE = 1,2-dichloroethene, DCP = 1,2-dichloropropane.

[7]Wells MW-1U and MW-2U were not sampled on 05/12/93 because petroleum hydrocarbons and lead were not detected in samples from these wells tested during previous sampling episodes.

[8]Chemical analyses conducted by North Creek Analytical.

[9]Chloroform (0.5 µg/l) also was detected by the HVOC analysis. An MTCA Method A cleanup level has not been established for chloroform. The MCL (maximum contaminant level for chloroform is 100 µg/l.

[10]1,2-Dibromoethane (EDB) (0.72 µg/l) also was detected by the HVOC analysis.

[11]MW-7U and MW-8 were not sampled in October 1992 and May 1993 because free product was detected on the water table.

[12]Field duplicate sample obtained from MW-3U.

[13]Model Toxics Control Act

[14]The MTCA Method A cleanup level for the sum of gasoline-range, diesel-range and heavy oil-range hydrocarbons is 1.0 mg/l.

[15]No established Method A cleanup levels for DCE and DCP. The MCLs (maximum contaminant levels) for these compounds are DCE - 70 µg/l and DCP - 5.0 µg/l.

µg/l = micrograms per liter

mg/l = milligrams per liter

"--" = not tested

Shaded value indicates a concentration greater than the MTCA Method A cleanup level.

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-83.
2. Soil classification using laboratory tests is based on ASTM D2487-83.
3. Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry – Absence of moisture, dusty, dry to the touch

Moist – Damp, but no visible water

Wet – Visible free water or saturated, usually soil is obtained from below water table

504-04 JAM:DMP 11-13-86

6-86

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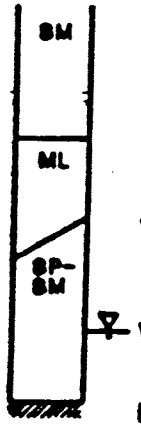
SOIL CLASSIFICATION SYSTEM

FIGURE 2

LABORATORY TESTS:

AL	Atterberg limits
CP	Compaction
CS	Consolidation
DS	Direct shear
GS	Grain-size analysis
HA	Hydrometer analysis
K	Permeability
M	Moisture content
MD	Moisture and density
SP	Swelling pressure
TX	Triaxial compression
UC	Unconfined compression

SOIL GRAPH:



Soil Group Symbol (See Note 1)

Distinct contact between Soil Strata

Gradual Change between Soil Strata

Water Level

Bottom of Boring

BLOW-COUNT/SAMPLE DATA:

Blows required to drive sampler 12 inches or other indicated distances using 300pound hammer falling 30 inches.

"P" indicates sampler pushed with weight of hammer or hydraulics of drill rig.

22 ■ Location of relatively undisturbed sample

12 ⊠ Location of disturbed sample

P □ Location of sampling attempt with no recovery

10 ◪ Location of sample attempt using Standard Penetration Test procedures

NOTES:

1. Soil classification system is summarized in Figure 2.
2. The reader must refer to the discussion in the report text as well as the exploration logs for a proper understanding of subsurface conditions.

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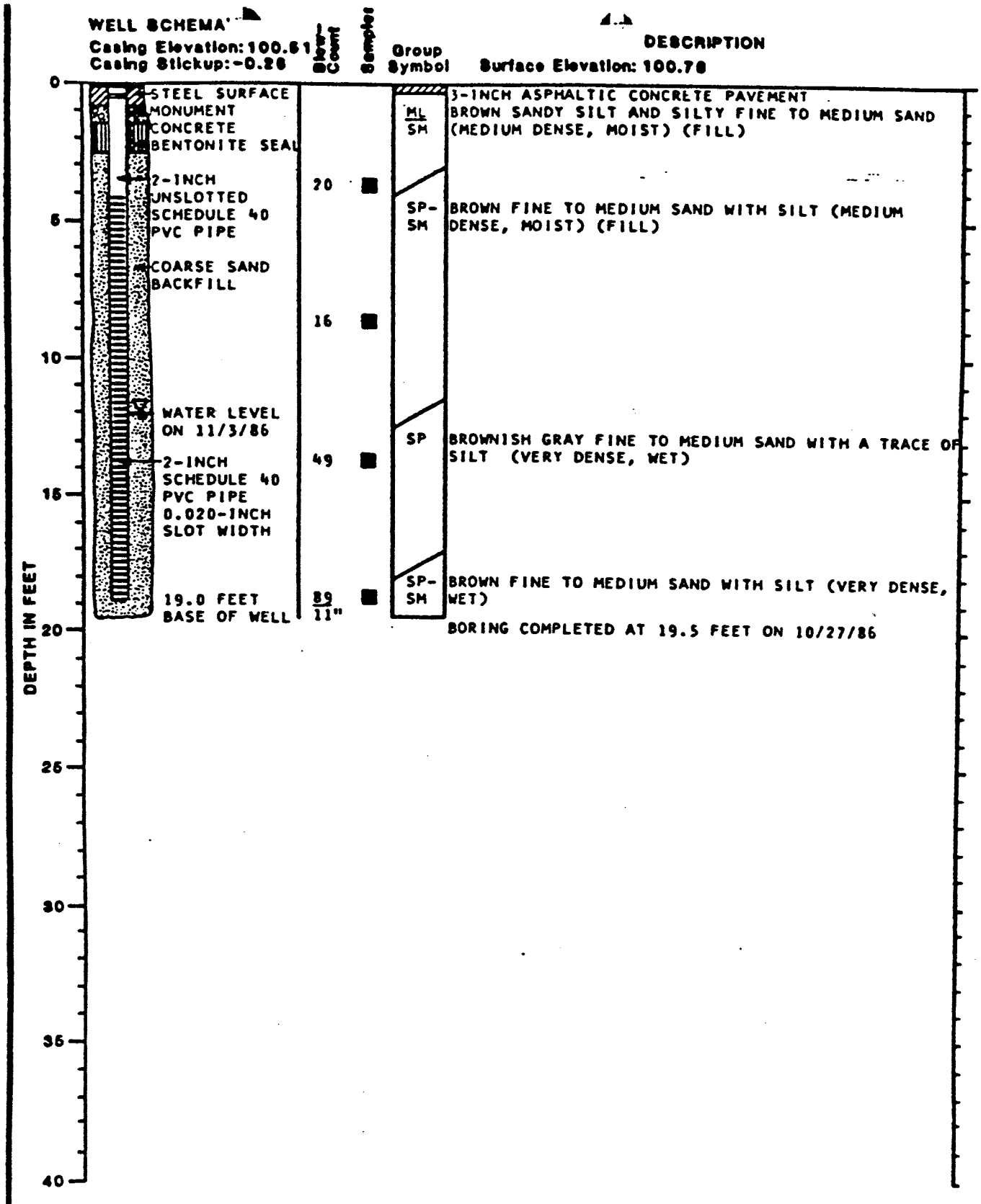
KEY TO BORING LOG SYMBOLS

FIGURE 3

DRAF



Note: See Figure 3 for Explanation of Symbols

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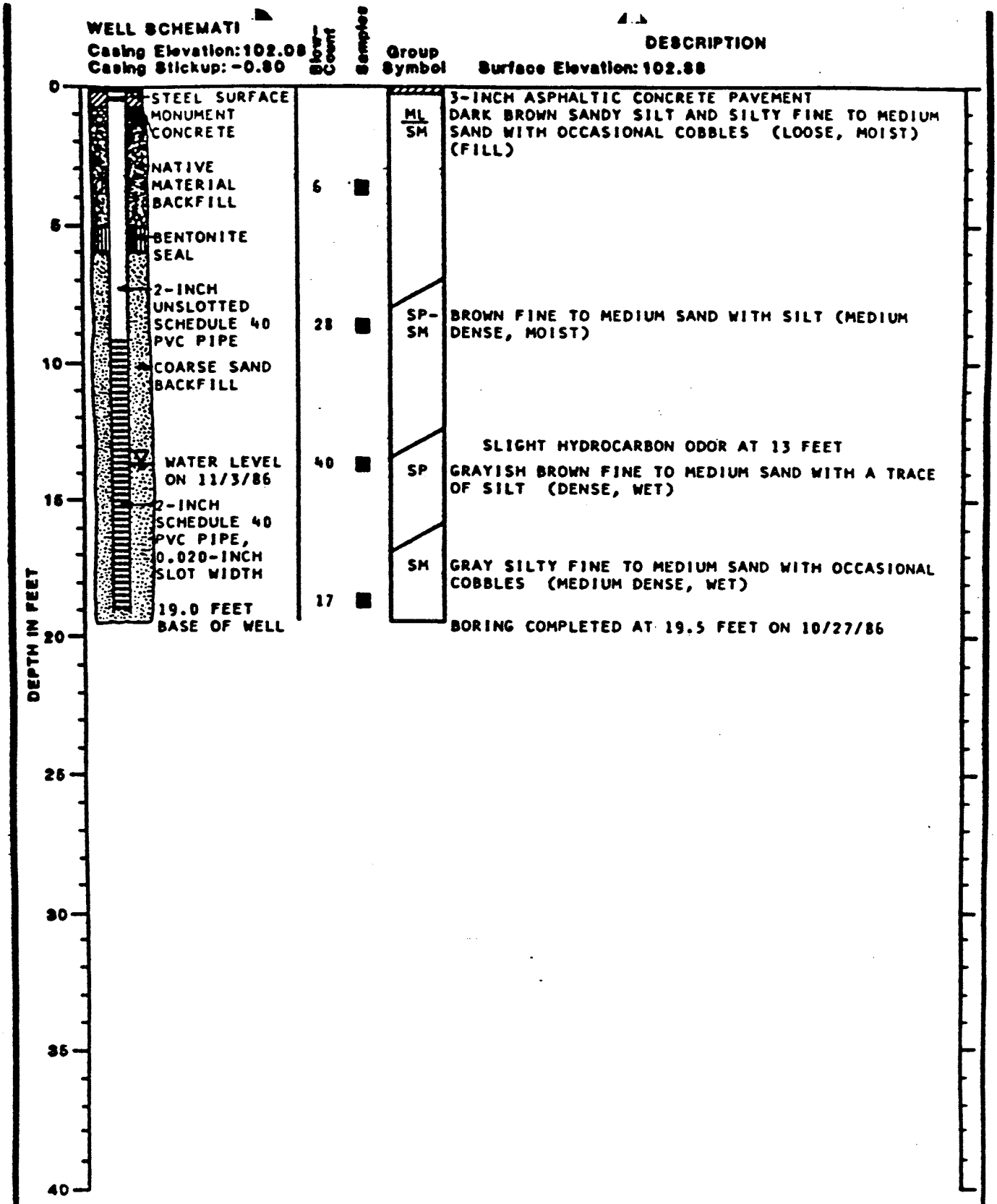
LOG OF MONITOR WELL

FIGURE 4

DRAFT



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LOG OF MONITOR WELL

FIGURE 5

DRAFT

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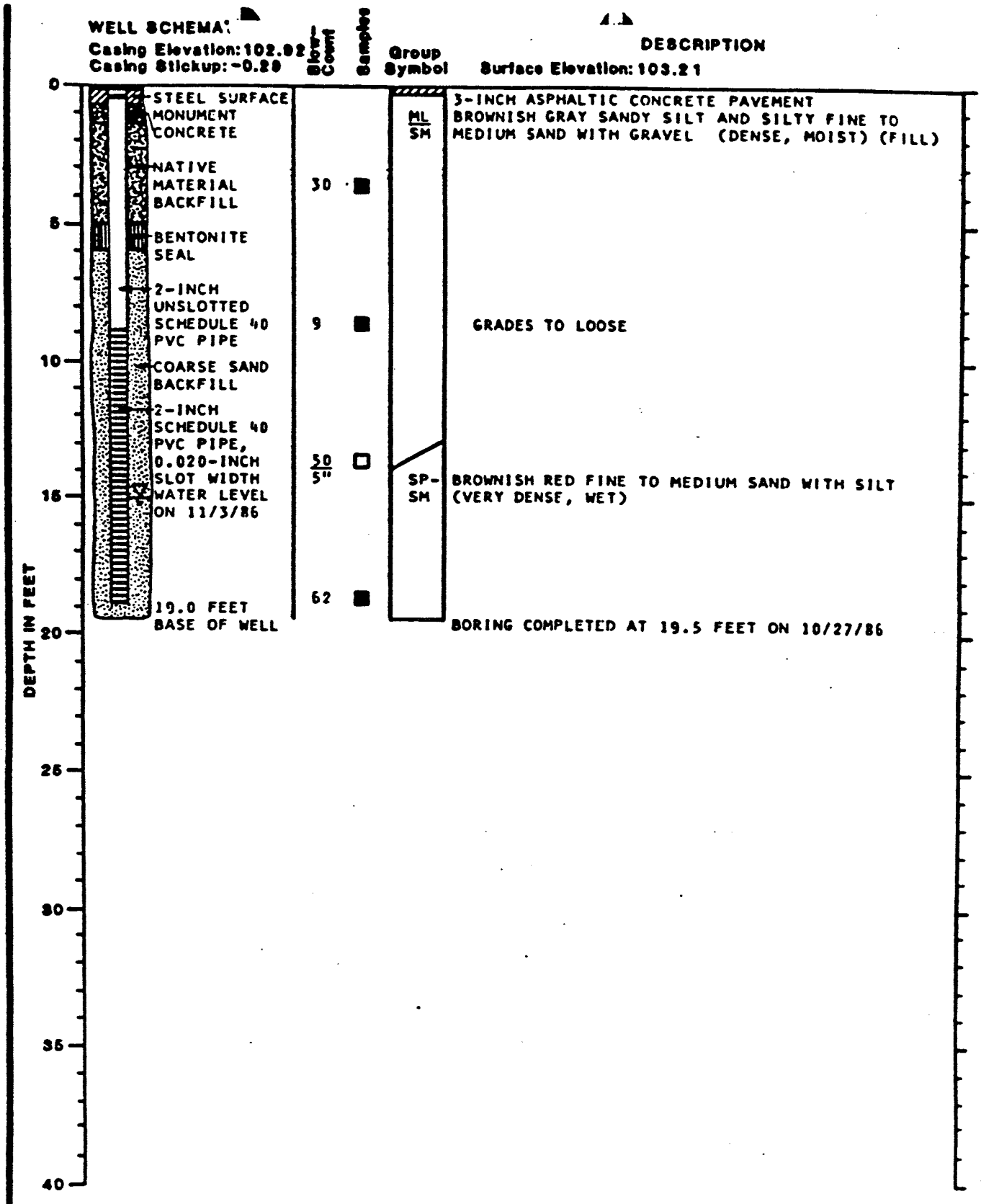

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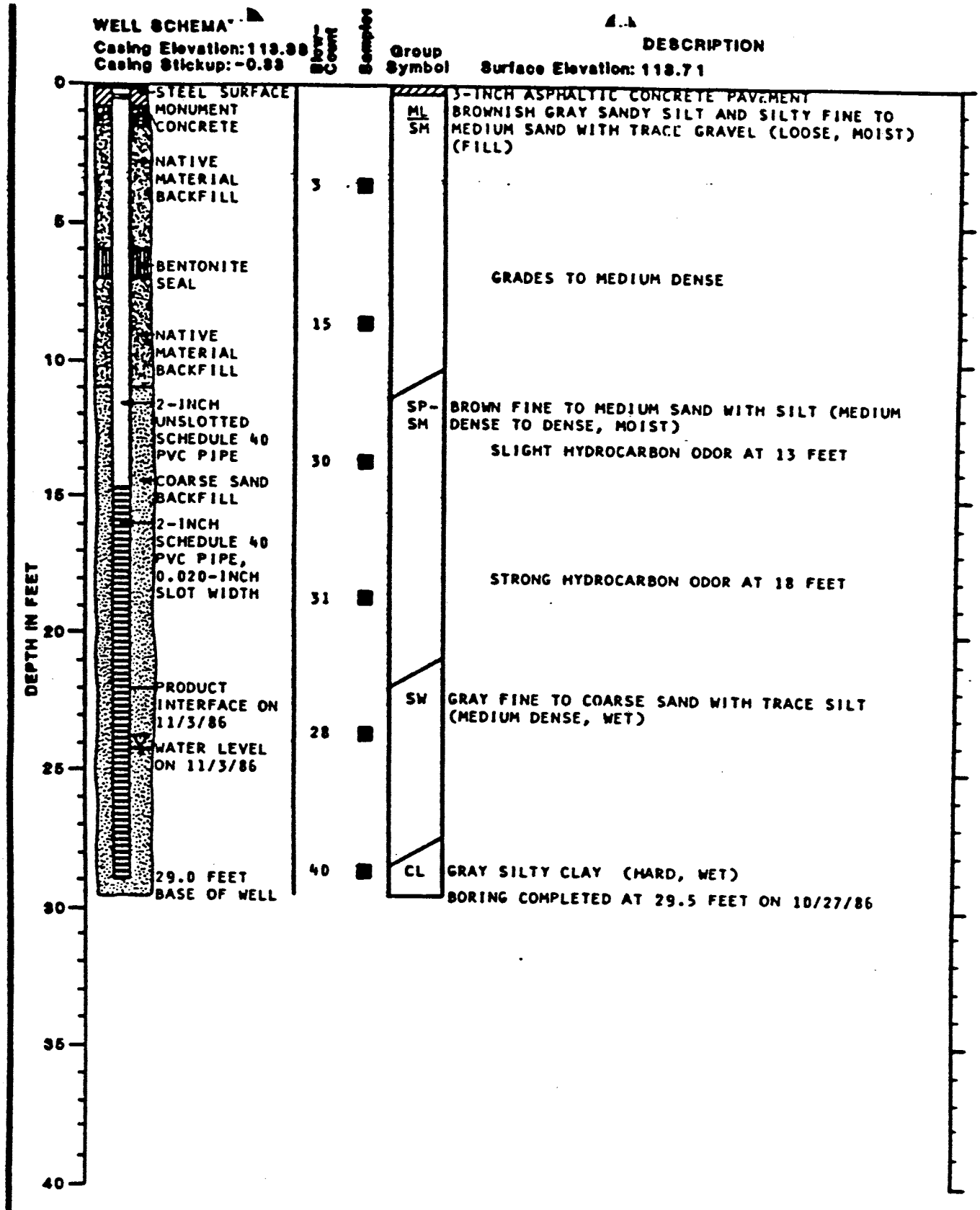
LOG OF MONITOR WELL

FIGURE 6

DRAFT



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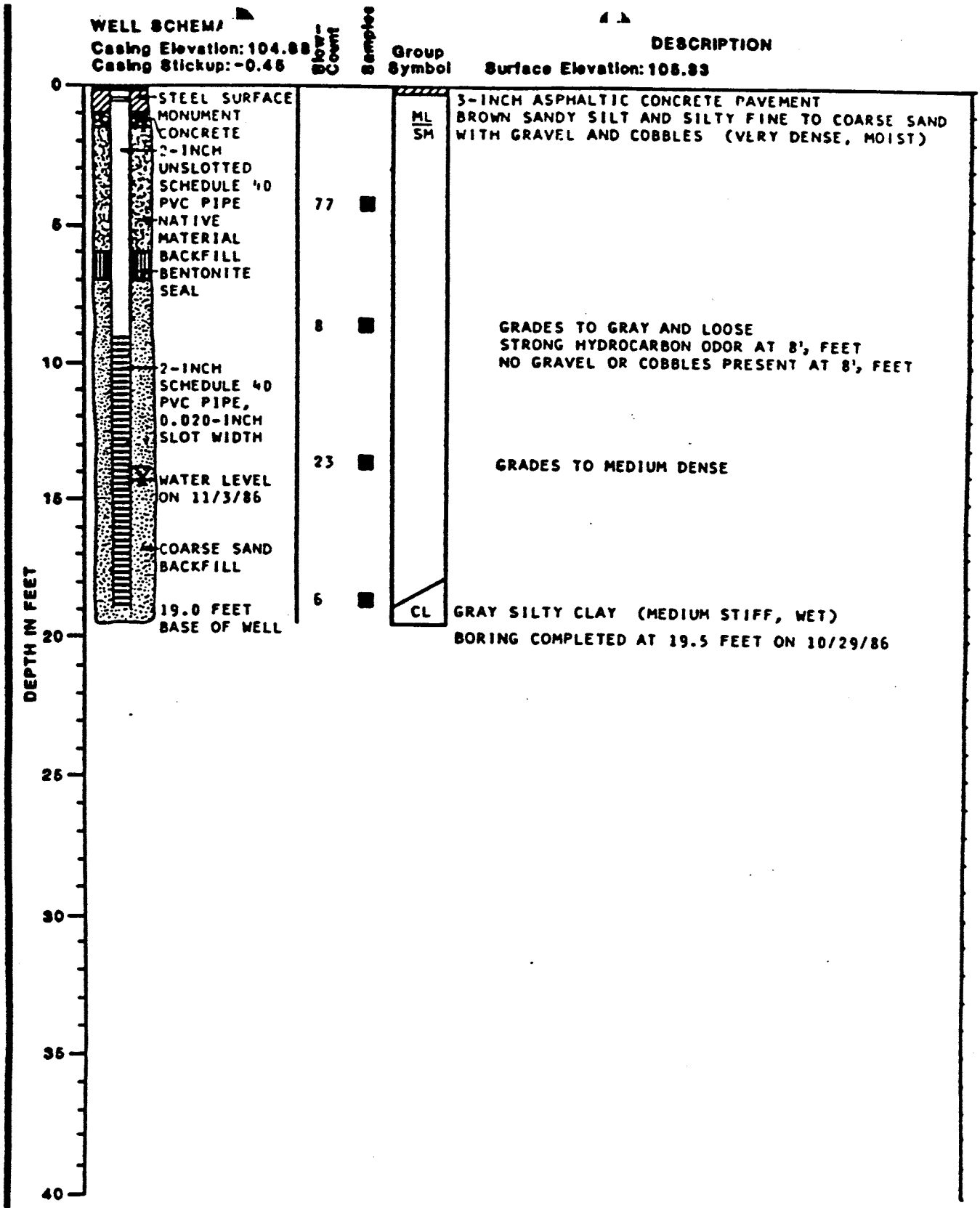
LOG OF MONITOR WELL

FIGURE 7

DRAFT



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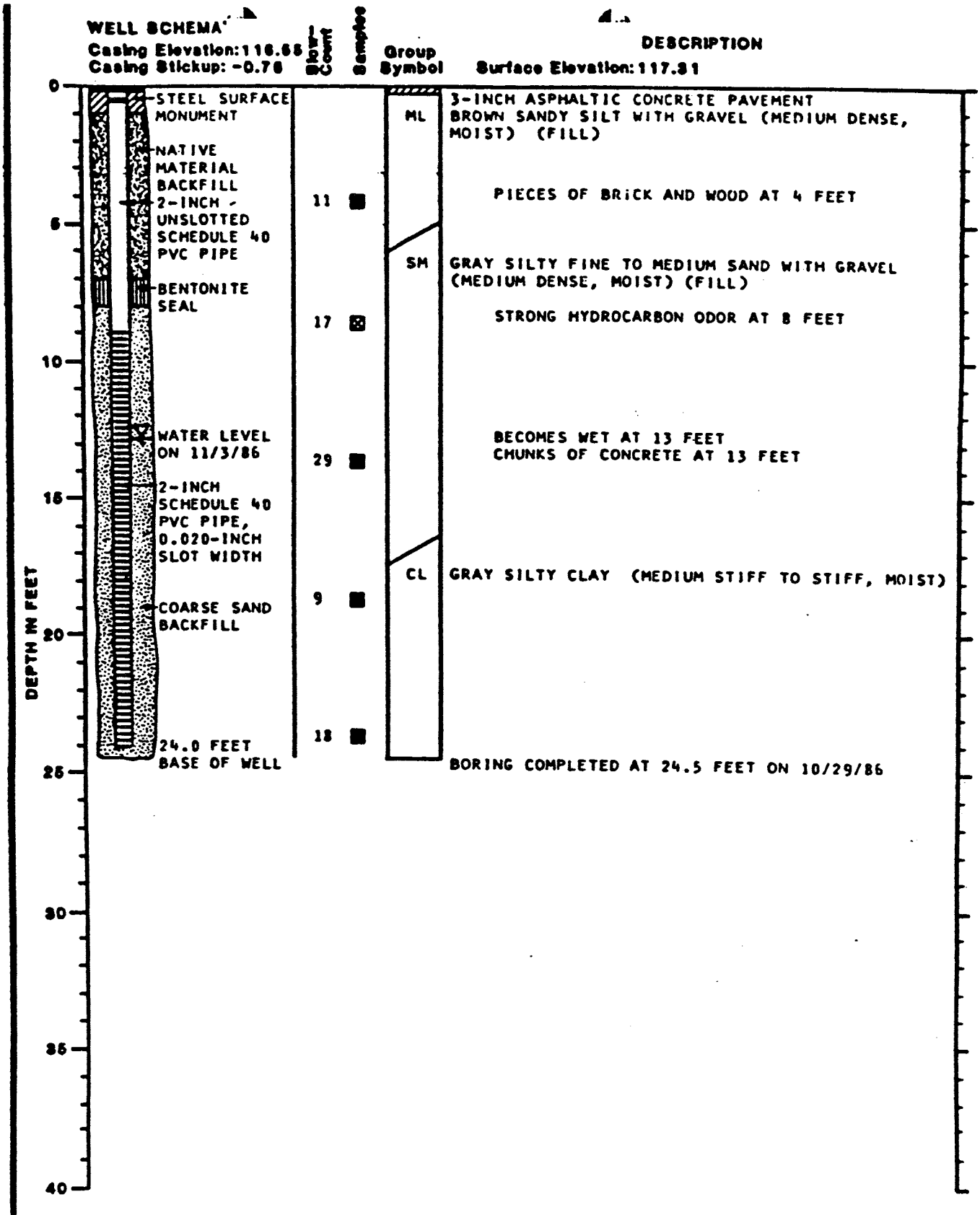
LOG OF MONITOR WELL

FIGURE 8

DRAFT



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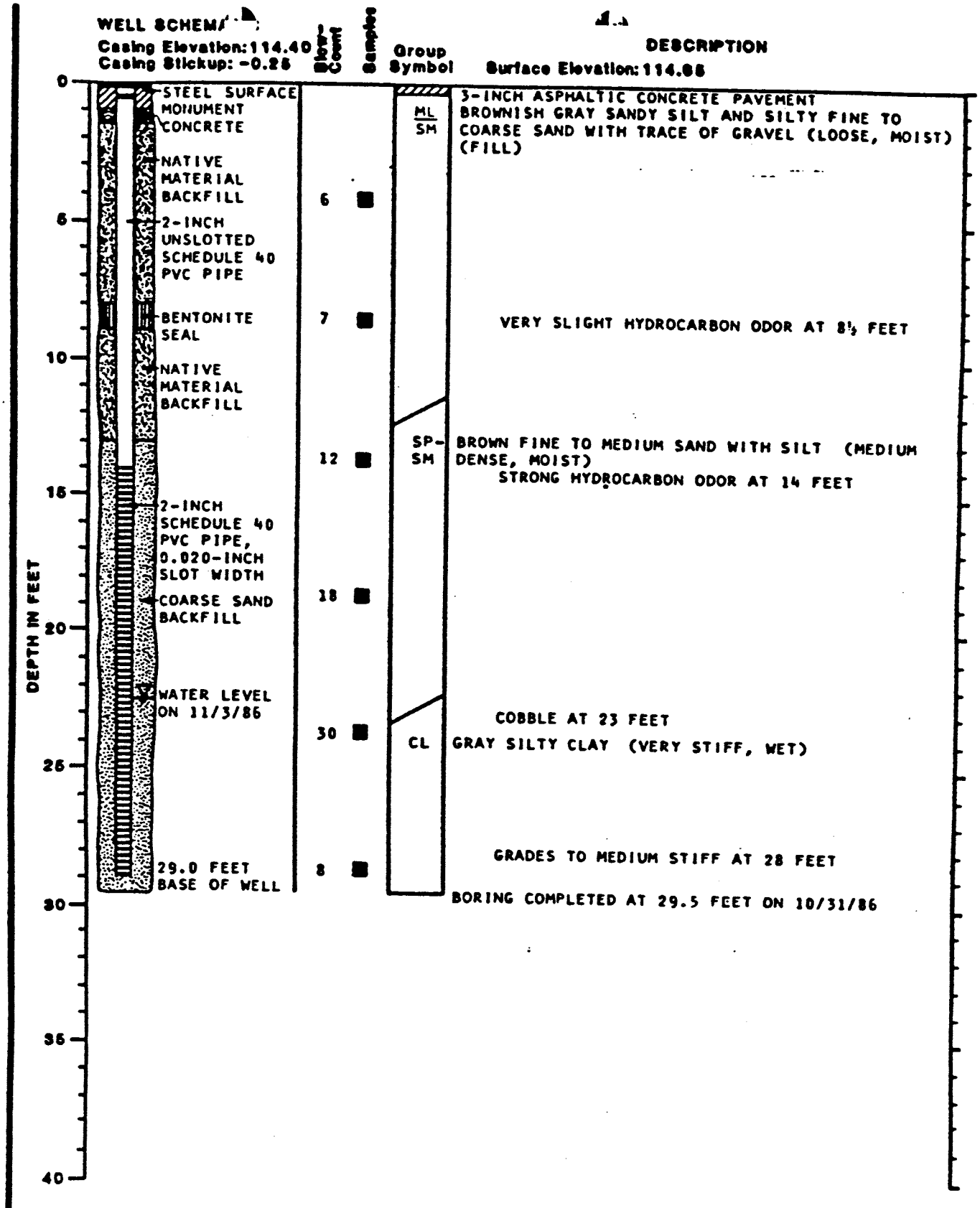
LOG OF MONITOR WELL

FIGURE 9

DRAFT



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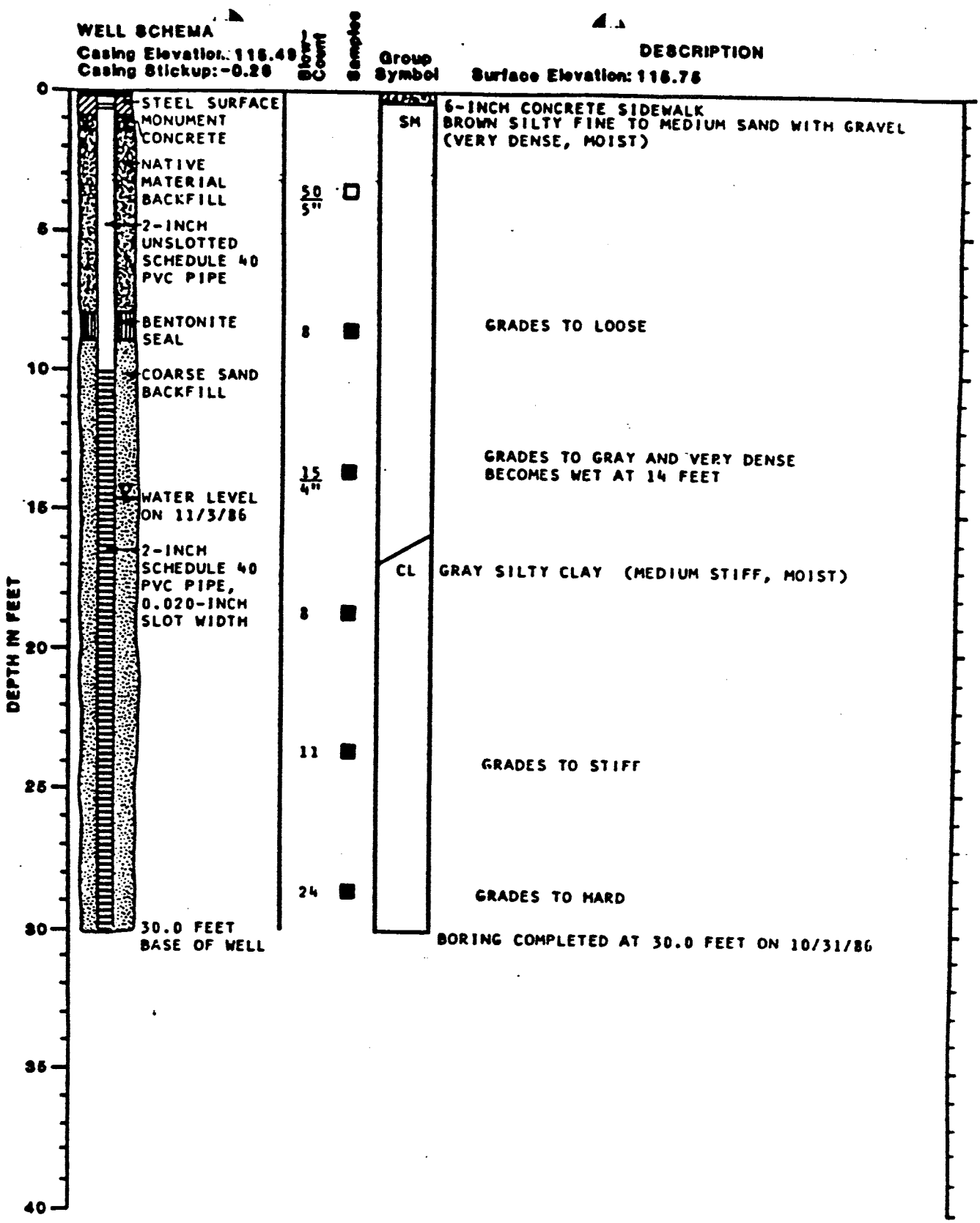
LOG OF MONITOR WELL

FIGURE 10

DRAFT



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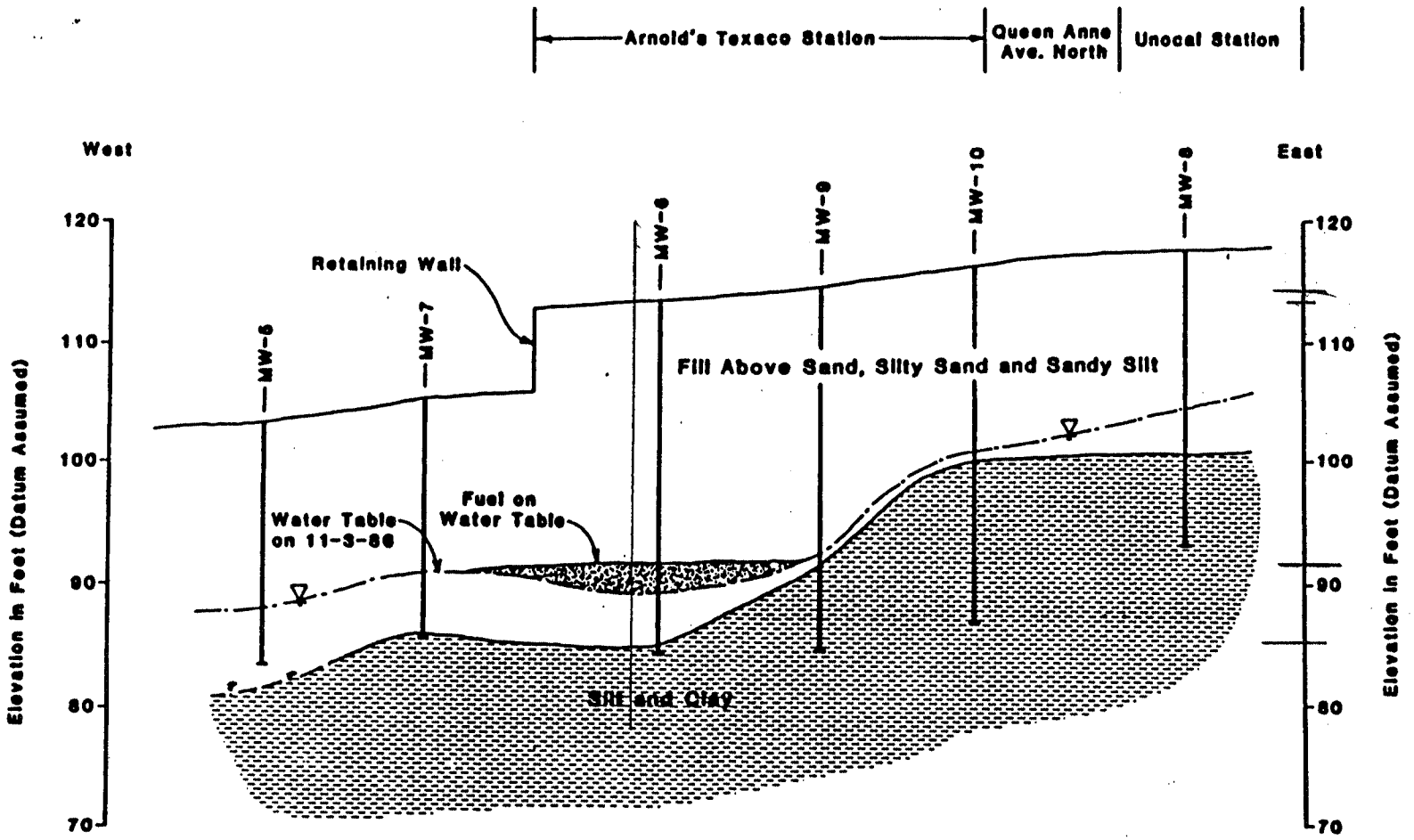
LOG OF MONITOR WELL

FIGURE 11

DRAFT



NOTE: THE SUBSURFACE CONDITIONS SHOWN ON THE SECTION ARE BASED ON INTERPOLATION BETWEEN WIDELY SPACED EXPLORATIONS AND SHOULD BE CONSIDERED TO BE APPROXIMATE.

APPROXIMATE HORIZONTAL SCALE: 1"=50'

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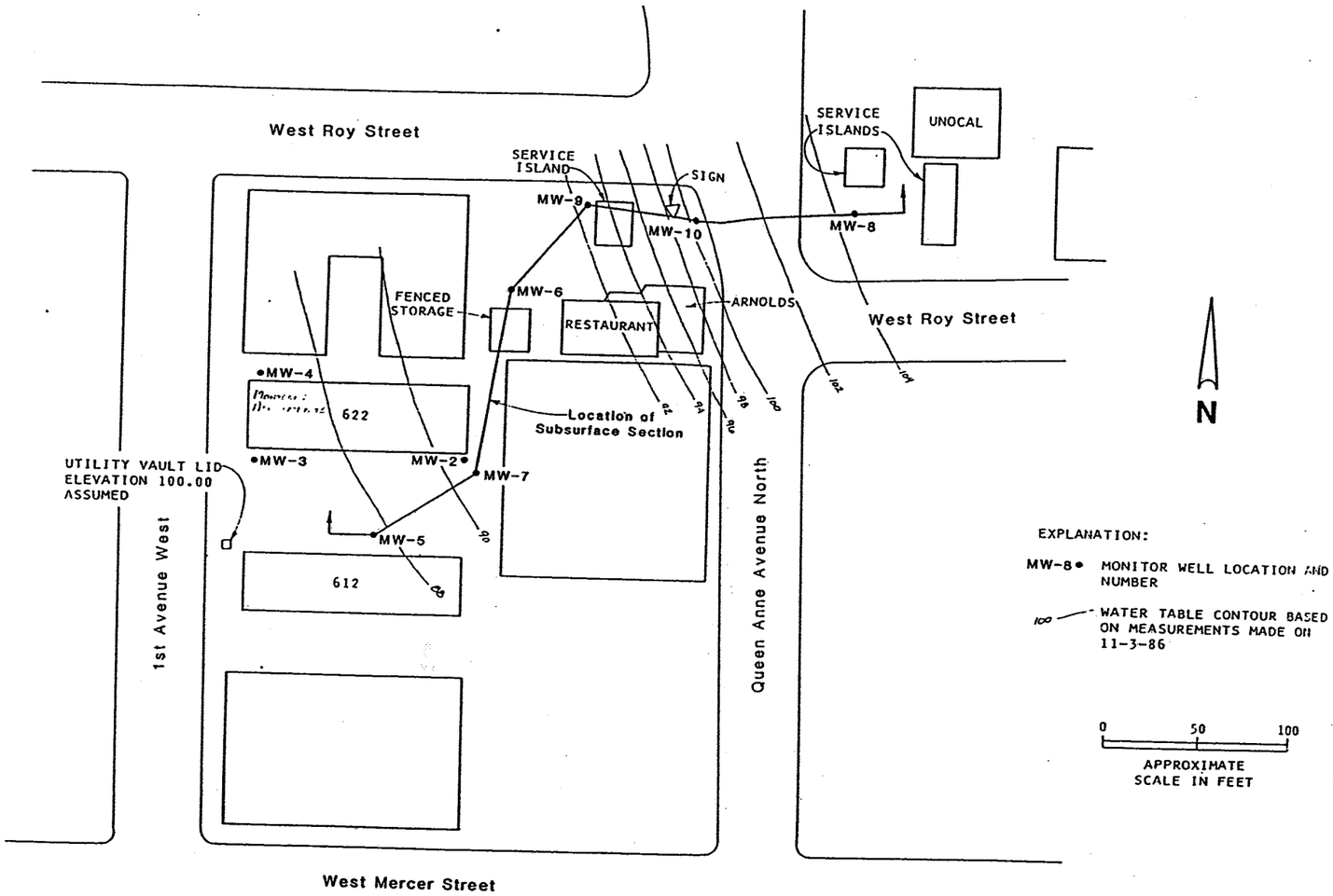
SUBSURFACE SECTION

FIGURE 12

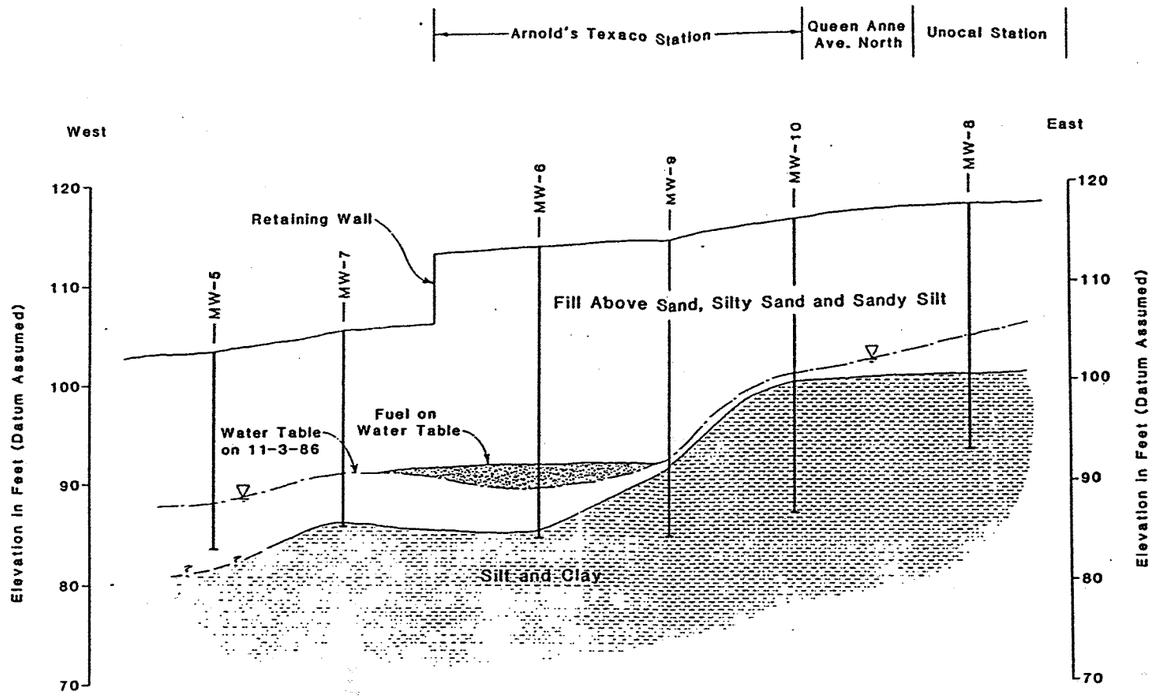


From: Miller, 1986

Monterey Apartments Monitoring Well Locations and Ground-Water Table Contours

WASHINGTON STATE DEPT OF ECOLOGY

Figure : 6



NOTE: THE SUBSURFACE CONDITIONS SHOWN ON THE SECTION ARE BASED ON INTERPOLATION BETWEEN WIDELY SPACED EXPLORATIONS AND SHOULD BE CONSIDERED TO BE APPROXIMATE.

From: Miller, 1986

Monterey Apartments Subsurface Section

WASHINGTON STATE DEPT OF ECOLOGY

Figure : 7

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
2. Soil classification using laboratory tests is based on ASTM D2487-90.
3. Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry – Absence of moisture, dusty, dry to the touch

Moist – Damp, but no visible water

Wet – Visible free water or saturated, usually soil is obtained from below water table

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SOIL CLASSIFICATION SYSTEM

FIGURE A-1

LABORATORY TESTS:

CA Chemical Analysis

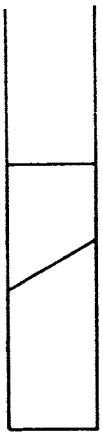
FIELD SCREENING TESTS:

Headspace vapor concentration data given in parts per million

Sheen classification system:

NS No Visible Sheen
SS Slight Sheen
MS Moderate Sheen
HS Heavy Sheen
NT Not Tested

SOIL GRAPH:



SM Soil Group Symbol (See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

Water Level

Bottom of Boring

BLOW-COUNT/SAMPLE DATA:

Blows required to drive a 2.4-inch I.D. split-barrel sampler 12 inches or other indicated distances using a 300-pound hammer falling 30 inches.

22 — Location of relatively undisturbed sample

12 — Location of disturbed sample

17 — Location of sampling attempt with no recovery

Blows required to drive a 1.5-inch I.D. (SPT) split-barrel sampler 12 inches or other indicated distances using 140-pound hammer falling 30 inches.

10 — Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) procedures

26 — Location of SPT sampling attempt with no recovery

Location of grab sample

"P" indicates sampler pushed with weight of hammer or against weight of drill rig.

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Boring Log Symbols and the exploration logs for a proper understanding of subsurface conditions.

2. Soil classification system is summarized in Figure A-1.

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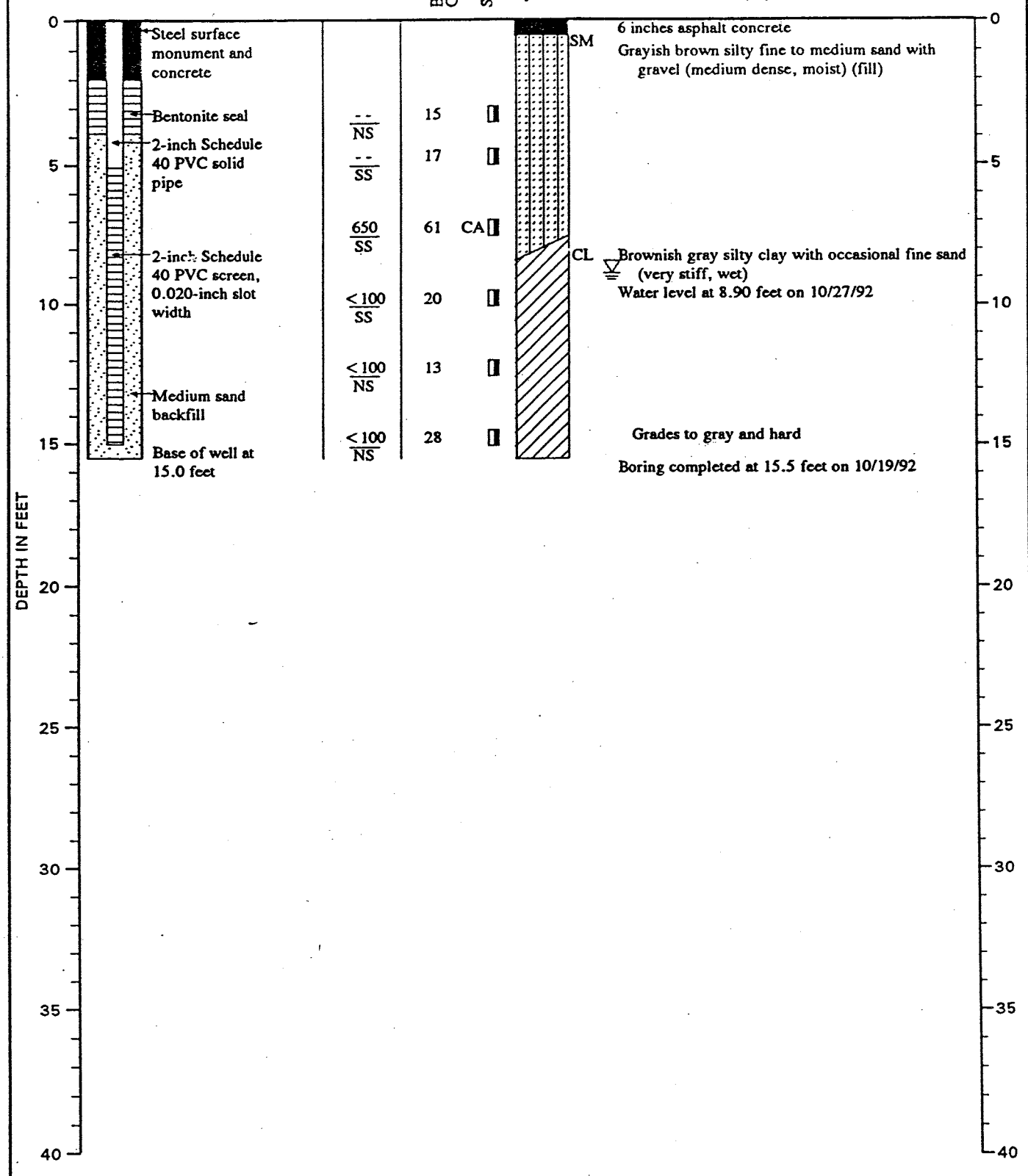
KEY TO BORING LOG SYMBOLS

FIGURE A-2

MONITORING WELL NO. MW-5U



Note: See Figure A-2 for explanation of symbols

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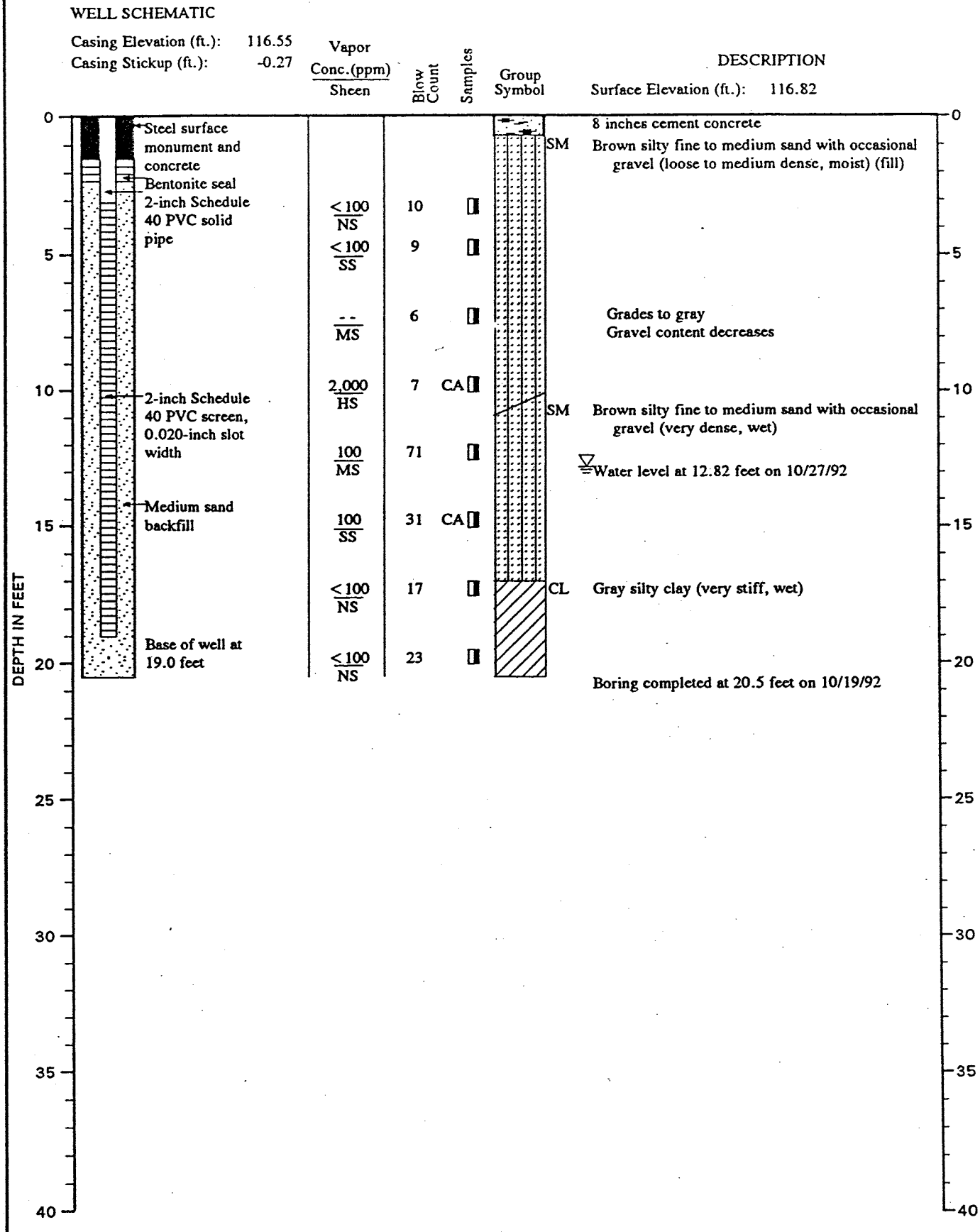
LOG OF MONITORING WELL

FIGURE A-3

:JKH:CMS 1/12/93

0161-153-R04 Tsk 6.3

MONITORING WELL NO. MW-6U



Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

FIGURE A-4

:JKH:CMS 1/12/93

0161-153-R04 Tsk 6.3

MONITORING WELL NO. MW-7U

WELL SCHEMATIC

Casing Elevation (ft.): 115.23
Casing Stickup (ft.): -0.21

Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.): 115.49)
				9 inches concrete and asphalt
			SP— SM	Brown fine to medium sand with silt and occasional gravel (medium dense, moist) (fill)
<100 / NS	11			
<100 / NS	10		SM	Brown silty fine to medium sand with occasional coarse sand and organic matter (loose to medium dense, moist) (fill)
<100 / SS	59			Encountered large root
	7			
>10,000 / HS	11	CA		
1,000 / SS	12			Sand content decreases Occasional organic matter
	37			
800 / SS	16		SP	Gray fine to medium sand (medium dense, wet) ▽ Water level at 20.54 feet on 10/27/92
3,300 / SS	23	CA		
			SM	Gray silty fine to medium sand with occasional organic matter (medium dense, wet)
380 / SS	27		CL	Gray silty clay (very stiff, wet) Boring completed at 25.5 feet on 10/20/92

Steel surface monument and concrete
Bentonite seal
2-inch Schedule 40 PVC solid pipe
2-inch Schedule 40 PVC screen, 0.020-inch slot width
Medium sand backfill
Base of well at 23.0 feet

DEPTH IN FEET

0 5 10 15 20 25 30 35 40

Note: See Figure A-2 for explanation of symbols

JKH:CMS 1/12/93

0161-153-R04 Tsk 6.3

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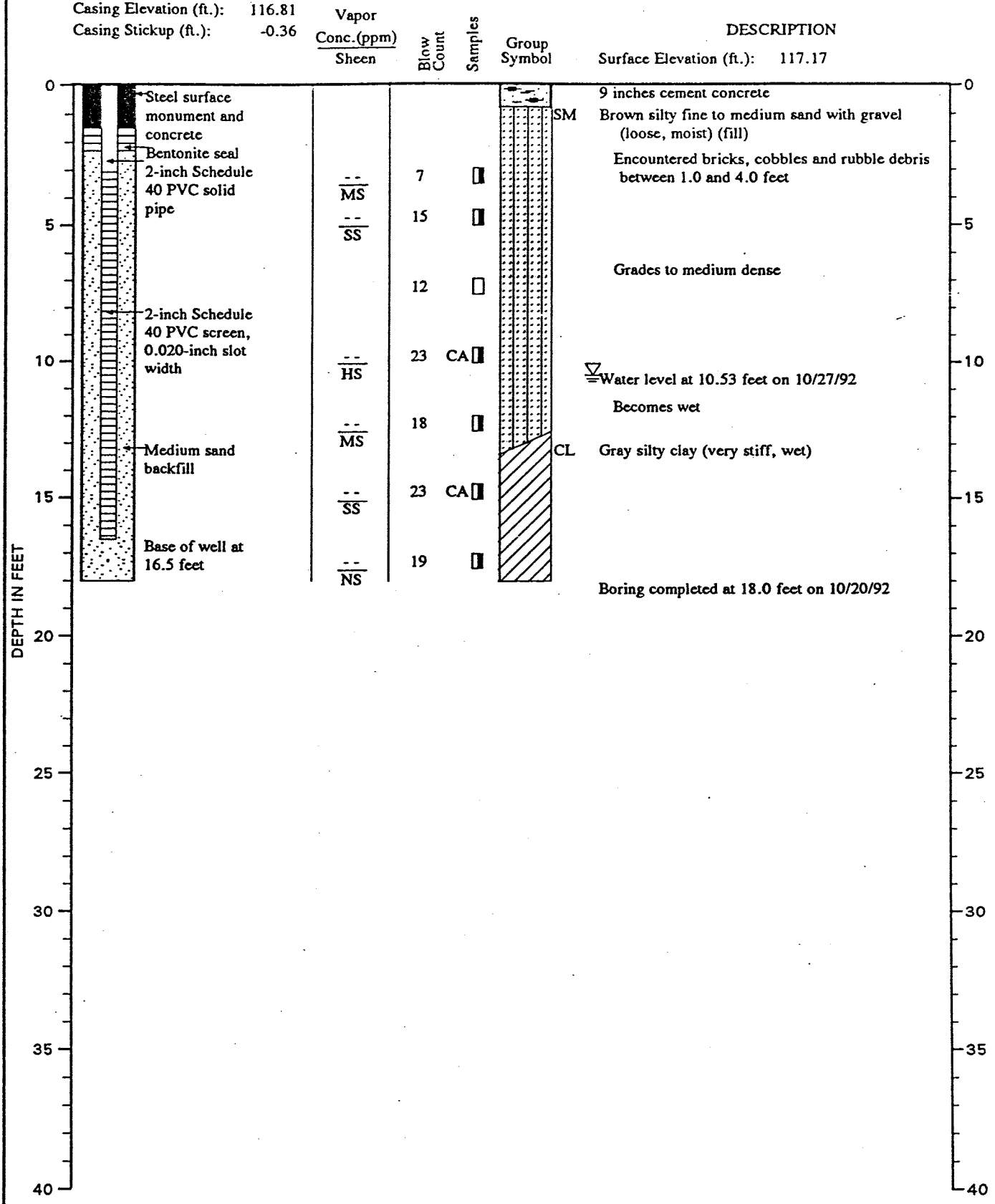
LOG OF MONITORING WELL

FIGURE A-5

MONITORING WELL NO. MW-8U

WELL SCHEMATIC

Casing Elevation (ft.): 116.81
Casing Stickup (ft.): -0.36



Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

FIGURE A-6

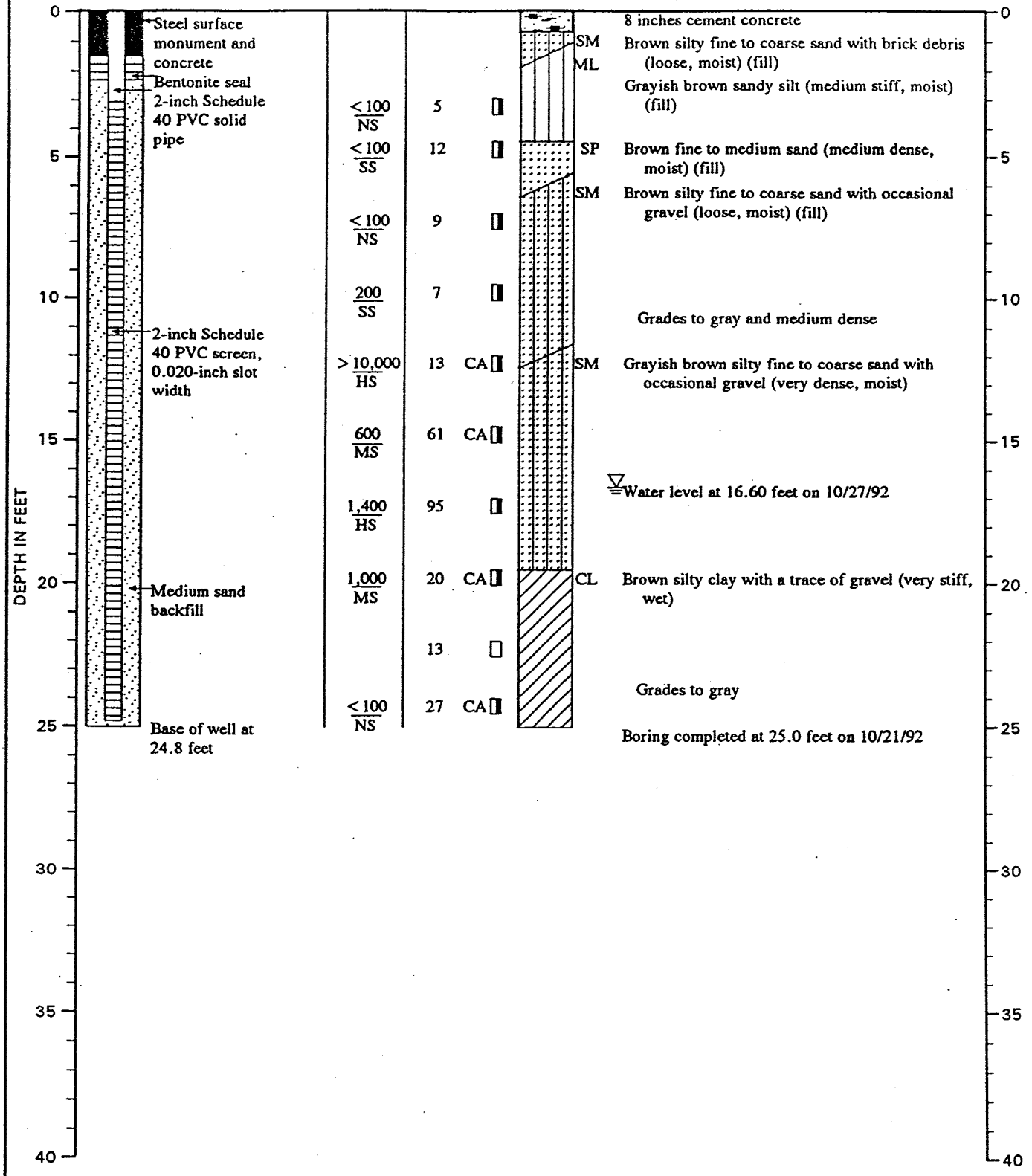
:JKH:CMS 1/12/93

0161-153-R04 Tsk 6.3

MONITORING WELL NO. MW-9U

WELL SCHEMATIC

Casing Elevation (ft.): 115.76
Casing Stickup (ft.): -0.34



Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

FIGURE A-7

JKH:CMS 1/12/93

0161-153-R04 Tsk 6.3

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-83.
2. Soil classification using laboratory tests is based on ASTM D2487-83.
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Moist - Damp, but no visible water

Wet - Visible free water or saturated, usually soil is obtained from below water table

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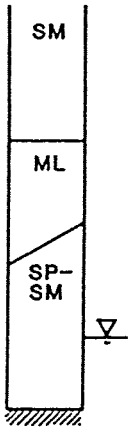
SOIL CLASSIFICATION SYSTEM

FIGURE A-1

LABORATORY TESTS:

AL	Atterberg limits
CP	Compaction
CS	Consolidation
DS	Direct shear
GS	Grain-size analysis
HA	Hydrometer analysis
K	Permeability
M	Moisture content
MD	Moisture and density
SP	Swelling pressure
TX	Triaxial compression
UC	Unconfined compression
CA	Chemical Analysis

SOIL GRAPH:



Soil Group Symbol (See Note 1)

Distinct contact between Soil Strata

Gradual Change between Soil Strata

Water Level

Bottom of Boring

BLOW-COUNT/SAMPLE DATA:

Blows required to drive Dames & Moore sampler 12 inches or other indicated distances using pound hammer falling inches.

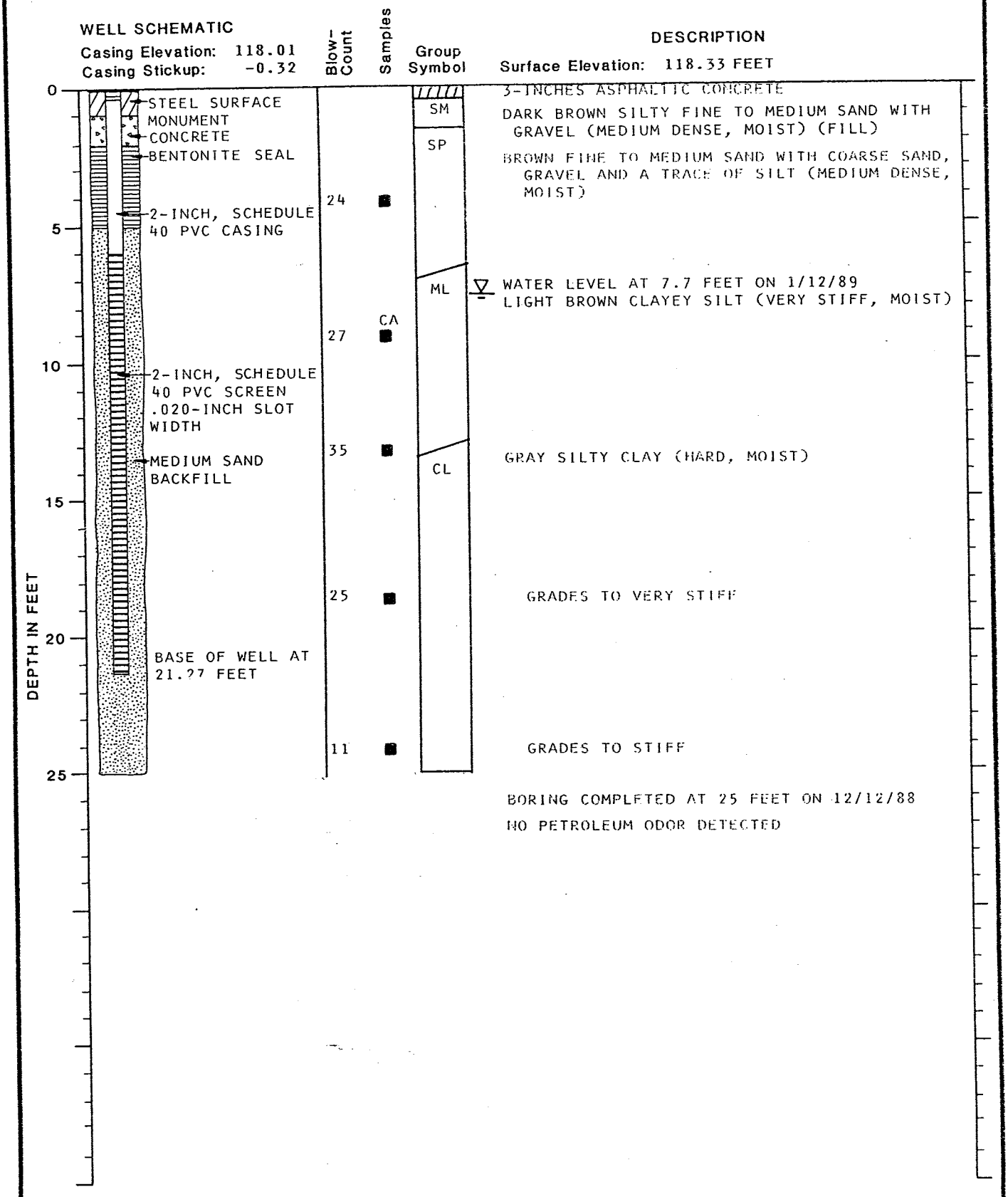
"P" indicates sampler pushed with weight of hammer or hydraulics of drill rig.

22 ■	Location of relatively undisturbed sample
12 ⊠	Location of disturbed sample
P □	Location of sampling attempt with no recovery
10 ◪	Location of sample attempt using Standard Penetration Test procedures
40 ⬓	Location of relatively undisturbed sample using 140 pound hammer falling 30 inches.

NOTES:

1. Soil classification system is summarized in Figure A-1.
2. The reader must refer to the discussion in the report text as well as the exploration logs for a proper understanding of subsurface conditions.

MONITOR WELL NO. MW-1U



Note: See Figure A-2 for Explanation of Symbols

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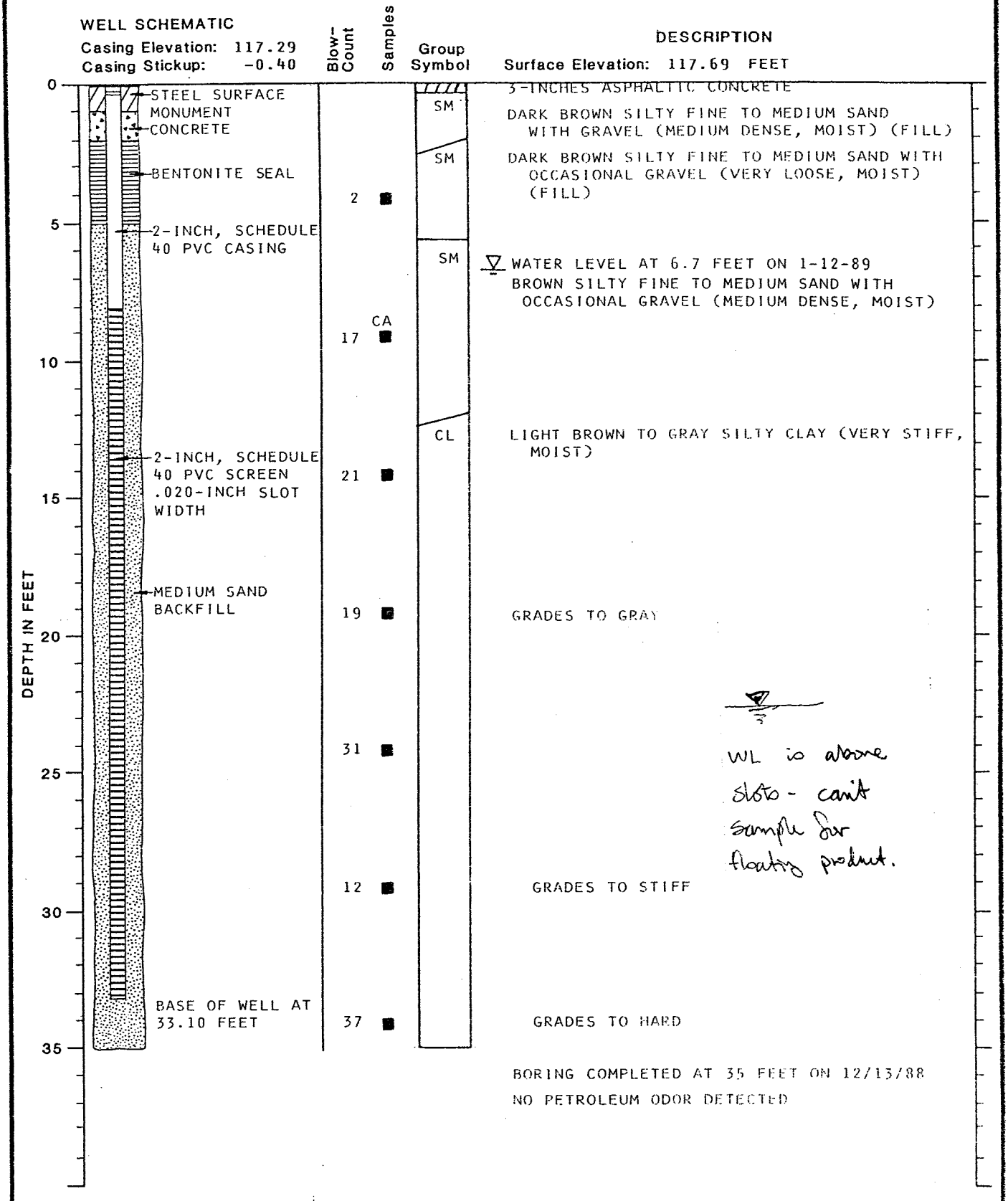
LOG OF MONITOR WELL

FIGURE A-3

8161-153-4 TTF:RK: 12/27/88

MONITOR WELL NO. MW-2U



Note: See Figure A-2 for Explanation of Symbols

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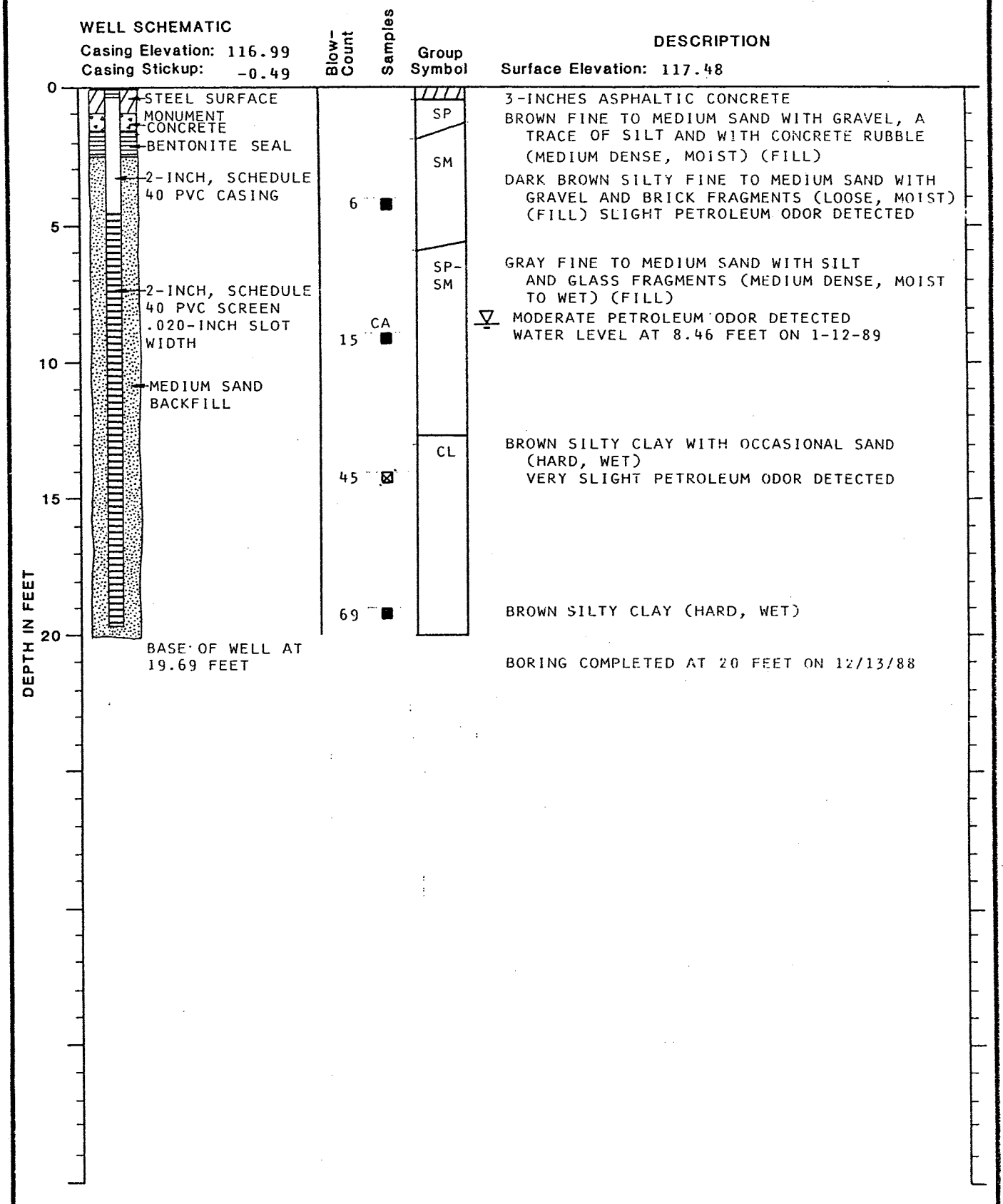
LOG OF MONITOR WELL

FIGURE A-4

0161-153-4 TFF:RK: 12/27/88

MONITOR WELL NO. MW-3U



Note: See Figure A-2 for Explanation of Symbols

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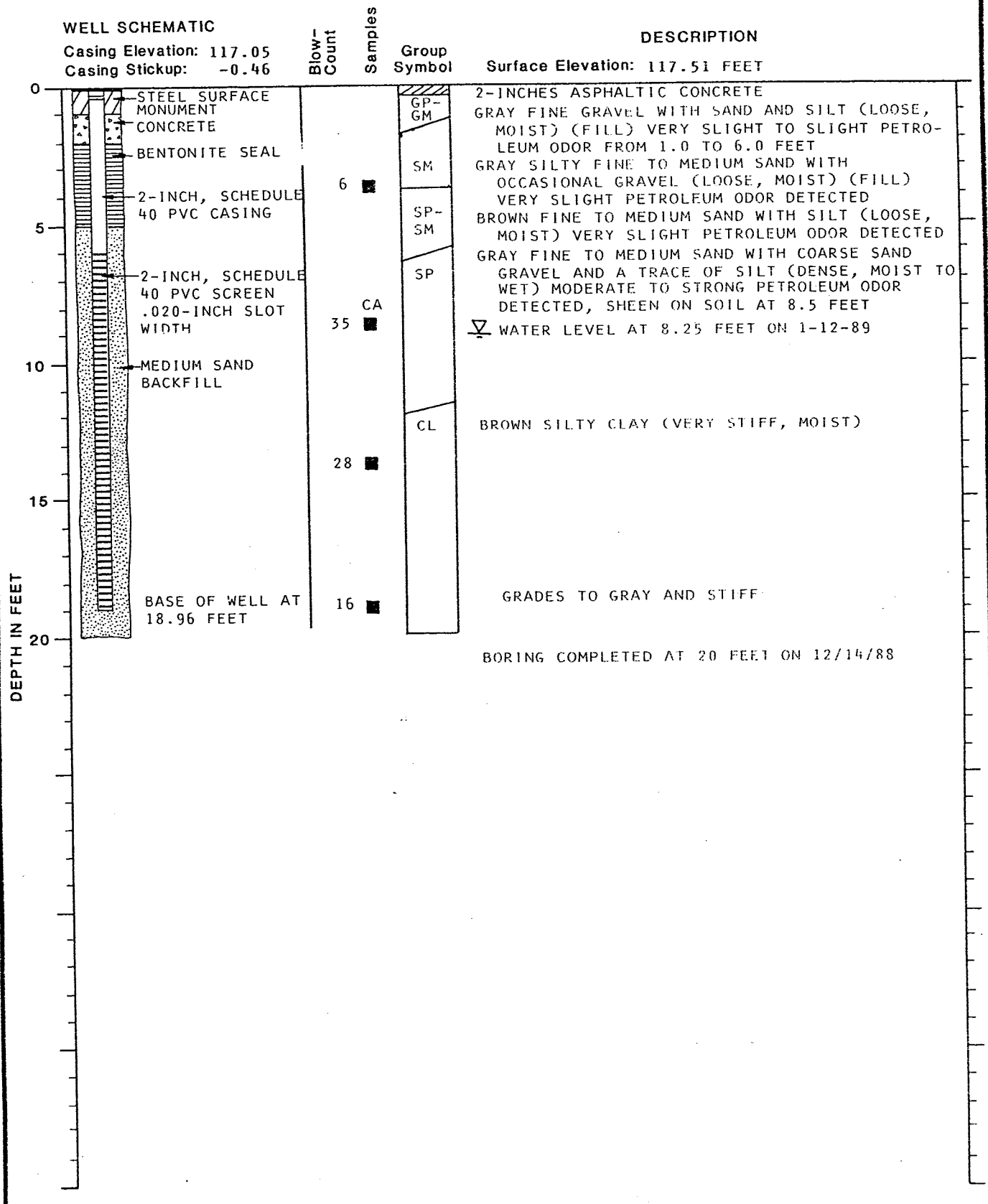
LOG OF MONITOR WELL

FIGURE A-5

0161-153-4 TTF:RK: 12/27/88

MONITOR WELL NO. MW-4U



Note: See Figure A-2 for Explanation of Symbols

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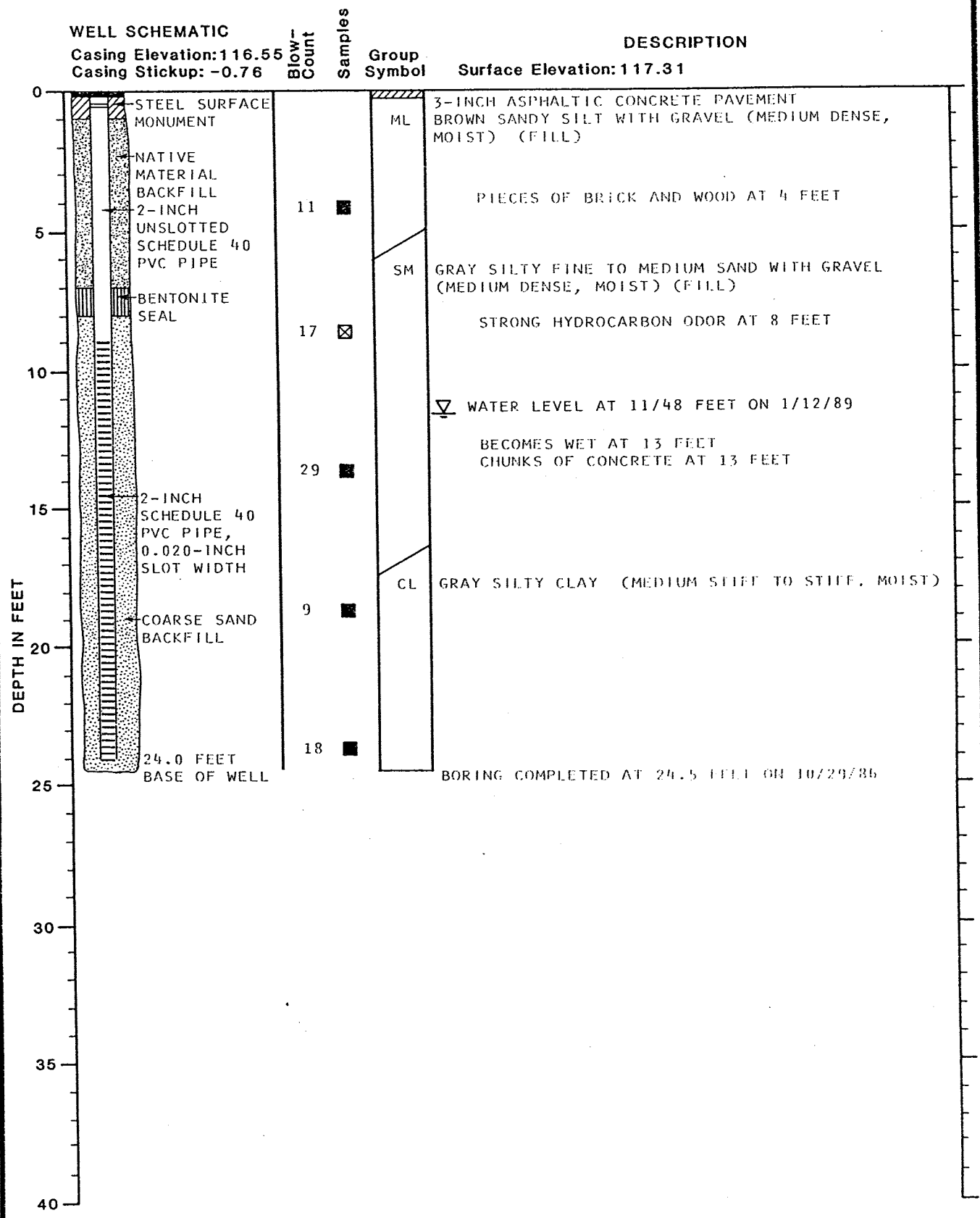
LOG OF MONITOR WELL

FIGURE A-6

0161-153-4 TTF:RK 12/27/88

MONITOR WELL NO. MW-8



0161-153-4 JAM:DMP 11-13-86

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LOG OF MONITOR WELL

FIGURE A-7

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
2. Soil classification using laboratory tests is based on ASTM D2487-90.
3. Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry – Absence of moisture, dusty, dry to the touch

Moist – Damp, but no visible water

Wet – Visible free water or saturated, usually soil is obtained from below water table

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SOIL CLASSIFICATION SYSTEM

FIGURE A-1

LABORATORY TESTS:

CA Chemical Analysis

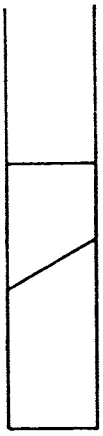
FIELD SCREENING TESTS:

Headspace vapor concentration data given in parts per million

Sheen classification system:

NS No Visible Sheen
SS Slight Sheen
MS Moderate Sheen
HS Heavy Sheen
NT Not Tested

SOIL GRAPH:



SM Soil Group Symbol (See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

Water Level

Bottom of Boring

BLOW-COUNT/SAMPLE DATA:

Blows required to drive a 2.4-inch I.D. split-barrel sampler 12 inches or other indicated distances using a 300-pound hammer falling 30 inches.

22 ■ Location of relatively undisturbed sample

12 ⊠ Location of disturbed sample

17 □ Location of sampling attempt with no recovery

Blows required to drive a 1.5-inch I.D. (SPT) split-barrel sampler 12 inches or other indicated distances using 140-pound hammer falling 30 inches.

10 ◨ Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) procedures

26 ◫ Location of SPT sampling attempt with no recovery

Location of grab sample

"P" indicates sampler pushed with weight of hammer or against weight of drill rig.

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Boring Log Symbols and the exploration logs for a proper understanding of subsurface conditions.

2. Soil classification system is summarized in Figure A-1.

GEI 121-90

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KEY TO BORING LOG SYMBOLS

FIGURE A-2

MONITORING WELL NO. MW-5U

WELL SCHEMATIC

Casing Elevation (ft.): 118.73
Casing Stickup (ft.): -0.35

Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.): 119.08)
			SM	6 inches asphalt concrete Grayish brown silty fine to medium sand with gravel (medium dense, moist) (fill)
-- / NS	15			
-- / SS	17			
650 / SS	61	CA		
			CL	Brownish gray silty clay with occasional fine sand (very stiff, wet)
				Water level at 8.90 feet on 10/27/92
<100 / SS	20			
<100 / NS	13			
				Grades to gray and hard
<100 / NS	28			Boring completed at 15.5 feet on 10/19/92

Steel surface monument and concrete

Bentonite seal

2-inch Schedule 40 PVC solid pipe

2-inch Schedule 40 PVC screen, 0.020-inch slot width

Medium sand backfill

Base of well at 15.0 feet

DEPTH IN FEET

0 5 10 15 20 25 30 35 40

Note: See Figure A-2 for explanation of symbols

:JKH:CMS 1/12/93

0161-153-R04 Tsk 6.3

Geo Engineers

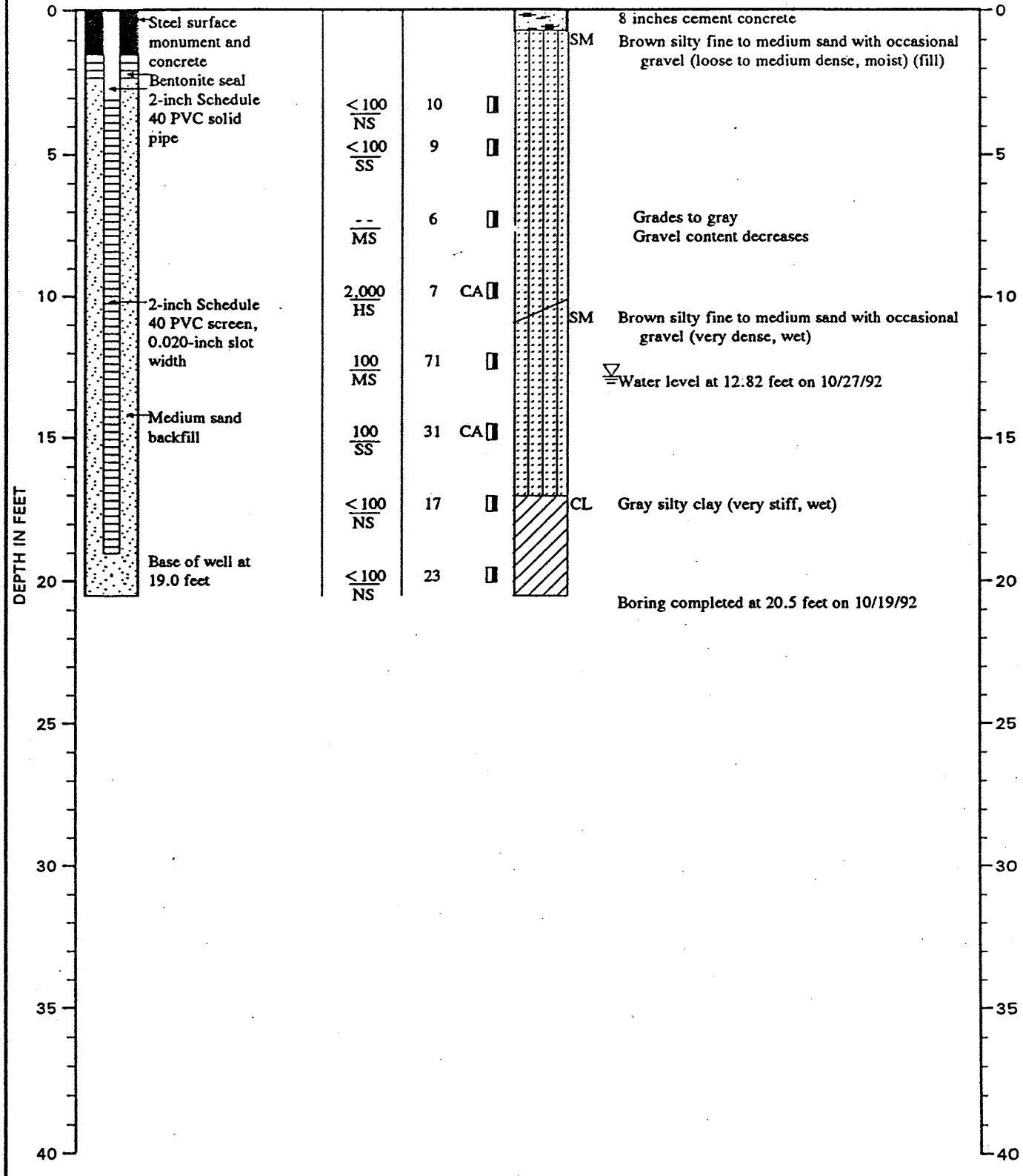
LOG OF MONITORING WELL

FIGURE A-3

MONITORING WELL NO. MW-6U

WELL SCHEMATIC

Casing Elevation (ft.): 116.55
Casing Stickup (ft.): -0.27



Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-4

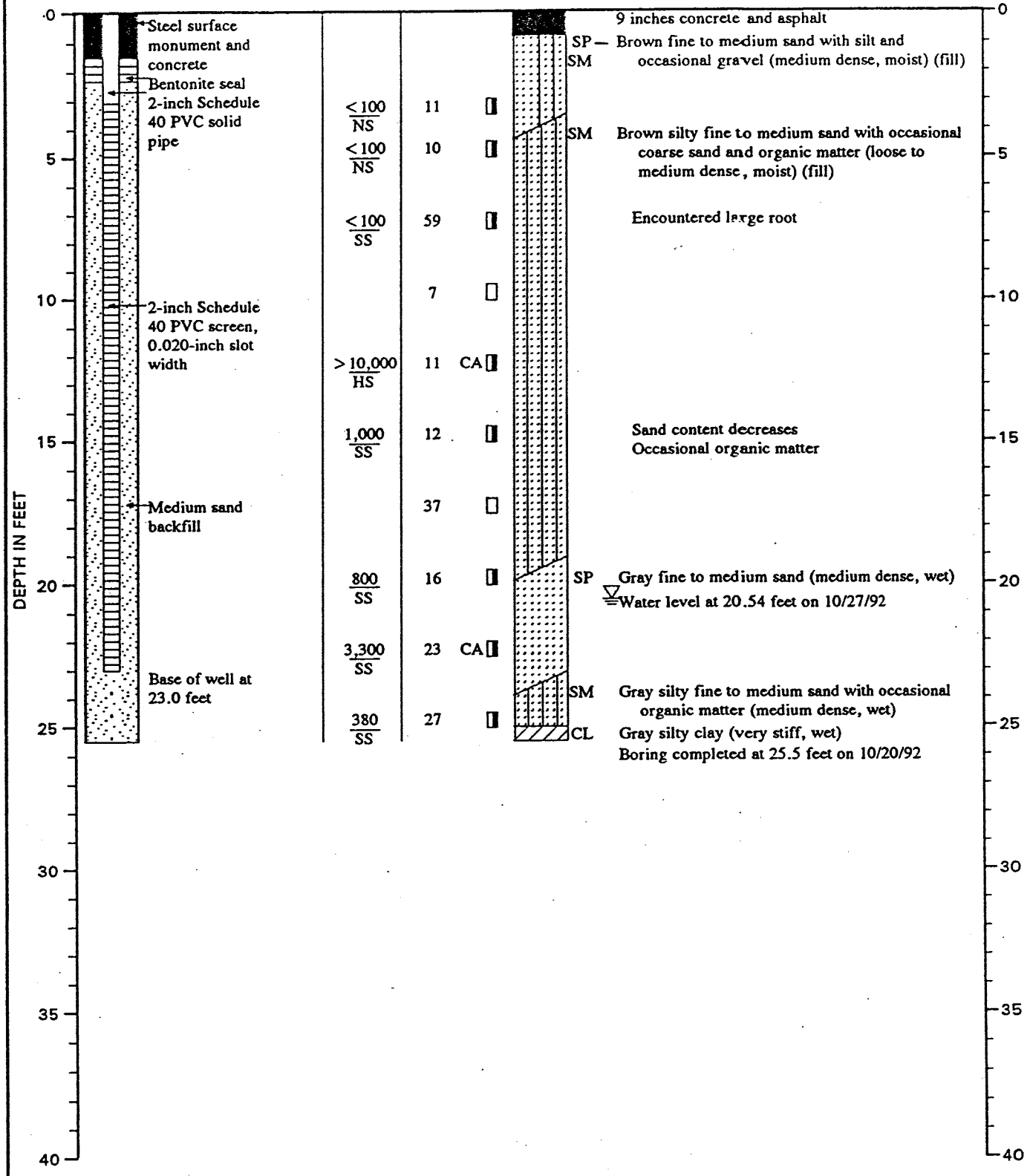
:JKH:CMS 1/12/93

0161-153-R04 Tak 6.3

MONITORING WELL NO. MW-7U

WELL SCHEMATIC

Casing Elevation (ft.): 115.23
Casing Stickup (ft.): -0.21



Note: See Figure A-2 for explanation of symbols

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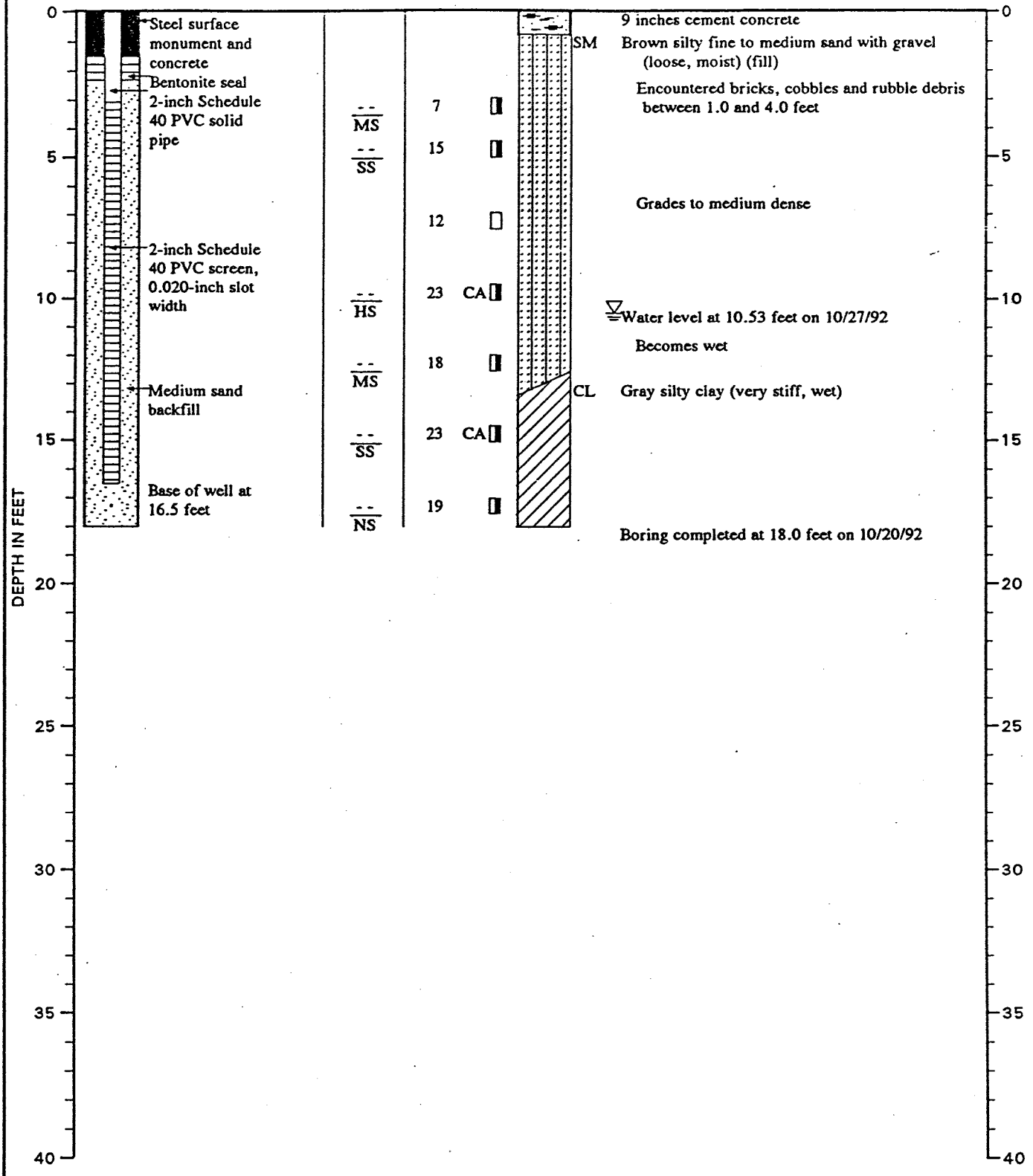
LOG OF MONITORING WELL

FIGURE A-5

:JKH:CMS 1/12/93

0161-153-R04 Tsk 6.3

MONITORING WELL NO. MW-8U



Note: See Figure A-2 for explanation of symbols

Geo Engineers

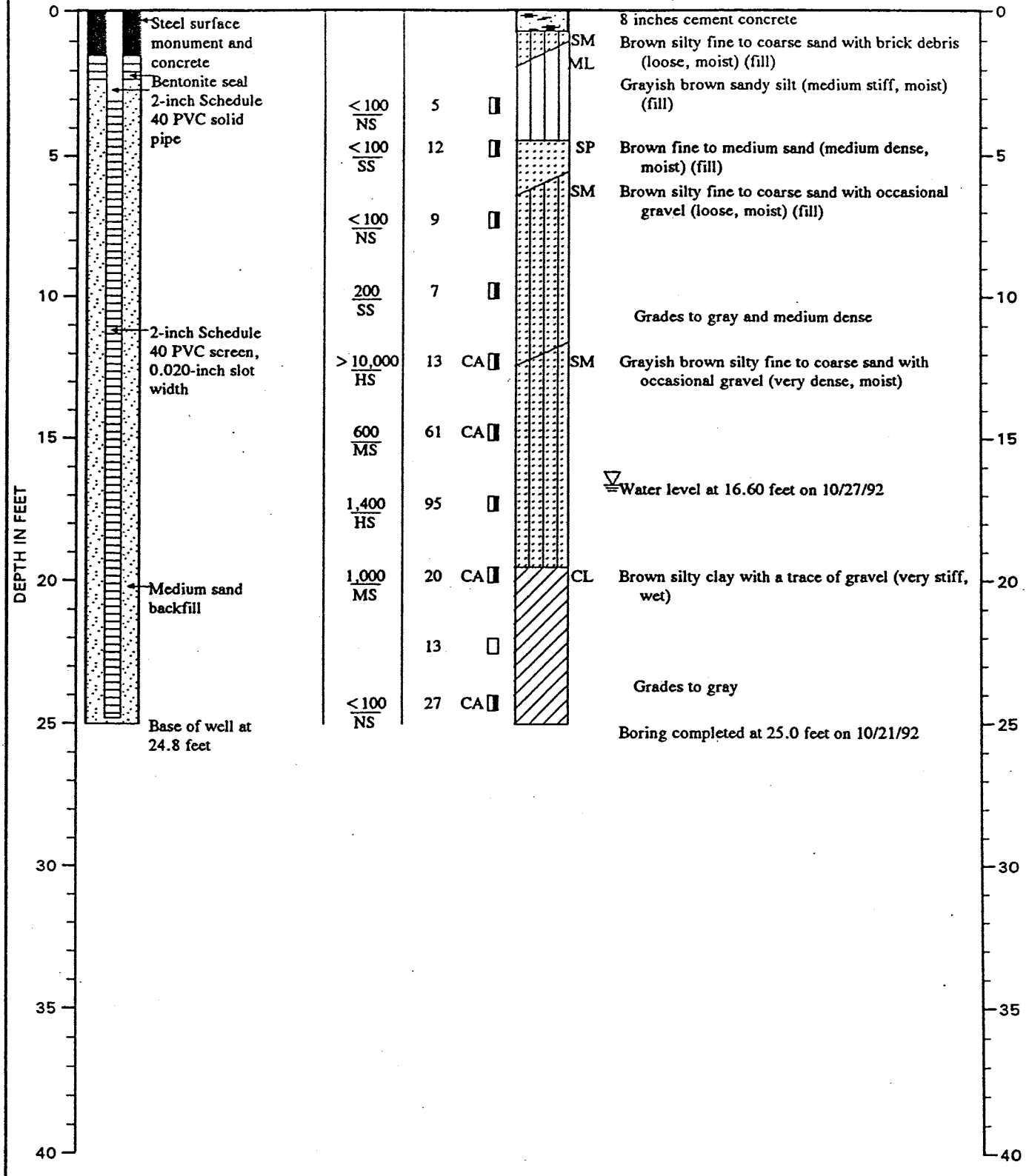
LOG OF MONITORING WELL

FIGURE A-6

:JKH:CMS 1/12/93

0161-153-R04 Tsk 6.3

MONITORING WELL NO. MW-9U



Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

FIGURE A-7

JKH:CMS 1/12/93

J161-153-R04 Task 6.3

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More Than 50% Retained on No. 200 Sieve	GRAVEL More Than 50% of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More Than 50% of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More Than 50% Passes No. 200 Sieve	SILT AND CLAY Liquid Limit Less Than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY Liquid Limit 50 or More	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
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Moist - Damp, but no visible water

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SOIL CLASSIFICATION SYSTEM

FIGURE A-1

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LABORATORY TESTS

CA Chemical Analysis

FIELD SCREENING TESTS:

Headspace vapor concentration data given in parts per million

Sheen classification system:

NS No Visible Sheen
SS Slight Sheen
MS Moderate Sheen
HS Heavy Sheen
NT Not Tested

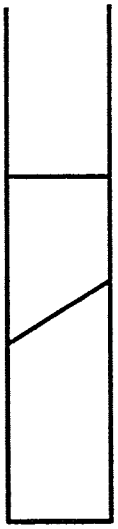
BLOW COUNT/SAMPLE DATA:

Blows required to drive a 2.4-inch I.D. split-barrel sampler 12 inches or other indicated distances using a 300-pound hammer falling 30 inches.

Blows required to drive a 1.5-inch I.D. (SPT) split-barrel sampler 12 inches or other indicated distances using a 140-pound hammer falling 30 inches.

"P" indicates sampler pushed with weight of hammer or against weight of drill rig.

SOIL GRAPH:



SM Soil Group Symbol (See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

Water Level

Bottom of Boring

22 Location of relatively undisturbed sample

12 Location of disturbed sample

17 Location of sampling attempt with no recovery

10 Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) procedures

26 Location of SPT sampling attempt with no recovery

Location of grab sample

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Boring Log Symbols and the exploration logs for a proper understanding of subsurface conditions.
2. Soil classification system is summarized in Figure A-1.

0000-000-00-0000 XXX:XXX:xxx 00/00/00 (XXXXX.ppt)

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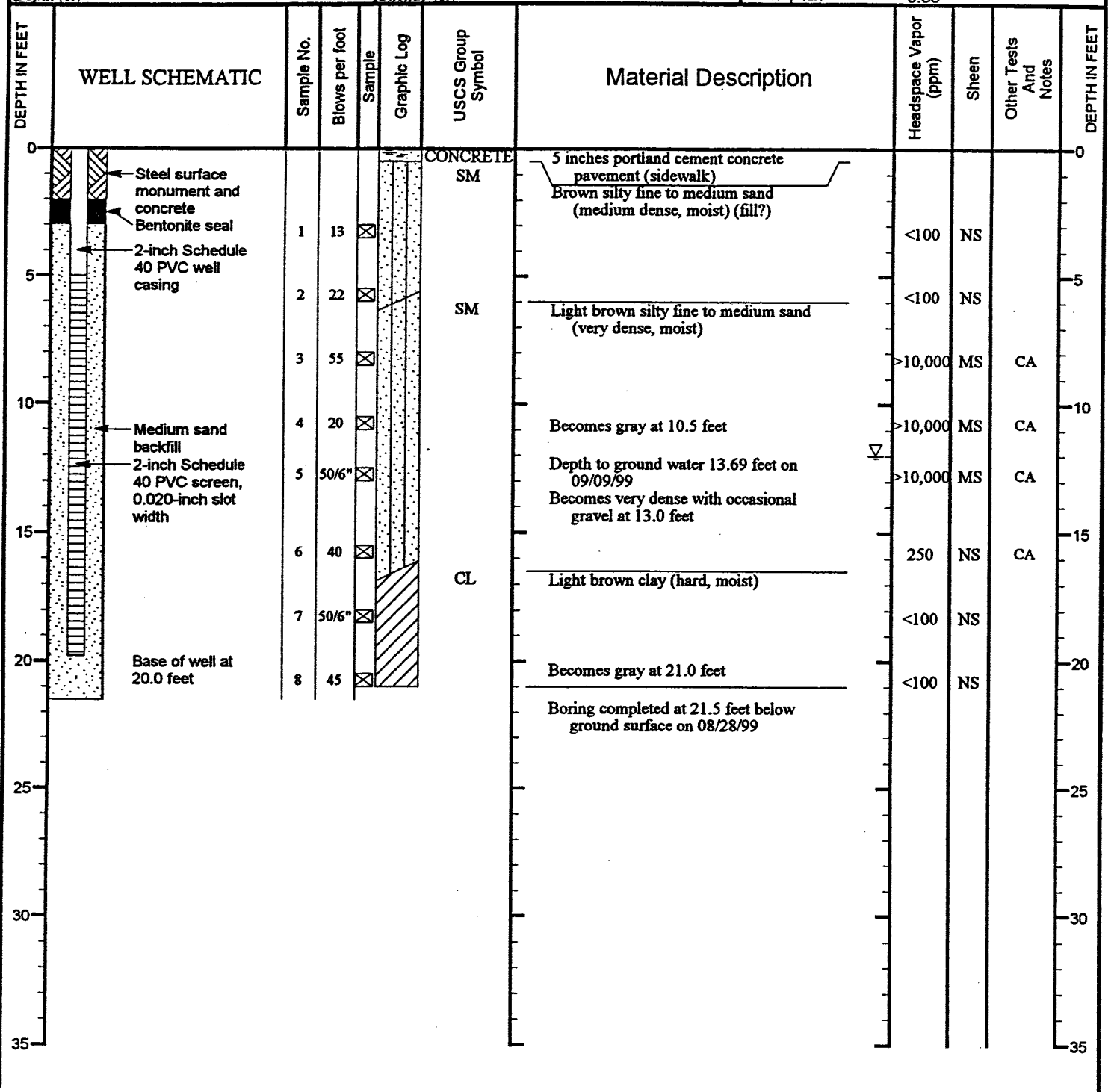
KEY TO BORING LOG SYMBOLS

FIGURE A-2

Project	Job Number	Location
Unocal 0255	0161-153-08	700 Queen Anne Ave. N., Seattle, WA

Date Drilled	08/28/99	Logged By	BES	Contractor	Cascade Drilling
Drill Method	4" Hollow Stem Auger	Equipment	Limited access rig	Drill Bit	
Sample Method	D&M	Hammer Data	140 lb hammer, 30" drop	X-coordinate: Y-coordinate:	Not Determined Not Determined
Total Depth (ft)	21.5	Elevation (ft)	116.34	Datum: System:	Not Determined Not Determined
Total Well Depth (ft)	20	Monument Elevation Stickup (ft)		Casing Elevation Stickup (ft)	116.01 -0.33



PJ GEI_CORP.GDT 10/11/99 0161-153-08

GEI WELL LOG 01

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LOG OF MONITORING WELL MW-10U

FIGURE A-3

Project	Job Number	Location
Unocal 0255	0161-153-08	700 Queen Anne Ave. N., Seattle, WA

Date Drilled	08/28/99	Logged By	BES	Contractor	Cascade Drilling
Drill Method	4" Hollow Stem Auger	Equipment	Limited access rig	Drill Bit	
Sample Method	D&M	Hammer Data	140 lb hammer, 30" drop	X-coordinate: / Y-coordinate:	Not Determined / Not Determined
Total Depth (ft)	19	Elevation (ft)	116.71	Datum: / System:	Not Determined / Not Determined
Total Well Depth (ft)	16	Monument Elevation / Stickup (ft)		Casing Elevation / Stickup (ft)	116.21 / -0.50

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	Sample	Graphic Log	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes	DEPTH IN FEET
0	Steel surface monument and concrete					CONCRETE	5 inches portland cement concrete pavement (sidewalk)				0
	Bentonite seal	1	24	☒		SM	Brown silty fine to medium sand with occasional gravel (medium dense, moist) (fill)	<100	SS		
5	2-inch Schedule 40 PVC well casing	2	29	☒				250	SS	CA	5
						SM	Gray silty fine to medium sand (very dense, moist)				
	2-inch Schedule 40 PVC screen, 0.020-inch slot width	3	55	☒				>10,000	MS	CA	
10							Depth to ground water 10.46 feet on 09/09/99				10
	Medium sand backfill	4	50/6"	☒				>10,000	HS	CA	
		5	50/6"	☒			Becomes wet at 13.0 feet	1,500	SS	CA	
15						CL	Light brown clay (hard, moist)				15
	Base of well at 16.0 feet	6	60	☒				<100	NS		
		7	50	☒				<100	NS		
							Boring completed at 19.0 feet below ground surface on 08/28/99				
20											20
25											25
30											30
35											35

GEI WELL LOG 0161-153-08.PJ GEI_CORP.GDT 10/11/99 0161-153-08

Geo Engineers

LOG OF MONITORING WELL MW-11U

FIGURE A-4

Project	Job Number	Location
Unocal 0255	0161-153-08	700 Queen Anne Ave. N., Seattle, WA

Date Drilled	08/28/99	Logged By	BES	Contractor	Cascade Drilling
Drill Method	4" Hollow Stem Auger	Equipment	Limited access rig	Drill Bit	
Sample Method	D&M	Hammer Data	140 lb hammer, 30" drop	X-coordinate: Y-coordinate:	Not Determined Not Determined
Total Depth (ft)	26	Elevation (ft)	116.31	Datum: System:	Not Determined Not Determined
Total Well Depth (ft)	23	Monument Elevation Stickup (ft)		Casing Elevation Stickup (ft)	115.93 -0.38

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	Sample	Graphic Log	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes	DEPTH IN FEET
0	Steel surface monument and concrete					ASPHALT CONCRETE SP-SM	3 inches asphalt pavement over 4 inches portland cement concrete pavement Brown fine to medium sand with silt (medium dense, moist) (fill)				0
	Bentonite seal	1	17					<100	SS		
5		2	14					<100	SS		5
	2-inch Schedule 40 PVC well casing					SM	Light brown silty fine to medium sand with occasional coarse sand and gravel (medium dense, moist)				
		3	16					>10,000	MS	CA	
						SM	Gray silty fine to medium sand with occasional coarse sand and gravel (medium dense, moist)				
10		4	32					>10,000	MS	CA	10
	Medium sand backfill	5	25					>10,000	MS	CA	
						SW	Gray fine to coarse sand (dense, wet)				
15	2-inch Schedule 40 PVC screen, 0.020-inch slot width	6	50/6"					>10,000	MS	CA	15
						SM	Gray silty fine to medium sand (dense, wet) Depth to ground water 17.88 feet on 09/09/99				
		7	50/6"					500	NS		
20		8	40					2,000	SS		20
		9	50/6"			CL	Brown clay (hard, moist)	<100	NS		
25	Base of well at 23.0 feet	10	50/6"				Boring completed at 26.0 feet below ground surface on 08/28/99 No ground water encountered during drilling	<100	NS		25
30											30
35											35

J GEI_CORP.GDT 10/11/99 0161-153-08

GEI WELL LOG 0161

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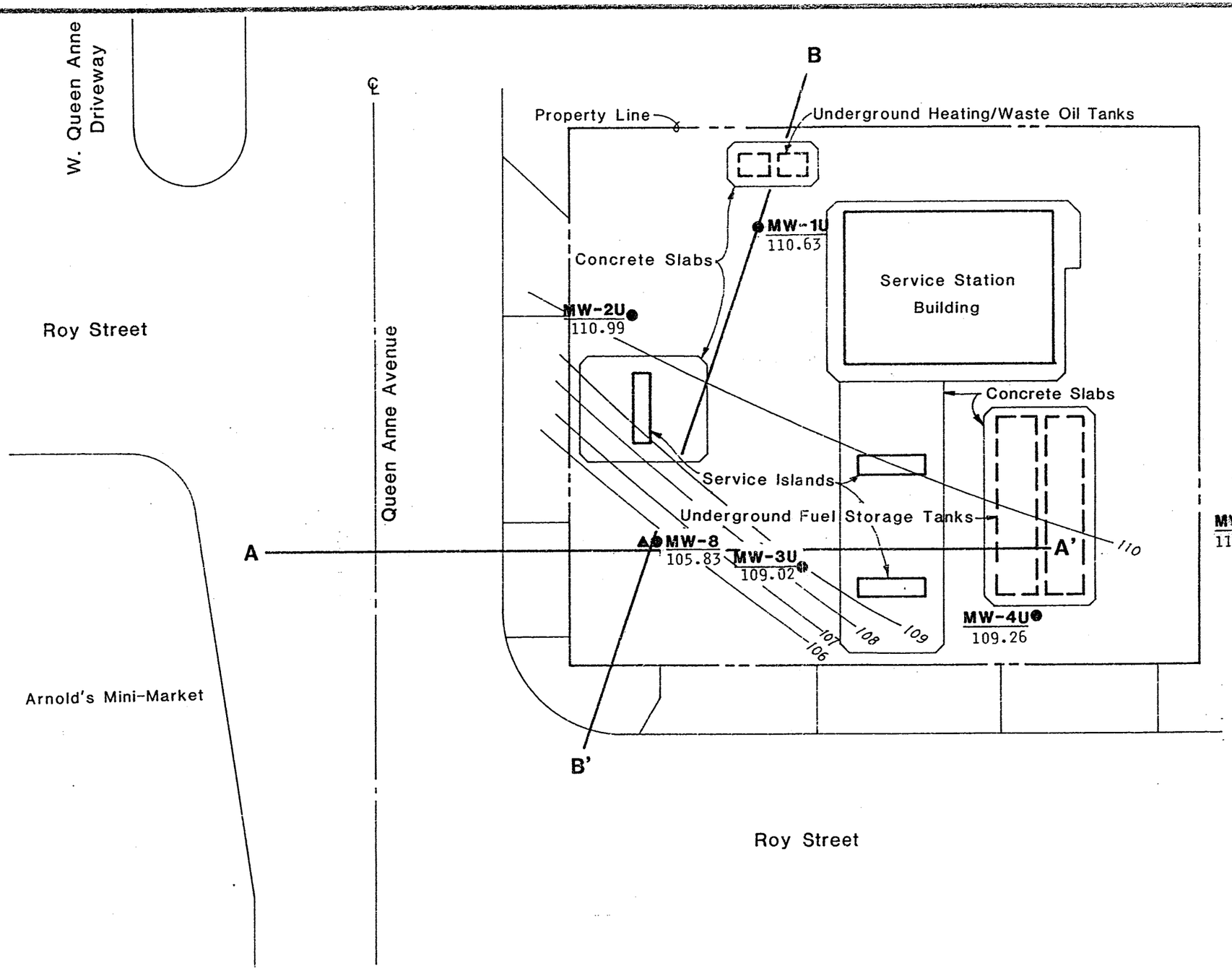
LOG OF MONITORING WELL MW-12U

FIGURE A-5



N

0 20 40

SCALE IN FEET

EXPLANATION:

MW-1U ● 110.63 — MONITOR WELL LOCATION AND NUMBER / GROUND WATER ELEVATION ON 1/12/89

APPROXIMATE DIRECTION OF GROUND WATER FLOW

109 — GROUND WATER TABLE CONTOUR BASED ON 1/12/89 DATA

▲ BENCHMARK AT MW-8 CASING RIM. ELEVATION OF 116.55 FEET BASED ON PREVIOUS SITE SURVEY.

REFERENCE: DRAWING ENTITLED "SERVICE STATION NO. 255 @ QUEEN ANNE AVENUE & ROY STREET, SEATTLE, WA.", PROVIDED BY UNOCAL.

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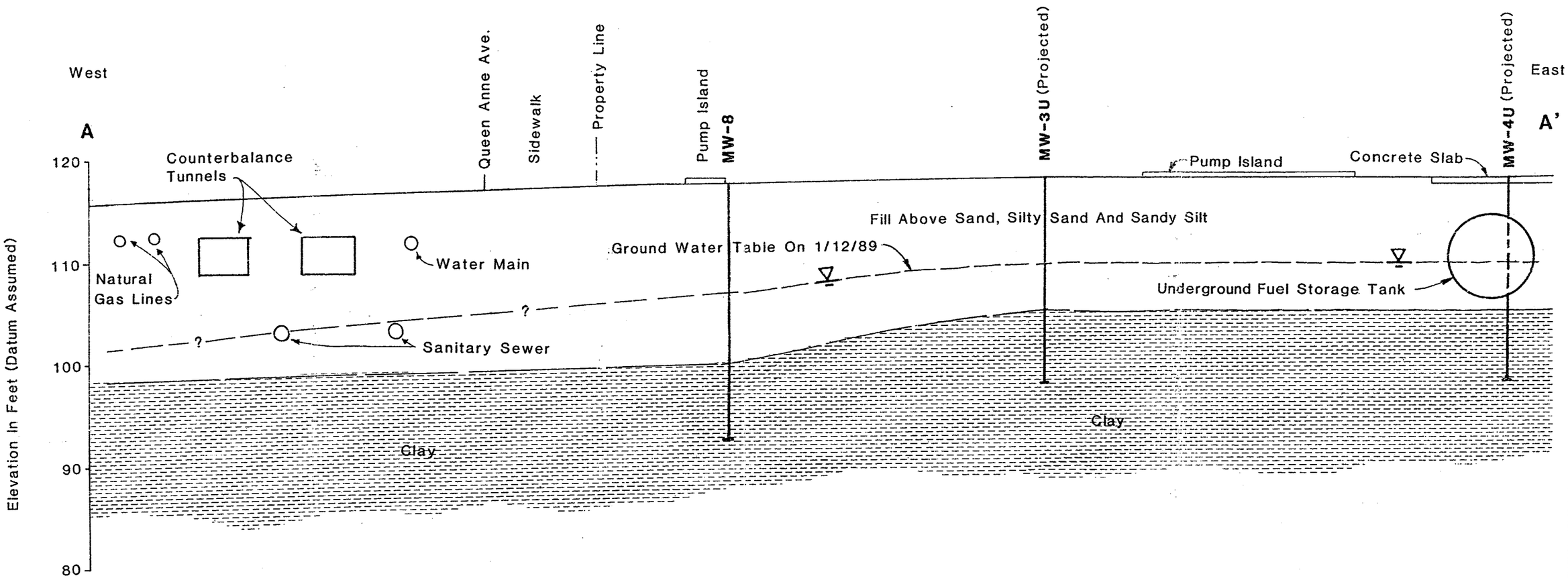
SITE PLAN

FIGURE 2

0161-153-4 JF:KKT 2-17-89



NOTE: THE SUBSURFACE CONDITIONS SHOWN ON THE SECTION ARE BASED ON INTERPOLATION BETWEEN WIDELY SPACED EXPLORATIONS, AND PREVIOUS STUDIES CONDUCTED FOR THE DEPARTMENT OF ECOLOGY. THEY SHOULD BE CONSIDERED TO BE APPROXIMATE.

HORIZONTAL SCALE: 1" = 10'

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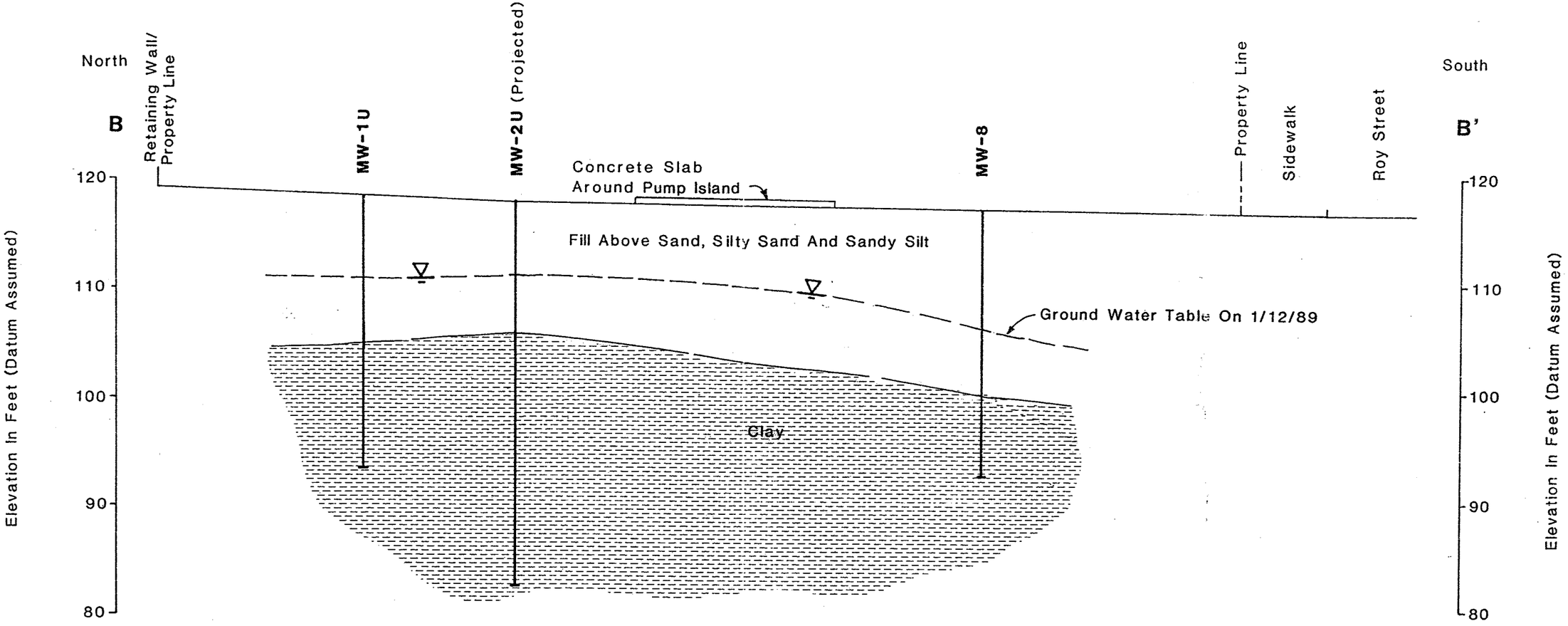
SUBSURFACE SECTION

FIGURE 3

0161-153-4 TTF:KKT 1-19-89



NOTE: THE SUBSURFACE CONDITIONS SHOWN ON THE SECTION ARE BASED ON INTERPOLATION BETWEEN WIDELY SPACED EXPLORATIONS AND SHOULD BE CONSIDERED TO BE APPROXIMATE.

HORIZONTAL SCALE: 1" = 10'

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SUBSURFACE SECTION

FIGURE 4

0161-153-4 TTF:KRT 1-19-89

SSS-11-1.5	B	X	G	D	O
02/18/99	<0.100	<0.300	87.4	302	<25.0
MTCA	0.5	20	100	200	200

EX-4-2	B	X	G	D	O
02/11/99	<0.100	0.942	379	7,050	306
MTCA	0.5	20	100	200	200

EX-13-3	B	X	G	D	O
02/12/99	<1.00	95.6	1,390	3,560	<275
MTCA	0.5	20	100	200	200

EX-14-5	B	X	G	D	O
02/12/99	<0.100	0.875	25.9	237	<25.0
MTCA	0.5	20	100	200	200

EX-15-5	B	X	G	D	O
02/15/99	<0.100	<0.300	238	59.6	96.9
MTCA	0.5	20	100	200	200

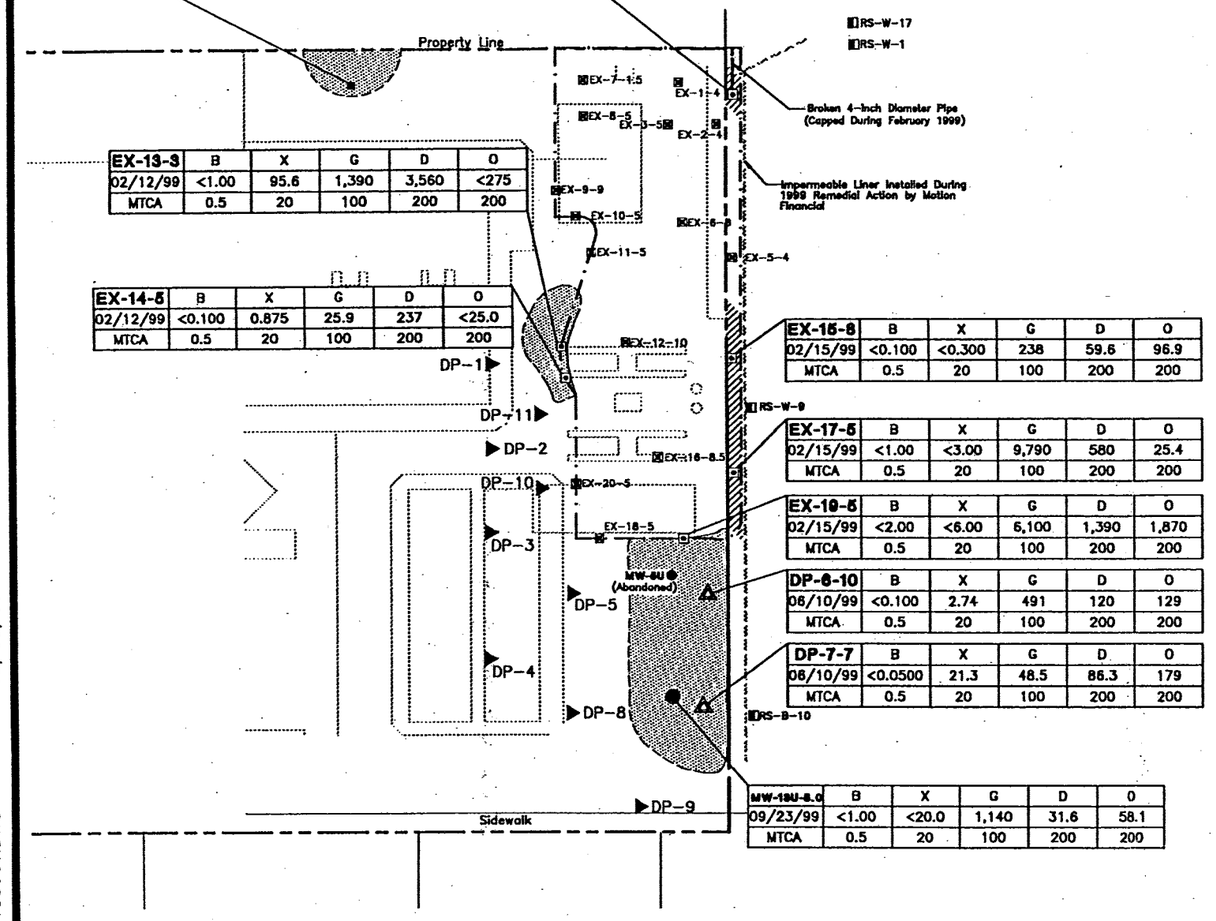
EX-17-5	B	X	G	D	O
02/15/99	<1.00	<3.00	9,790	580	25.4
MTCA	0.5	20	100	200	200

EX-19-5	B	X	G	D	O
02/15/99	<2.00	<6.00	6,100	1,390	1,870
MTCA	0.5	20	100	200	200

DP-6-10	B	X	G	D	O
06/10/99	<0.100	2.74	491	120	129
MTCA	0.5	20	100	200	200

DP-7-7	B	X	G	D	O
06/10/99	<0.0500	21.3	48.5	86.3	179
MTCA	0.5	20	100	200	200

MW-19U-8.0	B	X	G	D	O
09/23/99	<1.00	<20.0	1,140	31.6	58.1
MTCA	0.5	20	100	200	200



EXPLANATION:

- **MW-5U** ● MONITORING WELL
- (8') SAMPLE DEPTH (FEET BELOW GROUND SURFACE)
- EX-13-3 ⊙ SOIL SAMPLE BY GEOENGINEERS WITH HYDROCARBON CONCENTRATIONS EXCEEDING MTCA METHOD A SOIL CLEANUP LEVELS. LAST NUMBER REPRESENTS SAMPLE DEPTH IN FEET BGS (SEE NOTE 3)
- EX-12-10 ⊠ SOIL SAMPLE BY GEOENGINEERS WITH HYDROCARBON CONCENTRATIONS EITHER NOT DETECTED OR LESS THAN MTCA METHOD A SOIL CLEANUP LEVELS (SEE NOTE 3)
- RS-W-1 ◧ 1999 SOIL SAMPLE BY KLEEN ENVIRONMENTAL THAT EXCEEDS MTCA METHOD A CLEANUP LEVEL
- DP-2 ▲ JUNE 1999 DIRECT PUSH BORING BY GEOENGINEERS WITH HYDROCARBON CONCENTRATIONS EXCEEDING MTCA METHOD A SOIL CLEANUP LEVELS. LAST NUMBER REPRESENTS SAMPLE DEPTH IN FEET BGS.
- DP-6-10 ▶ JUNE 1999 DIRECT PUSH BORING BY GEOENGINEERS WITH NO EVIDENCE OF PETROLEUM HYDROCARBONS BASED ON FIELD SCREENING AND/OR CHEMICAL ANALYTICAL TESTING
- REMEDIAL EXCAVATION LIMITS (BY GEOENGINEERS FEBRUARY 1999)
- APPROXIMATE AREA OF SOIL ON THE UNOCAL SITE WITH RESIDUAL PETROLEUM CONCENTRATIONS EXCEEDING MTCA METHOD A CLEANUP LEVELS
- SOIL NEAR THE UNOCAL/ORESTES PROPERTY BOUNDARY WITH RESIDUAL PETROLEUM CONCENTRATIONS EXCEEDING MTCA METHOD A CLEANUP LEVELS.
- B BENZENE (mg/kg) BY EPA METHOD 8020 OR 8021B
- X XYLENES (mg/kg) BY EPA METHOD 8020 OR 8021B
- G GASOLINE-RANGE HYDROCARBONS (mg/kg) BY ECOLOGY METHOD WTPH-G
- D DIESEL-RANGE HYDROCARBONS (mg/kg) BY ECOLOGY METHOD WTPH-D EXTENDED
- O HEAVY OIL-RANGE HYDROCARBONS (mg/kg) BY ECOLOGY METHOD WTPH-D EXTENDED
- mg/kg MILLIGRAMS PER KILOGRAM

NOTES:

1. The service station buildings and subsurface facilities shown were removed in January 1992 or earlier.
2. The locations of all features shown are approximate.
3. "E" Samples were obtained from 1998 excavation. "EX" or "SSS" Samples were obtained from February 1999 excavations.
4. Refer to GeoEngineers' March 1999 report for facilities identification.

References: Drawing entitled "Service Station No. 0255 at Queen Anne Avenue & Roy Street, Seattle, WA" provided by Union Oil Company of California, undated. KLEEN soil samples based on their 1999 report.

N

0 20 40
SCALE IN FEET

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SOIL SAMPLE LOCATIONS AND 1999 EXCAVATIONS

FIGURE 3

12/03/99

P:\0161153\CAD\0161153O6T.DWG

DLC:HLA

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More Than 50% Retained on No. 200 Sieve	GRAVEL More Than 50% of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
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			GC	CLAYEY GRAVEL
	SAND More Than 50% of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More Than 50% Passes No. 200 Sieve	SILT AND CLAY Liquid Limit Less Than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY Liquid Limit 50 or More	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

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Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water

Wet - Visible free water or saturated, usually soil is obtained from below water table

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SOIL CLASSIFICATION SYSTEM

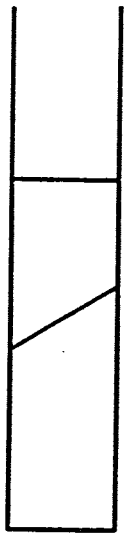
FIGURE A-1

f:\soila-1.doc

LABORATORY TESTS

AL	Atterberg Limits
CP	Compaction
CS	Consolidation
DS	Direct shear
GS	Grain size
%F	Percent fines
HA	Hydrometer Analysis
SK	Permeability
SM	Moisture Content
MD	Moisture and density
SP	Swelling pressure
TX	Triaxial compression
UC	Unconfined compression
CA	Chemical analysis

SOIL GRAPH:



SM Soil Group Symbol (See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

Water Level

Bottom of Boring

BLOW COUNT/SAMPLE DATA:

Blows required to drive a 2.4-inch I.D. split-barrel sampler 12 inches or other indicated distances using a 300-pound hammer falling 30 inches.

22 Location of relatively undisturbed sample

12 Location of disturbed sample

17 Location of sampling attempt with no recovery

Blows required to drive a 1.5-inch I.D. (SPT) split-barrel sampler 12 inches or other indicated distances using a 140-pound hammer falling 30 inches.

10 Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) procedures

26 Location of SPT sampling attempt with no recovery

Location of grab sample

"P" indicates sampler pushed with weight of hammer or against weight of drill rig.

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Boring Log Symbols and the exploration logs for a proper understanding of subsurface conditions.
2. Soil classification system is summarized in Figure A-1.

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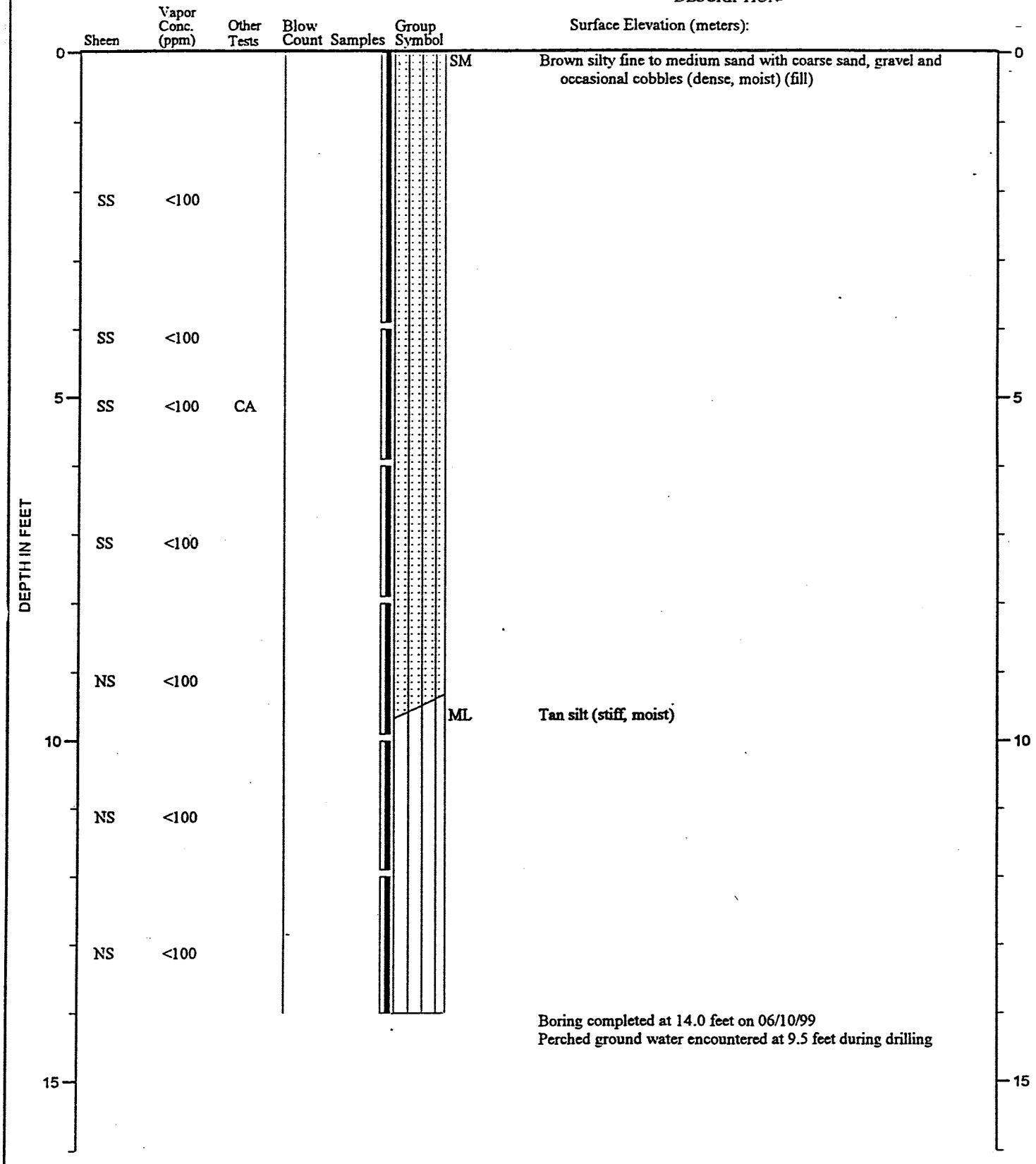
KEY TO BORING LOG SYMBOLS

FIGURE A-2

TEST DATA

BORING DP-1



Note: See Figure A-2 for explanation of symbols

TMK:CMS 7/20/99

11-153-06a

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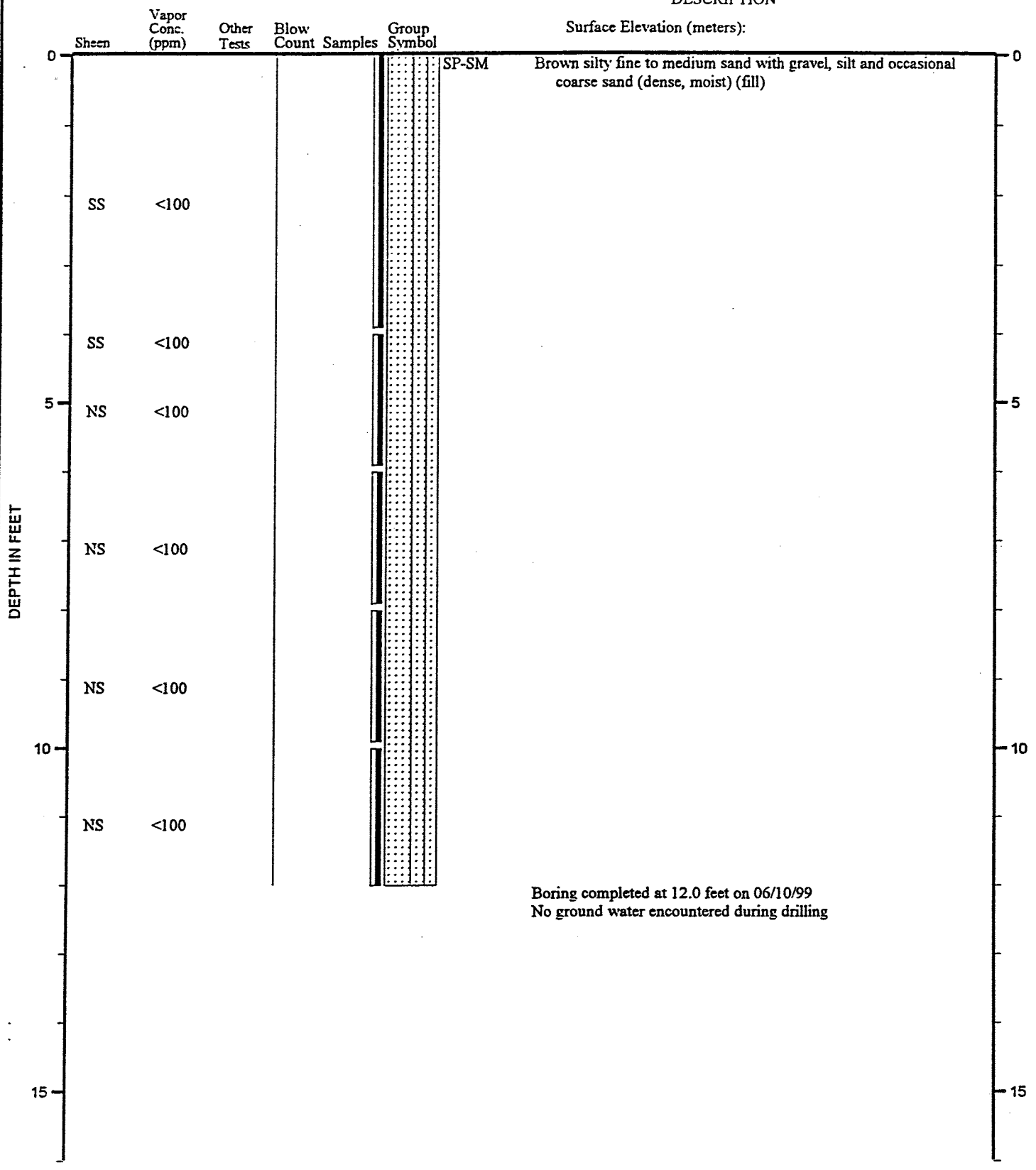
LOG OF BORING

FIGURE A-3

TEST DATA

BORING DP-2



Note: See Figure A-2 for explanation of symbols

TMK:CMS 7/7/99

11-153-06a

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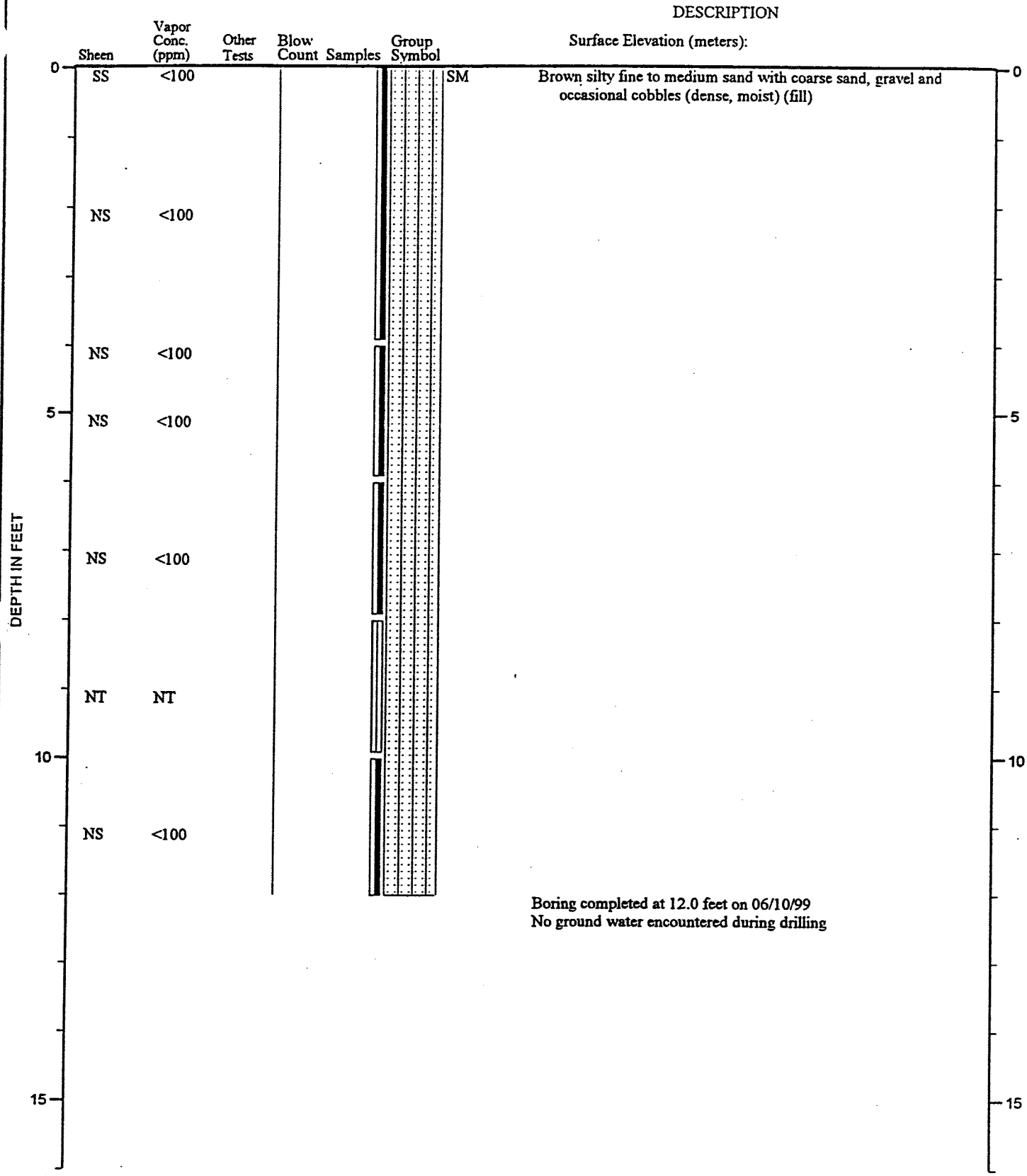
LOG OF BORING

FIGURE A-4

TEST DATA

BORING DP-3



Note: See Figure A-2 for explanation of symbols

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LOG OF BORING

FIGURE A-5

TEST DATA

BORING DP-4

Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION
						Surface Elevation (meters):
					SM	Brown silty fine to medium sand with coarse sand, gravel and occasional cobbles (dense, moist) (fill)
NS	<100					
NS	<100					
NS	<100					
NS	<100					
SS	<100					
						Grades to no cobbles or gravel
NS	<100				ML	Tan silt (stiff, moist)
						Boring completed at 12.5 feet on 06/10/99
						No ground water encountered during drilling

DEPTH IN FEET

0 5 10 15

TMK:CMS 7/7/99

91-153-06a

Note: See Figure A-2 for explanation of symbols

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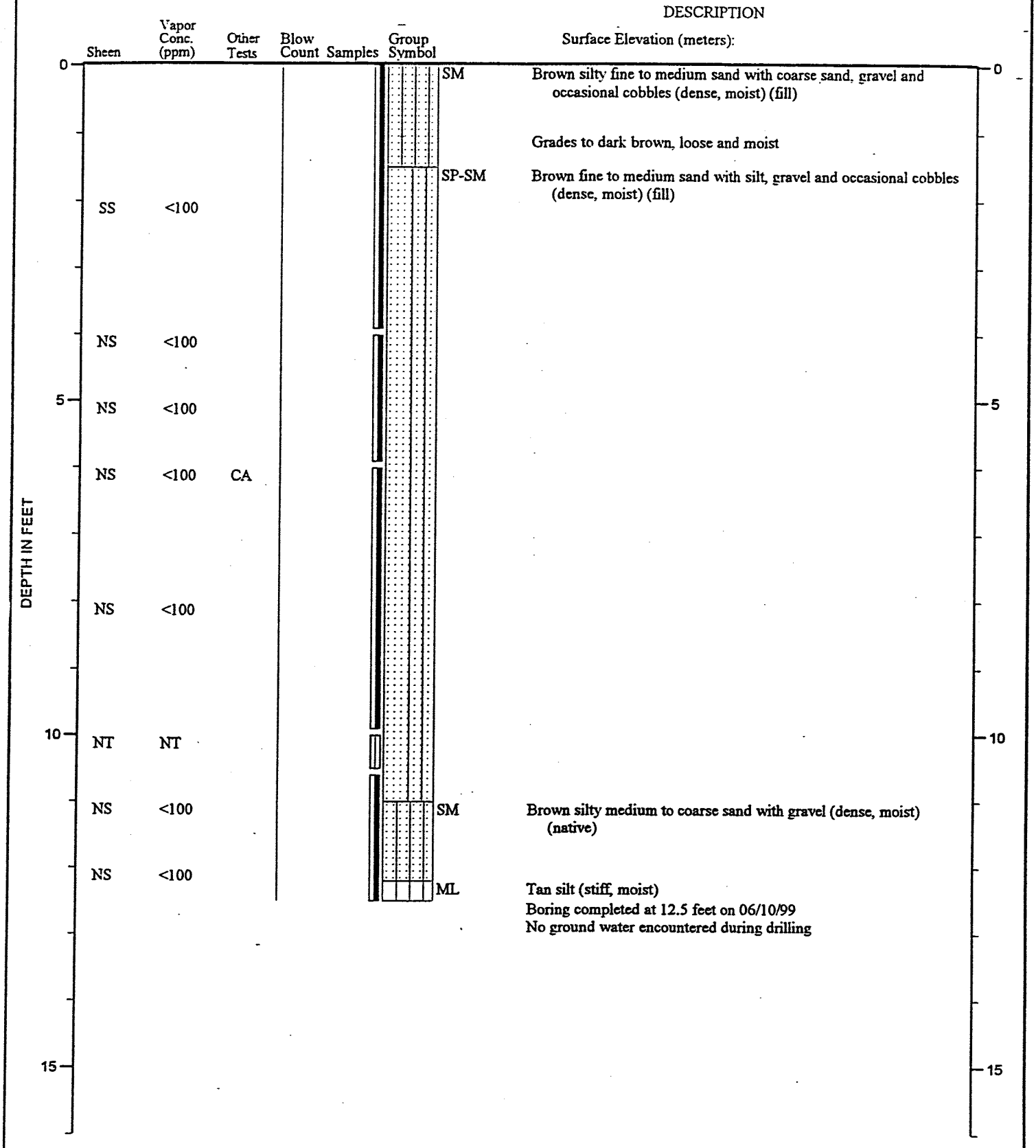
LOG OF BORING

FIGURE A-6

TEST DATA

BORING DP-5



Note: See Figure A-2 for explanation of symbols

TMK:CMS 7/20/99

31-153-06a

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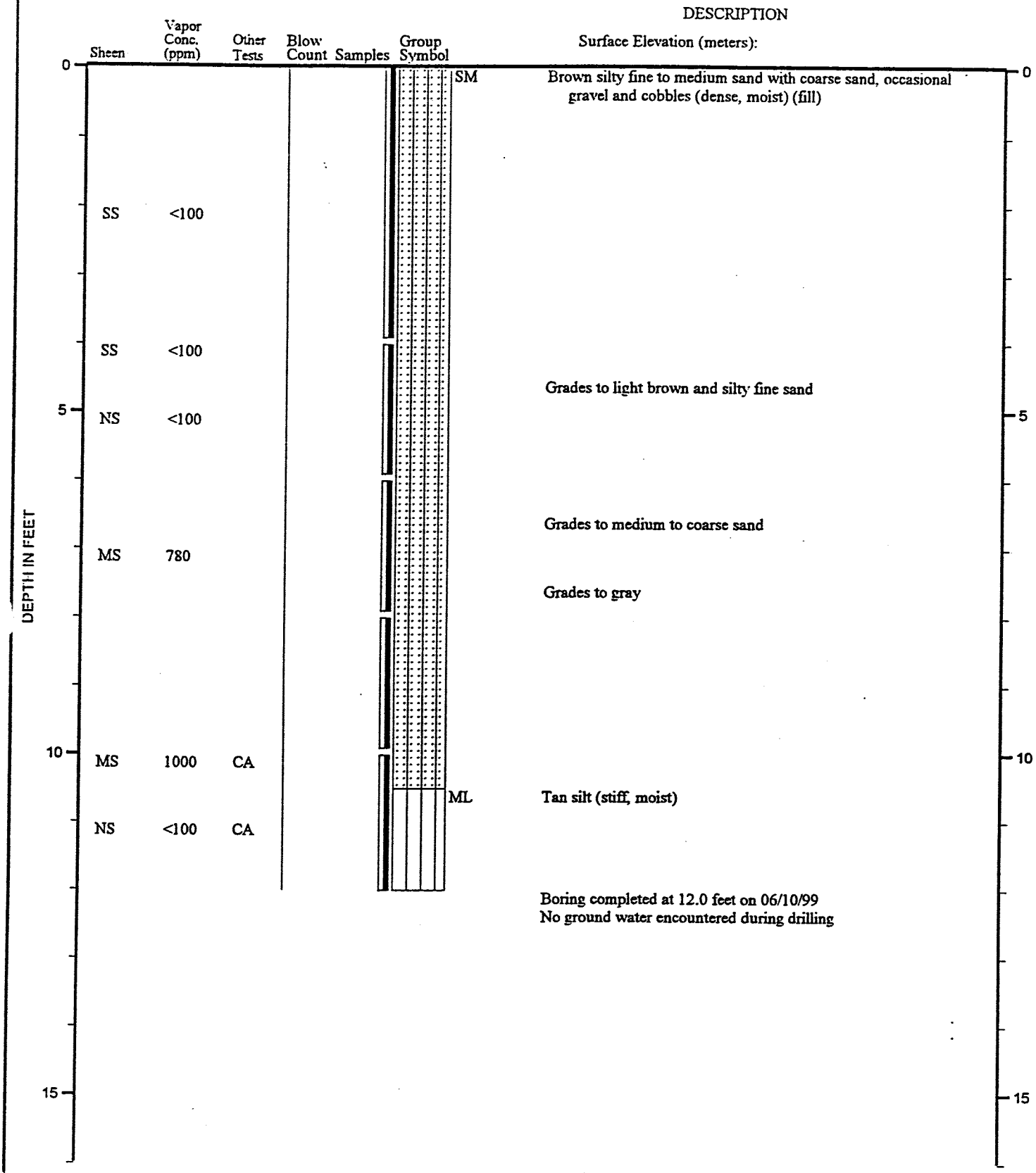
LOG OF BORING

FIGURE A-7

TEST DATA

BORING DP-6



Note: See Figure A-2 for explanation of symbols

IMK:CMS 7/7/99

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LOG OF BORING

FIGURE A-8

TEST DATA

BORING DP-7

Depth	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION
							Surface Elevation (meters):
0						SM	Brown silty fine to medium sand with coarse sand, gravel and occasional cobbles (dense, moist) (fill)
	SS	<100					
							Grades to dark brown
	SS	<100					Grades to light brown silty fine sand
5							
							Grades to with silt lenses Grades to gray
	MS	880	CA				
	MS	620					
10							
	SS	<100	CA				
							Boring completed at 12.0 feet on 06/10/99 No ground water encountered during drilling
15							

DEPTH IN FEET

TMK:CMS 7/7/99

01-133-06a

Note: See Figure A-2 for explanation of symbols

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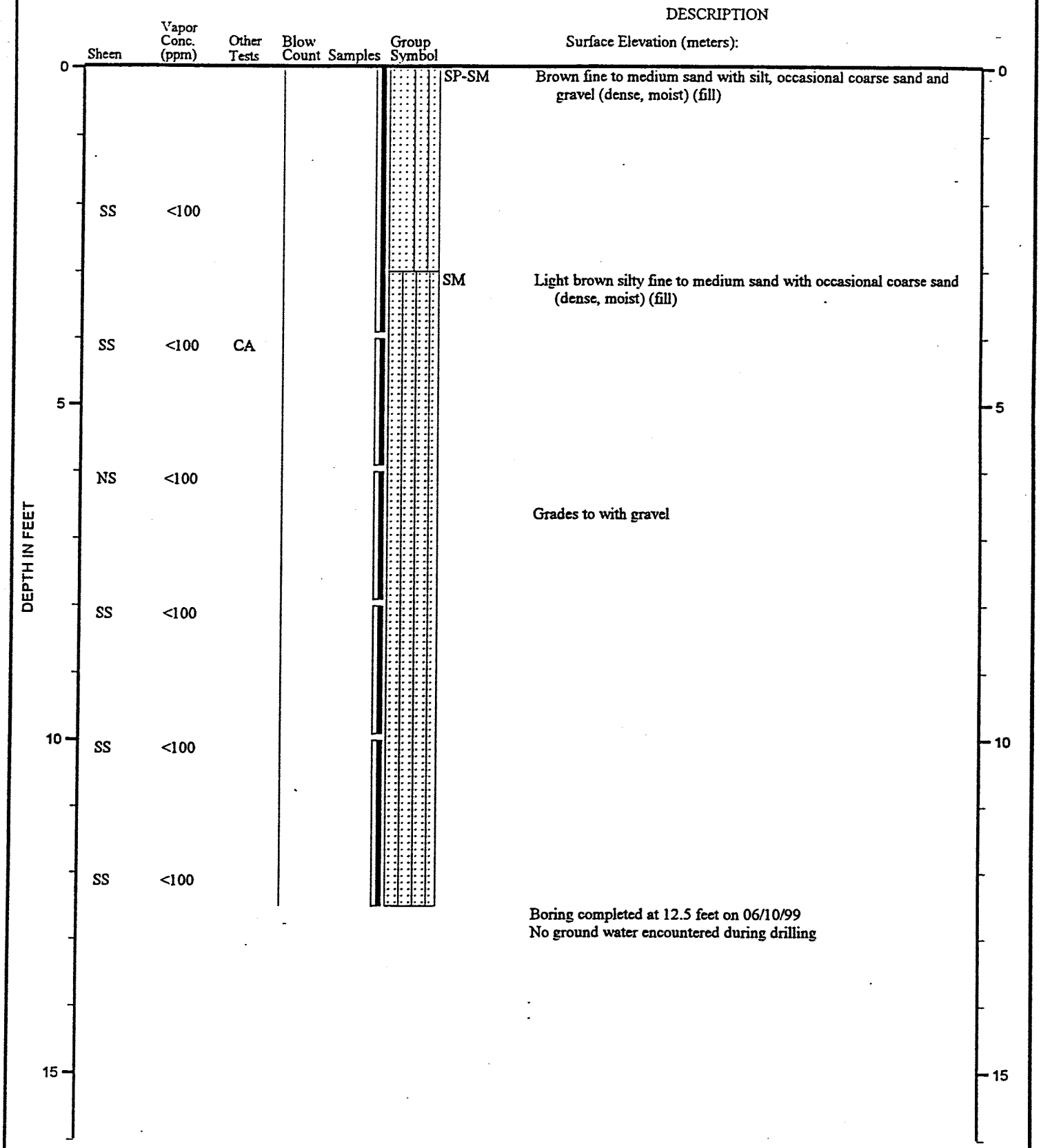
LOG OF BORING

FIGURE A-9

TEST DATA

BORING DP-8



Note: See Figure A-2 for explanation of symbols

TMK:CMS 7/7/99

1-153-06a

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LOG OF BORING

FIGURE A-10

TEST DATA

BORING DP-9

Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (meters):
					SP	Brown fine to medium sand with silty coarse sand and gravel (dense, moist) (fill)
					ML	Tan silt (stiff, moist)
					SP-SM	Light brown fine to medium sand with coarse sand and silt (dense, moist) (fill)
SS	<100					
SS	<100	CA				Grades to with wood below 4 feet and 6 feet (fill)
NS	<100				ML	Tan mottled silt (stiff, moist)
NS	<100					
						Grades to without mottling
NS	<100					

Boring completed at 10.5 feet on 06/10/99
No ground water encountered during drilling

DEPTH IN FEET: 0, 5, 10, 15

Note: See Figure A-2 for explanation of symbols

TMK:CMS 7/7/99

1-153-06a

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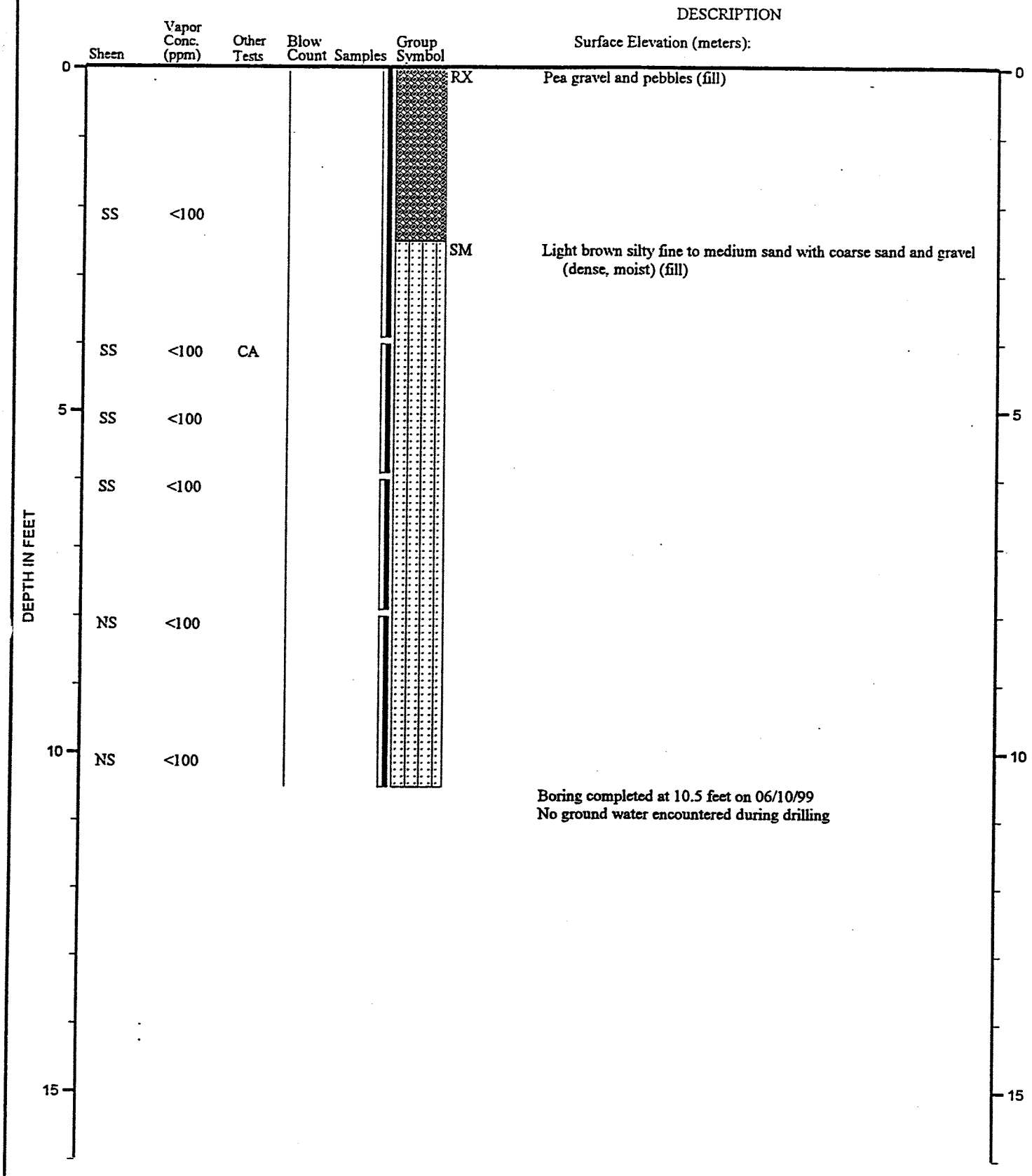
LOG OF BORING

FIGURE A-11

TEST DATA

BORING DP-10



Note: See Figure A-2 for explanation of symbols

TMK:CMS 7/7/99

61-153-06a

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LOG OF BORING

FIGURE A-12

TEST DATA

BORING DP-11

Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION
					SM	Surface Elevation (meters): Light brown silty fine to medium sand with coarse sand, gravel and occasional cobbles (dense, moist) (fill)
NS	<100					
NS	<100					
NS	<100					
NS	<100					
						Boring completed at 10.0 feet on 06/10/99
						No ground water encountered during drilling

DEPTH IN FEET

0 5 10 15

TMK:CMS 7/7/99

1-153-06a

Note: See Figure A-2 for explanation of symbols

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LOG OF BORING

FIGURE A-13

Project	Job Number	Location
Unocal 0255	0161-153-08	700 Queen Anne Ave. N., Seattle, WA

Date Drilled	09/23/99	Logged By	BES	Contractor	Cascade Drilling
Drill Method	4" Hollow Stem Auger	Equipment	Standard drilling rig	Drill Bit	
Sample Method	D&M	Hammer Data	140 lb hammer, 30" drop	X-coordinate: Y-coordinate:	Not Determined Not Determined
Total Depth (ft)	13.5	Elevation (ft)	Not Measured	Datum: System:	Not Determined Not Determined
Total Well Depth (ft)	12	Monument Elevation Stickup (ft)		Casing Elevation Stickup (ft)	117.83

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	Sample	Graphic Log	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes	DEPTH IN FEET
0	Steel surface monument and concrete surface seal Bentonite seal 2-inch Schedule 40 PVC well casing		60/6"			SP-SM	Brown fine to medium sand with silt and occasional fine gravel (very dense, moist) (fill)				0
5		1	70/6"				Depth to ground water approximately 5.2 feet on 09/24/99	<100	SS		5
	2-inch Schedule 40 PVC screen, 0.020-inch slot width	2	50/4"					<100	SS	CA	
10		3	25/50			CL	Tan clay (very stiff, moist) (native)	<100	SS		10
	Base of well at 12.0 feet 10/20 sand backfill	4	29					<100	NS		
15							Boring completed at 13.5 feet on 09/23/99 Ground water not encountered during drilling				15
20											20
25											25
30											30
35											35

GEI WELL LOG 016, JJ GEI CORP.GDT 11/3/99 0161-153-08

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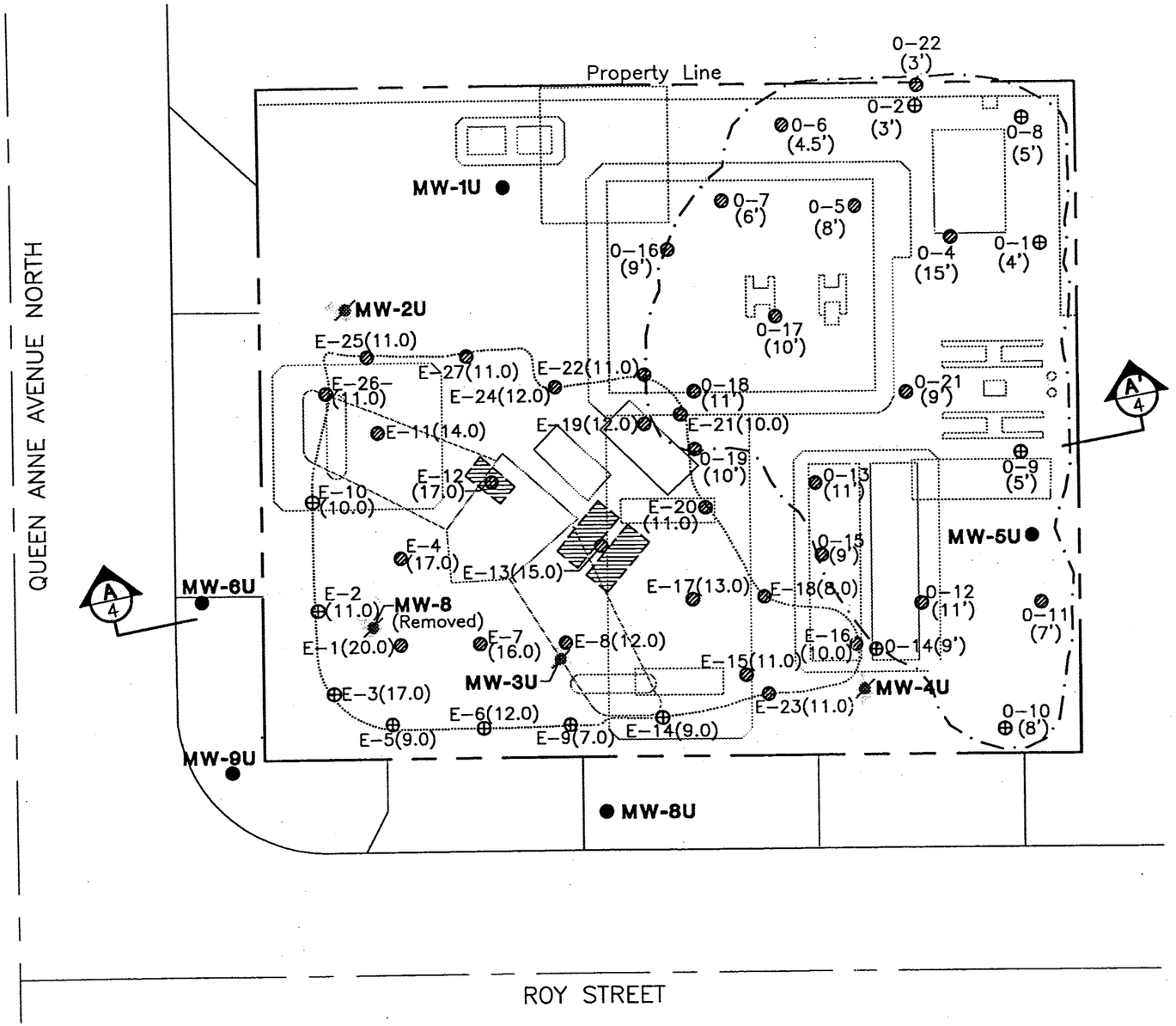
LOG OF MONITORING WELL MW-13U

FIGURE A-14



EXPLANATION:

- **MW-1U** ● MONITORING WELL
- **MW-4U** ⊗ ABANDONED MONITORING WELL
- 0-1 / E-7-16.0 ⊘ SOIL SAMPLE WITH HYDROCARBON CONCENTRATIONS EITHER NOT DETECTED OR AT CONCENTRATIONS LESS THAN MTCA METHOD A SOIL CLEANUP LEVELS
- 0-10 / E-9-7.0 ⊕ SOIL SAMPLE WITH HYDROCARBON CONCENTRATIONS EXCEEDING MTCA METHOD A SOIL CLEANUP LEVELS
- (8') SAMPLE DEPTH (FEET BELOW GROUND SURFACE)
- LIMITS OF 1993 EXCAVATION
- LIMITS OF 1998 EXCAVATION
- UST's REMOVED DURING 1998 REMEDIAL EXCAVATION ACTIVITIES
- A 4 CROSS SECTION LOCATION SEE FIGURE 4

Notes:
1. The service station buildings and subsurface facilities shown were removed in January 1992 or earlier.
2. The locations of all features shown are approximate.
3. "0" Samples were obtained from 1993 excavation. "E" Samples were obtained from 1998 excavation.

Reference: Drawing entitled "Service Station No. 0255 at Queen Anne Avenue & Roy Street, Seattle, WA" provided by Union Oil Company of California, undated.

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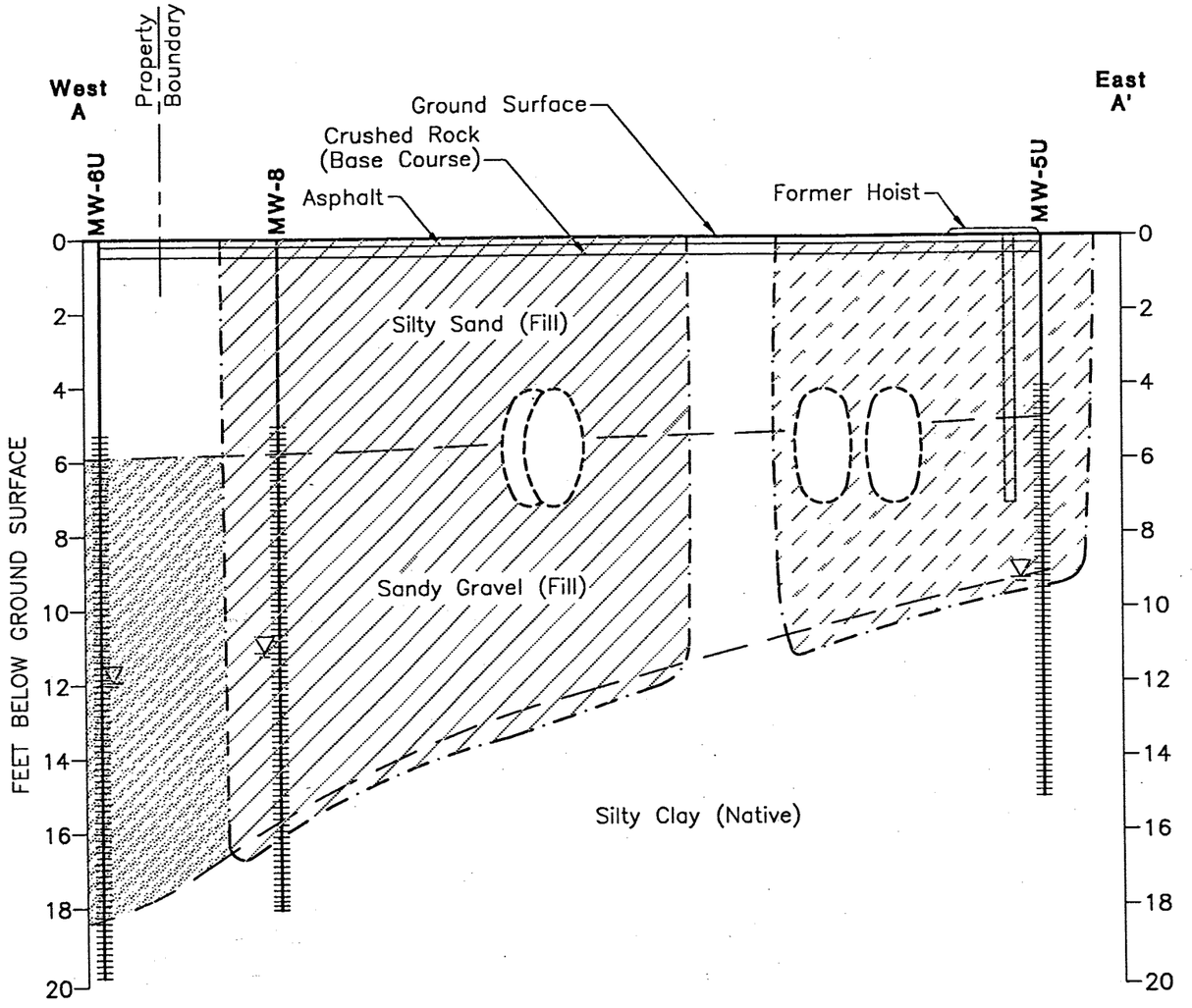
FORMER FACILITIES AND 1993 AND 1998 EXCAVATION AREAS

FIGURE 3

06/24/98
D:\0161\153\0161153E.DWG
DAC:SPS



EXPLANATION:

- MW-5U — MONITORING WELL
- SCREENED INTERVAL
- APPROXIMATE WATER LEVEL
- UST (REMOVED BY EXCAVATION)
- UST UNDERGROUND STORAGE TANK
- LIMITS OF 1993 EXCAVATION
- LIMITS OF 1998 EXCAVATION
- REMAINING SOIL CONTAINING PETROLEUM HYDROCARBONS
- — —— — APPROXIMATE GEOLOGIC CONTACT

SCALE

HORIZONTAL: 1"=20'

VERTICAL: 1"=4'

NOTES:

1. This cross section is a diagrammatic interpretation of subsurface conditions based on extrapolation of data from explorations. Actual conditions are substantially more complex than depicted. GeoEngineers does not represent the conditions illustrated as exact.
2. MW-8 is abandoned.
3. This Figure represents post remedial excavation conditions.

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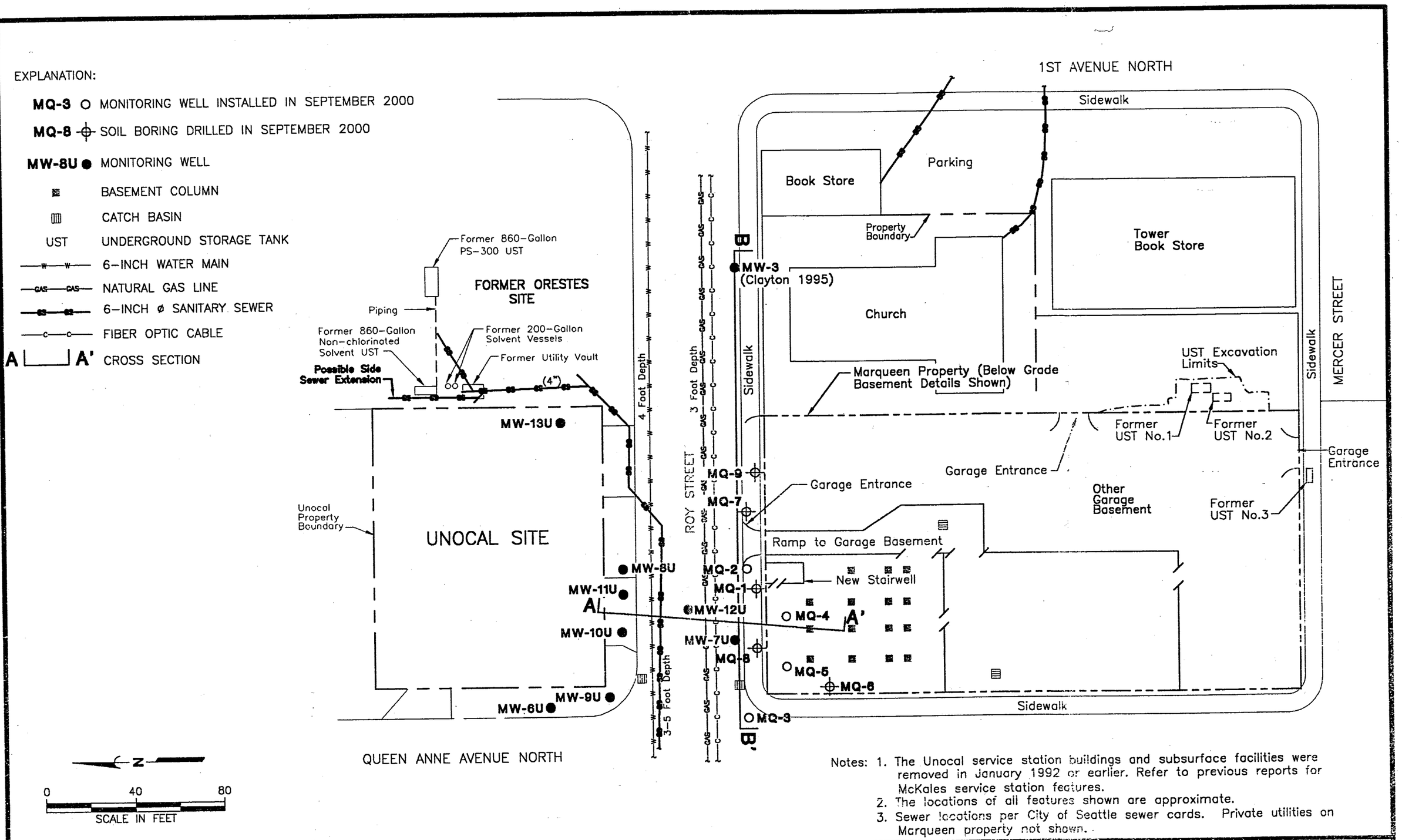
A-A' SOIL SUBSURFACE CROSS SECTION

FIGURE 4

07/08/98

D:\0161\153\0161153F.DWG

DAC:SPS



Notes:
1. The Unocal service station buildings and subsurface facilities were removed in January 1992 or earlier. Refer to previous reports for McKales service station features.
2. The locations of all features shown are approximate.
3. Sewer locations per City of Seattle sewer cards. Private utilities on Marqueen property not shown.

Reference: Drawing entitled "Underground Storage Tank Removal Summary Report, 10 Mercer Street Property" by RZA AGRA Inc., dated 10/11/93, and "Results of Underground Storage Tank Removal at 14 Roy Street" by QUEST dated 05/15/98.

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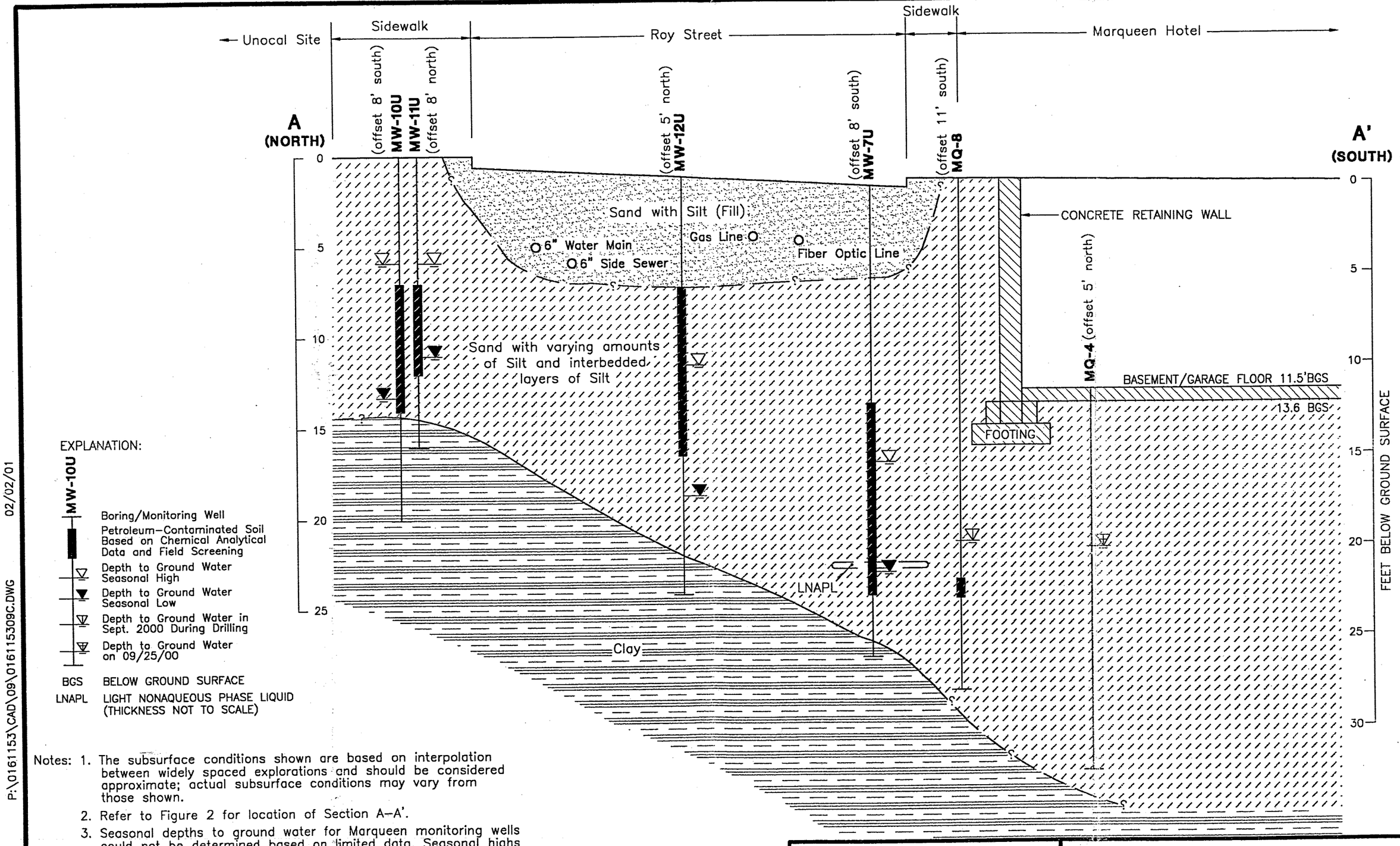
CROSS SECTION LOCATIONS

FIGURE 2

TMK:PB P:\0161153\CAD\09\0161153098.DWG 10/30/00



Notes:
1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. Refer to Figure 2 for location of Section A–A'.
3. Seasonal depths to ground water for Marqueen monitoring wells could not be determined based on limited data. Seasonal highs and lows for the remaining wells are based on depth to ground water data from November 1999 to August 2000.
4. Backfill surrounding and beneath basement floor and retaining wall is not shown.

HORIZONTAL SCALE: 1" = 10'
VERTICAL SCALE: 1" = 5'

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CROSS SECTION A-A'

FIGURE 3

02/02/01
P:\0161153\CAD\09\0161153O9C.DWG
BPP:HLA

B' (WEST)

B (EAST)

MQ-3 (offset 4' east) Marqueen Hotel West Wall

MQ-8 (offset 8' east)

MW-7U (offset 2.5' west)

MQ-1 (offset 8' east)

MQ-2 (offset 4' east)

Marqueen Hotel East Wall

MQ-7 (offset 4' east)

MQ-9 (offset 8' east)

MW-3

Sand with varying amounts of Silt and interbedded layers of Silt

LNAPL

Clay

FEET BELOW GROUND SURFACE

0
5
10
15
20
25
30

EXPLANATION:

MW-3 Boring/Monitoring Well

Petroleum-Contaminated Soil Based on Chemical Analytical Data and Field Screening

Depth to Ground Water in 12/95

Depth to Ground Water in Sept. 2000 During Drilling

Depth to Ground Water on 09/25/00

LNAPL LIGHT NONAQUEOUS PHASE LIQUID (THICKNESS NOT TO SCALE)

Notes: 1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

2. Refer to Figure 2 for location of Section B-B'.

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 5'

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CROSS SECTION B-B'

FIGURE 4

P:\0161153\CAD\09\0161153090.DWG 02/02/01

BPP:HLA