Golder Associates Inc.
CONSULTING ENGINEERS

FINAL REPORT
SOLID WASTE ASSESSMENT TEST
FOR THE NORTH PORT OF OAKLAND
REFUSE DISPOSAL SITE

Submitted to:
Waste Management of North America, Inc.

Prepared by:

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Alameda, CA

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893-7039.400

i. EXECUTIVE SUMMARY

This document presents a Solid Waste Assessment Test (SWAT) Report for the North Port of Oakland Refuse Disposal Site located near the intersection of Doolittle Drive and Harbor Bay Parkway in Oakland, California. The SWAT investigation was initiated pursuant to Section 13273 of the Water Code (Chapter 1532 of the California Code of Regulations) which requires the operator(s) of Rank 4 disposal sites to submit a SWAT Report to the Regional Water Quality Control Board (RWQCB) by July 1, 1990. The basis of the SWAT investigation has been included in a SWAT Proposal previously submitted to the RWQCB on June 30, 1989.

The North Port of Oakland Refuse Disposal Site consists of three parcels, A, B and C which comprise a total area of approximately 44 acres. The site is bounded by the Alameda Municipal Golf Course, the closed City of Alameda disposal site, the Oakland International Airport, and the National Airmotive Testing Facility. The SWAT investigation has focused on Parcel B, a 21 acre site located immediately south of Doolittle Drive and east of Harbor Bay Parkway. Based on information collected during this investigation, Parcel B was the only Parcel to receive refuse. **Initially marshland, the area of Parcel B received most of its refuse between 1957 and 1959.** Refuse had been placed by the City of Alameda in areas immediately adjacent to Parcel B, however, as early as 1947. Based on exploratory boreholes drilled through the refuse, **the composition of the waste placed in Parcel B is primarily dry demolition debris from buildings constructed of wood, concrete, brick and steel.** An area located immediately west of Parcel B, and owned by the City of Alameda, may have included the northwest corner of Parcel B, and was reportedly open to the public and received household refuse until about 1953. The total volume of fill material in Parcel B is estimated to be 340,000 cubic yards.

At the present time, the site has relatively flat topography with an elevation about 10 feet above the surrounding land. The fill cover material consists of silty clay, sandy clay and subangular gravel. A pumping station exists southeast and east of Parcel B which collects and pumps surface runoff from a drainage ditch that transects Parcel C. A tidal marshland is present along the northeast portion of Parcel B. Two 36-inch diameter culverts provide drainage to and from San Leandro Bay.

A preliminary hydrogeologic investigation utilized exploratory borings, test pits and piezometers to assess the local hydrogeologic characteristics of the site and to assist in the design of the SWAT investigation. The preliminary investigation indicated that the thickness of the refuse ranges between 10 and 15 feet and has been placed directly on native soils consisting of silty sand and Bay Mud. First groundwater, which appears to be significantly influenced by tidal behavior, is present at a depth generally less than five feet and shows a preferential flow direction to the east and northeast during low tide, and to the east and southeast during high tide.

Based on the findings of the preliminary hydrogeologic investigation, a SWAT investigation was designed and consisted of the drilling, installation and sampling of four water quality monitoring wells located on the perimeter of the facility (two upgradient and two downgradient), the sampling of three surface water locations (along drainages located on the north and southeast edges of the site), and water level monitoring of the four monitoring wells, and eight piezometers. Vadose zone sampling was not performed because of the shallow groundwater depth beneath the site.

Groundwater and surface water quality samples have been collected on four occasions in November, 1989, January, 1990, March, 1990 and May, 1990. Samples were analyzed for volatile and semi-volatile organic compounds (EPA Method 624 and 625), metals (by inductively coupled argon plasma emission spectroscopy and atomic absorption spectroscopy), total organic carbon, total Kjeldahl nitrogen, specific conductance, pH, total dissolved solids and chloride. Both standard Target List compounds and tentatively identified (library search) volatile and semi-volatile organic compounds were analyzed. The surface water sample located nearest to the National Airmotive Testing Facility was analyzed only in November 1989 for the full suite of parameters but was subsequently analyzed for total petroleum hydrocarbons.

The results of the groundwater analyses indicate the presence of six volatile organic and one semi-volatile organic Target List compounds. However, the volatile organic compounds were not detected regularly in each sample, in each round, and were not detected at all during the May 1990 sampling event. Two of the volatile organic compounds and one semi-volatile Target List compound were not detected consistently in all sampling rounds.

The results of the surface water analyses indicate the presence of no Target List volatile organic compounds and only one Target List semi-volatile organic compound in samples from two of the surface water locations (SW-1 and SW-2), and the presence of six Target List volatile and semivolatile organic compounds in samples from the third surface water location (SW-3) located in the southeast section of the site. Samples from SW-3 also showed concentrations of four metals above respective MCL values, high concentrations of hydrocarbons, and the presence of JP4 aviation fuel. The chemistry of the surface water samples is directly influenced by intruding high solute Bay water with the exception of the sample from location SW-3 near the National Airmotive Testing Facility which indicates a source similar in basic character to a typically dilute domestic water supply.

The highest number of detected target list and library search compounds were observed in the samples from [redacted]n the southeast corner of Panel B. This well is located near the surface drainage from which [redacted]has been collected and there is reason to believe that any detected chemicals in the groundwater at this location have been introduced from the surface drainage. The concentrations of the inorganic constituent parameters chloride and total dissolved solids were regularly detected at levels which exceed the secondary maximum contaminant level drinking water standards for the respective parameters. The high concentrations are, however, not conclusive of the presence of landfill leachate and are more indicative of the influence of Bay water intrusion to the groundwater regime beneath the site.

As a result of the SWAT Investigation at the North Port of Oakland Disposal Site, it is concluded that hazardous waste is not being generated by the disposal site and is, therefore, not leaking to the surrounding environment. The presence of organic compounds in the groundwater in the southeast portion of the landfill are believed to be the result of surface and/or subsurface infiltration from an adjacent chemical source not associated with the landfill. High concentrations of certain inorganic parameters are interpreted to be due to the intrusion of saline Bay water beneath the site and are not being produced by the presence of landfill leachate.

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ii. CERTIFICATION

The Solid Waste Assessment Test (SWAT) Report for the North Port of Oakland Refuse Disposal Site was developed by me, or under my direction and is complete and accurate to the best of my knowledge. The SWAT Report satisfies the requirements of AB3525. The hydrogeology investigation portion of the SWAT Report was conducted by qualified professionals having five or more years each of experience in groundwater hydrology.

Donald O. West 6-27-90

Donald O. West, R.G., C.E.G. Date
R.G. 3498 Expiration Date: June 30, 1990
C.E.G. 1229 Expiration Date: June 30, 1990

1. INTRODUCTION

This document presents a Solid Waste Assessment Test (SWAT) Report for the North Port of Oakland Refuse Disposal Site. The site, which is currently owned by the Port of Oakland, is located near the intersection of Doolittle Drive and Harbor Pay Parkway in Oakland, California (Figure 1). The SWAT Report presents the results of the SWAT Investigation performed at the site by Golder Associates Inc. on behalf of Oakland Scavenger Company, a wholly owned subsidiary of Waste Management of North America, Inc. (WMNA). The SWAT Investigation was initiated pursuant to Section 13273 of the Water Code (Chapter 1532 of the California Code of Regulations) which requires the operator(s) of Rank 4 disposal sites to submit a SWAT Report to the Regional Water Quality Control Board (RWQCB) by July 1, 1990.

This SWAT Report is organized to present information relative to the following:

- Site background;
- Assessment of site geology, hydrology and soils data;
- Monitoring well locations and construction details;
- Historical water level measurement data;
- Groundwater and surface water sampling; and
- Interpretation of chemical data with respect to the presence of hazardous waste at the site.

Much of the rationale used to determine the appropriate water quality sampling locations is based on the results of the preliminary hydrogeologic investigation described in the SWAT Proposal (Golder Associates Inc., 1989). The results of the preliminary investigation are summarized in this SWAT Report, however, the reader is referred to the SWAT Proposal for detailed information.

1.1 Previous Investigations

A preliminary hydrogeologic investigation was performed at the site in order to assist in characterizing the hydrogeologic conditions and identify past operation practices including waste types and locations of refuse placement. The results of the investigation provided the basis for the SWAT investigation described in a SWAT Proposal prepared for WMNA and submitted to the RWQCB on June 30, 1989.

The scope of work completed for the investigation included the review of past operation records, interviews with past employees and city and county representatives, and the review of low altitude aerial photographs. In addition, a field investigation was conducted which included the drilling and sampling of exploratory boreholes, excavation of test pits, installation of piezometers, and sampling and analysis of groundwater and surface water.

2. BACKGROUND - SITE ASSESSMENT DATA

This section is a summary, developed from Golder Associates Inc. (1989), of all relevant background data necessary for describing the characteristics of the North Port of Oakland Refuse Disposal Site. Any additional background information collected as a result of the SWAT Investigation is also included in this section.

Specific information on the site, presented in this section, includes:

- site description;
- waste and disposal history;
- site and regional geology;
- site and regional hydrogeology; and
- site soils data.

2.1 Site Description

The North Port of Oakland Refuse Disposal Site is located in Section 20, Township 2 South, Range 3 West, east of the intersection of Harbor Bay Parkway and Doolittle Drive in Oakland, California as shown in Figure 1. The site is bounded on the north by San Leandro Bay, on the east by marshland and an aircraft engine testing facility, and on the south by the Oakland International Airport's North Field

The site consists of three parcels identified as parcels A,B and C, respectively, as indicated on Figure 2. Parcel A, known as "Doolittle Pond," is bounded on the west by the City of Alameda Landfill, on the south by Doolittle Drive, and covers an area of approximately 13 acres. A 25-foot-wide berm forms the north and east boundaries of Parcel A. The berm is partially breached in two locations providing inflow and outflow of San Leandro Bay water.

Parcel B, located south of Parcel A, comprises an area of approximately 21 acres and is bounded on the north by Doolittle Drive, on the northeast by marshland, on the east by an aircraft engine testing facility, to the south by the Oakland Airport and a railroad tie storage area. Harbor Bay Parkway and the City of Alameda Municipal Golf Course form the westerly boundary. A small drainage separates Parcel B from Doolittle Drive. A second smaller drainage is located near the southeast corner of the Parcel.

Parcel C is located south of Parcel B and covers an area of approximately 10 acres. Oakland Airport's Runway 15/33 lies directly to the south. The elevation of Parcel C is near sea level and is relatively flat. A stormwater sump is located adjacent to the eastern portion of the parcel providing discharge of runoff water during the rainy season.

2.2 General Site History

The following historical account of the development of the site is based on the review of historical documents, aerial photographs and discussions with WMNA, Oakland Scavenger, Port of Oakland, and City of Alameda staff.

Prior to the development of Parcel B, the area was primarily marshland. By 1947 an area west of Parcel B began receiving refuse under what is currently the northeastern corner of the Alameda City Golf Course. This location was operated by the City of Alameda and reportedly only received household refuse. Between 1950 and 1953 the City of Alameda began placing refuse in the currently closed City of Alameda Landfill. Additionally, a small area near the northwest corner of Parcel B also received some refuse. Based on a review of aerial photographs, this area received refuse prior to initiation of a lease agreement between Oakland Scavenger and the Port of Oakland. Figure 2 identifies the area where this refuse was placed and the pre-site development conditions of Parcel B.

A lease agreement was initiated by the Port of Oakland (the lessor) with the Oakland Scavenger Company (the lessee) on January 5, 1959. The lease agreement included Parcels A, B and C as identified in "Port of Oakland Drawing No. BB-2652 M.O.I.A. Proposed Refuse Disposal Site, dated August 1957, Rev. 12/6/57". The lease was terminated on August 10, 1974. A review of aerial photographs indicates Parcel B continued to receive refuse at least through 1959.

A review of aerial photographs taken between March 1947 and April 1973 reveals that the subgrade and berms of Parcel A were constructed by 1965. Based on interviews with City of Alameda Staff refuse filling of Parcel A was intended to begin in 1966. The twenty-five foot wide berm constructed around the perimeter of the parcel, is still present today. The berm was reportedly constructed of demolition debris derived from a car dealership previously located on 98th Avenue in Oakland, California. An anti-syphon device was installed near the southeast corner of the parcel to flush and replenish bay water within the bermed area. No refuse was placed in Parcel A as supported by the review of aerial photographs and visual observation made during low tide.

Based on the review of aerial photographs, site inspections and exploratory drilling, no refuse was placed in Parcel C.

2.2.1 Waste Disposal History of Parcel B

The composition of the waste, filled in Parcel B, is primarily demolition debris. Interviews with past Oakland Scavenger employees indicate Parcel B was closed to the public and received dry demolition debris primarily from buildings consisting of wood, concrete, brick and steel. The landfill area west of Parcel B, owned and operated by the City of Alameda reportedly was open to the public and received household refuse. The dry wastes included in these areas were reportedly burned every two to three days to aid in compaction and mitigate differential settlement impacts.

The lateral limits of the Parcel B fill area are shown in Figure 2. The thickness of the fill within the limits of Parcel B varies across the site with the thickest portion of the fill occurring near the center (approximately 14 feet) and thinning to the outer boundaries of the fill area. The total quantity of fill material is estimated to be 340,000 cubic yards, based on the review of the exploratory borings and the limits of waste disposal.

Prior to landfill development, the tidal waters present in Parcel B were reportedly discharged by pumping. Refuse disposal operations were initiated along the western edge of Parcel B and proceeded laterally towards the eastern portion of the site. Demolition debris was reportedly hauled to the site using end dumps. Upon reaching the site, the debris was dumped and compacted using D-8 caterpillars. The fill material was brought to final grade as filling proceeded laterally.

Additionally, a six-inch to two-foot thick layer of final soil cover was placed and tracked over the refuse concurrent with the filling operation. The cover material consists of silty clay, sandy clay and 1/2 inch diameter subangular gravel reportedly imported from Leona Quarry and other areas within the Oakland/Hayward hills.

Based on field observations of the refuse and soil interface made during exploratory drilling, the refuse was placed directly on native underlying soils. As indicated previously, the exact date of closure is unknown, however based on a review of aerial photographs, discussions with City of Alameda Staff and past Oakland Scavenger employees it is estimated to be after the last placement of refuse in 1959 and early 1960.

The present topography of the site is relatively flat and slopes gently to the outer edges of the parcel. The berm, present prior to landfill operations, remains intact and represents the southern extent of refuse. The elevation of the fill area is generally about 10 feet above the surrounding topography. A significant amount of settlement of the fill surface is observed associated with several structures located along the western edge of the landfill. Site inspections revealed that at least two feet of settlement relative to these structures has occurred over time. The settlement is interpreted to be most likely due to the varying compaction characteristics of the demolition debris, the unconsolidated nature of the underlying soils, and compaction methods employed at the site.

2.3 Present Land Use

The National Oceanic and Atmospheric Administration (NOAA) currently maintains facilities at the landfill as shown on Figure 3. Additionally, the Port of Oakland currently maintains an athletic field and building that were previously used by the Oakland Raiders football organization. The field is reportedly not in present use. National Airmotive currently maintains and operates an aircraft turbine engine testing facility on the south eastern edge of the landfill.

Doolittle Pond (Parcel A) is currently a wildlife preserve maintained by the East Bay Regional Park District. Waterfowl inhabit the pond in great concentrations, using the banks of the berm for nesting. Immediately adjacent to Parcel A (on the west) is the closed City of

Alameda Landfill. A model airplane field at the southeast corner of the landfill is maintained by the City of Alameda.

The Alameda Municipal Golf Course is located west of Parcel B. As noted previously, the northeastern portion of the golf course was previously used as a refuse disposal area. The golf course is irrigated regularly with water supplied by deep on-site irrigation wells.

A railroad tie storage area lies directly southwest and west of Parcels B and C, respectively. The owner of the ties is unknown and no information is available regarding how long the ties have been stored there. Directly south of Parcel B is Oakland Airport's Runway 15/33. Southeast and east of Parcels B and C, respectively, the Port of Oakland operates a pumping station and sump which collects and pumps surface runoff from a drainage ditch which transects Parcel C in an east-west direction. Water is pumped to a channel (along the east side of Earhart Drive) which empties into San Leandro Bay.

A tidal marshland is present along the northeast portion of Parcel B. Two 36-inch diameter culverts provide drainage to and from San Leandro Bay.

2.4 Regional Hydrogeology

The site is located along the edge of the San Francisco Bay in a portion of the area identified as the East Bay Plain. The region is bounded on the north by the Oakland Alluvial Plain, on the east by the foothills of the Diablo Range, on the south by the San Leandro alluvial cone and on the west by the San Francisco Bay. The Quaternary alluvial deposits in the region have been described by Helley et al. (1972). The geologic conditions of the region are depicted in geologic maps and cross-sections presented in the SWAT Proposal (Golder Associates Inc., 1989, Figures 4 and 5). These conditions are consistent with those later described from the results of the SWAT Investigation (Section 3.1.4). No change in the geologic characteristics of the site reported in the SWAT Proposal was determined as a result of the SWAT Investigation.

The East Bay Plain is situated on the eastern side of the San Francisco Bay depression. The East Bay Plain includes an alluvial area close to the foothills of the Oakland/Hayward Hills and a marshland area adjacent to San Francisco Bay. The alluvial materials near the site are included as part of the San Leandro alluvial cone.

The geologic structure of the East Bay Plain is dominated by northwest trending faults such as the Hayward Fault. The Hayward fault is the closest active fault and is located approximately four miles northeast of the site.

The alluvial sediments of the East Bay Plain consist of a mixture of gravels, sands, and clays (Pliocene to late Pleistocene) deposited by coalescing alluvial fans west of the foothills. The particle size and bed thickness of the alluvium generally decreases westward from the foothills where drainages exit the foothills. The aquifers associated with the San Leandro cone are composed of gently westward-sloping sand and gravel beds deposited by meandering streams. Adjacent to the streams, the deposits are described as being well sorted permeable gravel and sand. Adjoining the stream channels, the alluvium contains poorly sorted, silty sand, gravel and more fines. During flood flows fine-grained flood plain deposits were laid down laterally over the banks of the channels.

In the vicinity of the site, estuarine deposits were laid down during times of transgressive seas associated with Pleistocene interglacial periods. These sediments are primarily bluish gray clays which are fairly continuous beneath the present-day San Francisco Bay. These sediments are known as Bay Mud. Extensive sand and gravel beds were deposited by San Leandro Creek as well as by Alameda and San Lorenzo Creeks during lower sea level conditions associated with glacial periods of the Pleistocene.

Groundwater recharge to aquifers in the East Bay Plain is poorly understood. Confined and unconfined aquifers are present in the area. Recharge of shallow unconfined aquifers is thought to be by direct infiltration of precipitation, irrigation and streamflow while the recharge of confined aquifers is thought to be primarily by subsurface inflow from adjacent aquifers and leakage between aquifers (Hickenbottom and Muir, 1988).

The groundwater of the East Bay Plain is generally of a calcium- to sodium-bicarbonate chemical type and is low in total dissolved solids (300 to 1000 mg/L) (Hickenbottom and Muir, 1988). Though the general water quality of the shallow aquifers of the East Bay Plain is reported to be of good quality (Hickenbottom and Muir, 1988), there are indications of high nitrate levels (Maslonkowski, 1984), salt-water intrusion (particularly in the San Leandro, San Lorenzo, Alameda, and Oakland areas) (Maslonkowski, 1984), and bacterial and chemical contamination (Hickenbottom and Muir, 1988). Chemical constituents reported to have been detected in the shallow groundwater include petroleum products, lead and chromium, and benzene, acetone and other organic solvents. As of 1988, no chemical leaks from surface storage facilities to the subsurface had been reported in the vicinity of the North Port of Oakland Disposal Site (Hickenbottom and Muir, 1988, Figure 17).

2.5 Regional Soil Types

The soils within a one-mile radius of the site have been classified by the U. S. Department of Agriculture Soil Conservation Service (SCS) (1981) and are depicted in Figure 6 of the SWAT Proposal (Golder Associates Inc., 1989). The area adjacent to and underlying the site has been classified as Urban Land, which is generally described as an area covered by buildings, roads, parking lots, and urban structures. The soil material is primarily heterogenous fill. Descriptions of other units surrounding the site are described below.

The Reyes clay is a poorly drained, deep soil located on tidal flats with slopes of less than two percent and elevations from sea level to five feet. It is formed in alluvium deposited from mixed sources. It is strongly alkaline. Usually, an olive gray layer of about six inches is on the surface, followed by approximately 36 inches of mottled dark greenish gray and black clay, and 30 inches more of a dark greenish gray clay. Below about 72 inches, polysulfides exist. Permeability and runoff are very slow. The available water capacity is from 0.5 to 3.0 inches, and the water table usually lies at 8 to 24 inches below the surface. The Baywood variant sand is typically a very deep and excessively drained soil formed in eolian sediment derived from old beach deposits. It is a slightly acid, loamy sand which, on the surface, is grayish brown and brown to about 32 inches, and becomes pale brown and light yellowish brown extending to 60 inches or more. Runoff is slow to medium, but permeability is rapid. Available water capacity is 4.0 to 5.5 inches. Roots extend deeper than 60 inches although, if left bare, wind erosion will occur.

The Urban Land-Baywood complex is usually about 60 percent Urban Land, 35 percent Baywood loamy sand, and 5 percent other soils, occurs on mounds and ridges adjacent to beaches at elevations of 10 to 60 feet and slopes of up to 8 percent. The Xerpsamments fill is characterized as a moderately alkaline, sandy material dredged from old beach areas, it occurs on elevations near sea level to 10 feet on slopes less than 2 percent and typically extends to 60 inches in depth. It may consist of as much as 5 percent shells by volume. It is rapidly permeable, runoff is slow, and the available water capacity is 3 to 4 inches. Root zones are from 40 to 60 inches deep. The hazard of erosion is slight although windblown soil may occur.

Although the site region is classified as Urban Land, the soil underlying the Parcel B landfill is interpreted to be estuarine deposits comparable to the Reyes clay.

2.5.2 Inventory of Wells

A total of 24 wells has been identified within a one-mile radius of the site. Figure 4 shows the locations of the wells. As indicated in Table 1, the majority of the wells are less than 100 feet deep. Well use is variable and includes irrigation, monitoring, geotechnical borings, and cathodic protection. Two deep wells greater than 500 feet provide irrigation water at the City of Alameda Municipal Golf Course. A review of the drillers' logs for these wells indicates well yields of 1150 to 1600 gallons per minute (gpm).

Six monitoring wells are located at the City of Alameda Landfill and are currently being monitored on a quarterly basis. A preliminary review of well logs indicates that these wells are generally less than 75 feet deep.

2.6 Site Hydrogeologic Data

To initially assess the local hydrogeological characteristics of the site, and to assist in the design of the SWAT Investigation, a preliminary hydrogeologic investigation at the North Port of Oakland Disposal Site was performed by Golder Associates Inc. (1989). This investigation, included the drilling of exploratory boreholes, installation of piezometers, excavation of test pits, monitoring of tidal and groundwater levels, and preliminary surface water and groundwater sampling. The locations of the borings, piezometers, and test pits are shown in Figure A-1 of the SWAT Proposal (Golder Associates Inc., 1989).

These investigations provided information on the vertical and horizontal extent of landfill refuse, the composition of the landfill and surrounding materials, the location of water bearing zones, the direction of groundwater flow, and preliminary water quality. The results of the investigations aided in the placement of water quality monitoring wells.

2.6.1 Groundwater Occurrence

Shallow groundwater was observed in five piezometers installed around the perimeter of the landfill during the preliminary investigation. These piezometers were installed both within the channel deposits and Bay Mud and range in depth from 7.5 to 17.5 feet below ground surface (bgs). Three deeper piezometers were installed in the Bay Mud at approximately 50 feet depth. The construction details of both the shallow and deep piezometers are given in Table 2. From the results of the preliminary investigations, shallow groundwater was found at a depth of two to three feet below ground surface around the perimeter of the landfill and at a depth of approximately six to nine feet below ground surface in boreholes drilled through the refuse.

Water level measurements were taken initially in both the shallow and deep piezometers during high and low tide conditions. The water level contours for the shallow zone were developed from shallow piezometers screened from approximately 2 to 15 feet below grade in both the channel and Bay Mud deposits. The potentiometric surface maps developed from the preliminary investigation are shown in Figures 11 and 12 of the SWAT Proposal (Golder Associates Inc., 1989). These figures show the groundwater flow to be toward the northeast and east in the shallow aquifer, and to the east and southeast in the deeper aquifer. The direction of the flow appears to be controlled in part the behavior of tidal conditions. The presence of a high tide causes a swing in flow toward the east and southeast, while the groundwater behavior is predominantly toward the east and northeast during low tide. The hydraulic gradient under both tidal influences ranges between 0.002 ft/ft and 0.005 ft/ft. A slightly steeper gradient in the deeper groundwater horizon during low tide suggests that some degree of hydraulic continuity may exist between the deeper Bay Mud and San Leandro Bay. This groundwater flow behavior is consistent to that observed during the SWAT Investigation (Section 3.3.2).

Water level monitoring was conducted in shallow piezometers to observe potential tidal response on shallow groundwater. Tidal monitoring was conducted near the intersection of Doolittle Drive and Earhart Road concurrently with water level monitoring in order to observe tidal response. The results of the monitoring are shown in Figure 14 of the SWAT Proposal (Golder Associates Inc., 1989). The results of the tidal monitoring indicate that some degree of hydraulic continuity exists between the shallow channel deposits underlying the landfill and San Leandro Bay.

2.6.2 Surface Water Occurrence

Four surface water drainages are located in and adjacent to the landfill (Figure 3). One drainage transects the northern edge of the landfill and Doolittle Drive. Surface water generally flows from west to east. A 36-inch diameter culvert (under Earhart Drive) provides flow from this drainage to the marshland area near the northeast side of the site. A second drainage parallels the east side of Earhart Drive. Two 36-inch diameter culverts (under Doolittle Drive) provide flow to and from San Leandro Bay for both of these drainages. These two drainages have been observed to fluctuate in response to tidal changes. A third drainage which trends east-west, is present near the southeast corner of the landfill. No measurable amount of water level fluctuation has been observed in this drainage to-date that would suggest direct communication with other adjacent or nearby tidal channels.

A fourth drainage is present near the east side of Parcel C and was constructed to collect surface runoff from the airport runway and nearby areas during the winter rainy season. During periods of high runoff, water from this drainage is pumped to San Leandro Bay.

2.6.3 Site Stratigraphy

Based on the data from the exploratory borings, the site is underlain by four basic units including: 1) soil cover; 2) refuse; 3) silty sand; and, 4) Bay mud. The soil cover consists of a mixture of firm to stiff silty clay to sandy clay with 0.5-inch diameter subangular gravel. The thickness of the soil cover as observed in the exploratory borings generally ranged from six inches to two feet.

Below the cover, the exploratory borings and trenches encountered refuse consisting of a mixture of soil and construction debris including concrete, brick, wood, metal and plastic. The thickness of the refuse was variable but generally ranged from 10 to 15 feet.

Below the refuse, a 5 to 15-foot thick horizon of loose, silty sand was encountered. Bay Mud, which consists of soft silty clay to clay with occasional silt and sand lenses, was encountered at depth in all borings.

Cross-section diagrams showing the lateral and vertical distribution of refuse and the underlying lithologic units across the site were presented as Figures 9 and 10 in the SWAT Proposal (Golder Associates Inc., 1989). The conditions shown in these Figures are consistent with those described from the results of the SWAT Investigation (See Section 3.1.4). No changes in the observed distribution of refuse and underlying lithologic units at the Site exist between descriptions presented in the SWAT Proposal and the SWAT Report.

3. SWAT INVESTIGATION

This section presents the results of the hydrogeologic investigations performed at the North Port of Oakland Refuse Disposal Site as originally proposed in the SWAT Proposal (Golder Associates Inc., 1989). Included in the following discussions is detailed information regarding monitoring well installation, surface water and groundwater sampling procedures, and surface water and groundwater sampling results. The conclusions reached from the results of the sampling program are presented in Section 4.

3.1 Monitoring Well Installation

Monitoring wells were installed at the North Port of Oakland Disposal Site so as to obtain representative water quality samples from the uppermost water-bearing zone beneath the site.

Four monitoring wells were installed and constructed so as to be in compliance with Section 2555(c) and 2555(d) of the Water Code.

3.1.1. Well Locations

As originally proposed in the SWAT Proposal, four shallow monitoring wells–MW-1, MW-2, MW-3, and MW-4–were installed around the perimeter of the landfill to sample upgradient and downgradient water quality. The wells were installed to penetrate the shallow channel sediments which underlie the landfill and which represent the horizon of the uppermost water-bearing zone beneath the site. The locations of the monitoring wells are shown in Figure 3.

3.1.2. Construction Design

The construction details for each monitoring well, including elevation, borehole diameter, well depth, screened interval, filter-pack interval, and filter-seal interval are summarized in Table 2. The monitoring well construction logs and the soil boring logs are presented in Appendix A. A discussion of the drilling activities for each of the monitoring wells is given below.

A decontamination area was established on-site for steam cleaning drilling and sampling equipment before the drilling of each new well. Each boring was continuously cored using hollow stem auger drilling techniques to ensure that the target monitoring zone was reached. Soil samples were described according to the Unified Soil Classification System.

Each of the wells was completed with four-inch I.D. PVC well casing and screen. The well screen and filter pack for each well was constructed with 0.01-inch slotted screen and Lonestar 1/20 graded sand. The screen slot size and filter pack sand were determined from the soil grain size analyses performed as part of the preliminary hydrogeologic investigation. The results of the eight soil grain size analyses performed are reported in Appendix B of the SWAT Proposal (Golder Associates Inc., 1989). Soil grain size distributions measured from soil samples obtained during the installation of the monitoring wells confirm the results of the preliminary investigation. The soil grain size distribution curves are presented in Appendix B. The use of a 0.01-inch slot size is determined to be sufficient to screen out at least 90% of the filter pack material.

Other soil properties tested during the installation of monitoring wells include specific gravity, permeability and natural moisture content (Table 3). The values obtained for specific gravity, 2.76 to 2.80 gms/cm^3, correspond to values typical of the range of soils from sands to clays, respectively. Natural moisture contents ranging from 17% to oversaturation were computed for the tested soils. These values may not be indicative of true soil conditions because of the draining of the soils due to tidal dewatering. Permeability values in the range of 3.0 x 10^{-4} cm/sec to 6.0 x 10^{-6} cm/sec were obtained from laboratory testing of the soil samples. The low values of permeability indicate that the horizons from which the tested soils were collected contain significant clay and fine grained sediment. However, the sample from MW-3 was composed primarily of fine sand and should have shown a permeability of greater than the

4.0 x 10^{8} cm/sec reported. It is hypothesized that a clay seam may have interfered in the testing of this sample.

The reported laboratory-tested soil permeability values are five orders of magnitude less than the calculated values of hydraulic conductivity achieved during hydrologic slug testing of the monitoring wells (see Section 3.2). The magnitude of the difference between the two sets of values, though large, may be explained in part by considering the nature of the specific test. Since the laboratory tests involve a much smaller testing scale (0.5-foot vertical test section) than the field hydrologic tests, and increased density of fine sediments in a sampled soil core (e.g., a clay seam) will significantly affect the results of the test by decreasing the overall permeability of the tested soil core. The field hydrologic test, meanwhile, involves testing a much larger soil interval both vertically and radially. If a moderately permeable sand seam is within the region of influence of the test, the results may show a higher hydraulic conductivity for the tested zone than if the sand seam were isolated from the test. In this sense, the results of the field hydrologic test represent the cumulative effect of the entire hydraulic zone thickness and may give a more representative characterization of the hydraulic properties of the shallow subsurface materials than would the testing of limited soil cores.

During the drilling of the boreholes, environmental monitoring of the ambient air within the borehole was performed. Measurements of the concentrations of organic vapors (in ppm) and the percentage of combustible gas were performed concurrent to drilling and were taken at approximately 5-foot depth intervals. The percentage of combustible gas in the boreholes was measured with respect to the lower explosive limit (LEL) of methane. The LEL of methane is defined as the concentration of methane in air by volume at which the gas/air mixture can burn or explode. This concentration for methane is 50,000 ppm (5% methane in air) and is read as 100% LEL by the monitoring equipment (MSA 361 explosimeter or equivalent device).

Following well installation, well development was initiated using a combination of methods which included bailing, surging, and pumping. Initially, wells were bailed to remove formation materials within the well. After bailing, the wells were further developed by surging, bailing and pumping until the water became clear and relatively free of sediment. Field parameters, consisting of pH, temperature and specific conductivity were measured during development activities. The results of well development including purge volumes and field parameters are included in the well construction diagram presented in Appendix B.

After installation and development, the four monitoring wells were surveyed by Isakson and Associates Inc. of Walnut Creek, California. The elevations of the wells and piezometers obtained from the survey are relative to the City of Alameda Datum.

Well MW-1

Well MW-1 was drilled and installed on October 12, 1989. The well is one of two upgradient monitoring wells and has a surface elevation of 103.48 feet relative to the City of Alameda Datum. The well was drilled to a total depth of 15.0 feet using a hollow-stem auger drill rig with 10-inch O.D. auger flights. Drilling progressed through one foot of loose dark brown silt, some gravel and silt (soil cover), refuse consisting of concrete chunks, metal fragments, wood and glass from 1 foot below ground surface (bgs) to 5 feet bgs, silty clay from 5 feet bgs to 7 feet bgs, and Bay Mud from 7.0 feet bgs to the bottom of the borehole at 15.0 feet bgs. A 2-inch shell horizon was encountered at approximately 14.0 feet bgs. Groundwater was first encountered at a depth of about 5.5-feet bgs while drilling MW-1.

The well was completed with 10-feet of four-inch I.D. schedule 40 PVC slotted screen set from 5 feet to 15 feet bgs, and 7.5 feet of schedule 40 PVC casing from 5 feet bgs to 1.7 feet above ground surface. The annular seal consists of filter pack sand (3 feet bgs to 15 feet bgs), bentonite pellets (1.5 feet bgs to 3 feet bgs), and cement/sand grout (1.5 feet bgs to the surface). A locking steel security cover was installed over the well.

Environmental air monitoring was conducted during the drilling of borehole MW-1. A reading of 2% LEL (lower explosive limit) was recorded as measured from the top of the borehole when the drilling depth had reached a depth of 10.5 feet bgs. No other readings above 0% LEL were observed, nor were organic vapors detected.

Well MW-2

Well MW-2 was drilled and installed on October 12, 1989. The well is the second of two upgradient monitoring wells and has a surface elevation of 102.19 feet above the City of Alameda Datum. The well was drilled to a total depth of 15.0 feet using a hollow-stem auger drill rig with 10-inch O.D. auger flights. Drilling progressed through silty to sandy clay (0-feet to 4.0 feet bgs), silty clay with glass refuse (4.0 to 7.0 feet bgs), and Bay Mud (7.0 feet bgs to 15.0 feet bgs). Some organic materials were observed from the surface to a depth of 10.5 feet bgs with no organics observed from 10.5 feet bgs to the bottom of the hole. Groundwater was first encountered at a depth of approximately 2.5 feet bgs.

The well was completed with 10-feet of four-inch I.D. schedule 40 PVC well screen and 7.5 feet of schedule 40 PVC well casing (casing stick-up is 1.9 feet). The annular space consists of a filter sand pack (2.5 feet bgs to 15.0 feet bgs), a bentonite pellet seal (1.0 feet bgs to 2.5 feet bgs), and a cement/sand grout (0 feet bgs to 1.0 feet bgs). A locking steel security cover was installed over the well.

Environmental air monitoring was conducted during the drilling of borehole MW-2. A reading of 10% LEL was recorded as measured from the top of the borehole when the drilling had reached a depth of 7.5 feet bgs. A reading of 8% LEL was also observed at a drilling depth of 15.0 feet bgs. No other readings above 0% LEL were observed. At a drilling depth of 10.5 bgs, a reading of 0.1 ppm organic vapor was detected at the mouth of the borehole. Organic vapors were not detected at any other depth during drilling.

Well MW-3

Well MW-3 was drilled and installed on October 13, 1989. The well is one of two downgradient monitoring wells and has a surface elevation of 102.48 feet above the City of Alameda Datum. The well was drilled to a total depth initially of 18.0 feet using a hollow-stem auger drill rig with 10-inch O.D. auger flights. Drilling progressed through silty clay to gravel (0 feet to 6.0 feet bgs), fine to coarse sands with gravel (6.0 to 16.0 feet bgs), and Bay Mud (16.0 feet bgs to 18.0 feet bgs). Upon pulling the augers from the borehole, however, the bottom 10 feet of the hole slumped in leaving a borehole depth of 8.0 feet bgs. The hole was then rebored using 12-inch O.D. augers and the well was completed. Groundwater was first encountered at about 4.5-feet bgs while drilling MW-3.

The well was completed with 15-feet of four-inch I.D. schedule 40 PVC well screen and 5.0 feet of schedule 40 PVC well casing (casing stick-up is 0.9 feet). The annular space consists of a filter sand pack (2.5 feet bgs to 18.0 feet bgs), a bentonite pellet seal (1.5 feet bgs to 2.5 feet bgs), and a cement/sand grout (0 feet bgs to 1.5 feet bgs. A locking steel security cover was installed over the well.

Environmental air monitoring during the drilling did not indicate the presence of organic or explosive gases within the borehole.

Well MW-4

Well MW-4 was drilled and installed on October 13, 1989. The well is the second of two downgradient monitoring wells and has a surface elevation of 102.52 feet above the City of Alameda Datum. The well was initially drilled to a total depth of 15.0 feet using a hollow-stem auger drill rig with 10-inch O.D. auger flights. Drilling progressed through silty clay (0-feet to 7.0 feet bgs), fine to coarse sands (7.0 to 10.5 feet bgs), and Bay Mud (12.0 feet bgs to 15.0 feet bgs). Groundwater was first encountered at a depth of approximately 5.0 feet bgs while drilling well MW-4.

Upon removal of the auger flights, a high rate of groundwater flow was observed entering the borehole. This induced some borehole wall slumping. The hole was, therefore, backfilled with bentonite pellets to 12 feet bgs and then completed.

The well was completed with 12-feet of four-inch I.D. schedule 40 PVC well screen and 5.0 feet of schedule 40 PVC well casing (casing stick-up is 1.1 feet). The annular space consists of a filter sand pack (3.0 feet bgs to 12.0 feet bgs), a bentonite pellet seal (1.5 feet bgs to 3.0 feet bgs), and a cement/sand grout (0 feet bgs to 1.5 feet bgs). A locking steel security cover was installed over the well.

Environmental air monitoring during the drilling did not indicate the presence of organic or explosive gases within the borehole.

3.1.3. Quality Assurance

Each of the four monitoring wells was designed and installed to be in compliance with Section 2555(c) and (d) of the Water Code. Documentation of monitoring well Quality Assurance is presented in this SWAT Report in the form of construction as-built diagrams (Appendix B). The rationale for monitoring well locations and construction design is discussed above in Section 3.1.1 and 3.1.2, as well as in the SWAT Proposal.

3.1.4. Site Stratigraphy

The general stratigraphy across the site as modified by information obtained during the drilling of boreholes MW-1 through MW-2 is shown in Figures 6 through 8. The relationships between the various soil units are consistent to those identified in the SWAT Proposal. The additional cross-section C-C′ was constructed to depict the subsurface conditions at the location of monitoring well MW-3. This cross-section is significant in that it shows the presence of a relatively thick section (15 feet) of a silty sand and gravel channel deposit. During the installation- of well MW-3, this deposit was observed to produce significant water, and is interpreted to be in hydraulic communication with bay water and thus is expected to respond quickly to tidal changes.

3.2 Hydrogeologic Testing

As a means of obtaining hydraulic conductivity estimates of subsurface materials at the site, a series of variable head tests were performed in monitoring wells MW-1, MW-2, MW-3 and MW-4. Variable head, or slug tests, are a relatively quick means for obtaining approximate values of aquifer parameters. The tests provide point estimates of hydraulic conductivity representative of materials immediately in the vicinity of the screened portion of the well, and therefore, must be viewed as first approximations to the aquifer values.

3.2.1 Field Methods

The tests were initiated by causing a nearly instantaneous change in the level of water within the well through the sudden removal or introduction of a slug of known volume followed by monitoring of the water level recovery with time. The slug consisted of a sealed 10-foot-long section of 3-in diameter PVC filled with sand which could be quickly lowered into or removed from the well. Water level recovery was monitored using a submersible pressure transducer (0-5 psi range) in conjunction with a MINI/8[R] data acquisition system for data storage and transfer.

Both rising and falling head tests were performed in each well. The sudden rise in water level following addition of the slug into the well and the subsequent water level decline to the original level constituted a falling head test. At the completion of a falling head test, the slug was removed from the well causing a rapid water level decline. Monitoring of the water level recovery constituted a rising head test. At least one rising and one falling head test was performed in each of the four wells. In well MW-1 two tests of each type were performed.

3.2.2 Analysis

Data interpretation was performed by the method discussed in Hvorslev (1951). The method is based on the reasoning that the rate of inflow with time, q, into or out of the piezometer is proportional to the hydraulic conductivity, K, and the unrecovered head difference, H-h:

$$q(t) = FK(H-h) \quad [1]$$

where F is a shape factor dependent on the dimensions of the piezometer. The basic time lag, T_o, is defined as follows,

$$T_o = (pi*r^2)/F*K \quad [2]$$

and when substituted in Eq. [1], results in an ordinary differential equation. The solution, with the initial condition that the $h=H_o$ at $t=0$ is,

$$(H-h)/(H-H_o) = e^{-t/To} \quad [3]$$

where H is the head of water in the well prior to any drawdown, h is the head at time t, and H_o is the water level in the evacuated well. We note that in Eq. [3] when $(H-h)/(H-H_o) = 0.37$, $T_o=t$. The basic time lag, T_o, therefore, can be determined graphically from a plot of the natural logarithm of $(H-h)/(H-H_o)$ versus time. Hydraulic conductivity can then be determined from Eq. [2]. Hvorslev (1951) evaluated the shape factor, F. With a piezometer of length, L, and a radius, r, the resulting expression for K is,

$$K = r^2*ln(L/r)/(2*L*T_o) \quad [4]$$

The analysis above assumes that the medium is homogeneous, infinite, and isotropic and that the medium and water are both incompressible. These assumptions and conditions have not been completely satisfied in this analysis. As a result, estimates obtained by this method should be viewed as only rough approximations to the actual parameters.

3.2.3 Results

Hydraulic conductivity values determined from the slug tests are summarized in Table 4. The test data have been plotted in Figures D1 through D8 in Appendix D. In fitting straight line sections to the data curves, emphasis has been placed on the early-time data, in accordance with the method of Hvorslev. Chirlin (1989) has pointed out that this approach ignores the storativity of the medium and can result in errors in the calculated values of conductivity of as much as one order of magnitude. The values of conductivity are, therefore, very approximate. Hydraulic conductivity values determined from the slug tests ranged over approximately one-order of magnitude from about 5×10^{-2} to about 3×10^{-3} cm/s. Considering the material screened by the four wells, the magnitude of the values is not surprising.

Within each series of tests at a particular well, the calculated values were fairly consistent with one another. Performance of the falling head tests, however, consistently resulted in hydraulic conductivities that were up to twice as large as those determined in the rising head tests. One explanation for the systematic difference between values from rising and falling head tests in the same well is the possible release of gas bubbles in the medium when the low pressures occur at the start of the rising head test. These could temporarily block pores and give the appearance of reduced conductivity.

3.3 Groundwater and Surface Water Sampling

3.3.1. Sampling Locations

Groundwater Sampling Locations

Groundwater samples were obtained from four locations as defined by monitoring wells MW-1, MW-2, MW-3 and MW-4 (Figure 3). The rationale used to locate these wells was discussed above in Section 3.1.1.

Surface Water Locations

Surface water samples were collected from the three locations shown in Figure 3. Two locations were situated along the northern drainage between the landfill and Doolittle Drive; one location at the western end of the drainage and one locations at the eastern end of the drainage. These sample locations were chosen to provide an indication of background surface water quality (at the western end of the drainage) and potential downstream degradation of water quality (at the eastern end of the drainage) from the landfill. **A third sample location (SW-3) was chosen to evaluate potential impacts from the aircraft engine testing facility as well as landfill impacts on surface water in the southeastern drainage (see Figure 3).**

Vadose Zone Sampling

Because of the shallow groundwater depth beneath the site, no vadose zone sampling was performed.

3.3.2. Sampling and Analytical Procedures

Sampling procedures capable of obtaining representative samples were used in the sampling program as outlined in the SWAT Proposal (Golder Associates Inc., 1989). Procedures follow guidelines emplaced by the State Water Resources Control Board (1988) and by the U. S. Environmental Protection Agency (1986). Based on the results of the preliminary hydrogeologic investigation, the following analytical protocol was followed:

- Purgeable organics with all peaks reported by EPA Method 624;
- Base/Neutral and acid extractable organics with all peaks reported by EPA Method 625;

- Metals (Ag, As, Ba, Be, Ca, Cd, Cr, Cr^{6}, Co, Cu, Fe, K, Mn, Mo, Na, Ni, Pb, Sb, Ti, V, and Zn) by inductively coupled argon plasma emission spectroscopy (ICAP);
- Mercury and selenium by atomic absorption spectroscopy (AA);
- Total organic carbon;
- Total Kjeldahl nitrogen;
- Specific conductance;
- pH;
- Total dissolved solids;
- Chloride; and
- Total petroleum hydrocarbons (SW-3 only).

Those Target List volatile and semi-volatile organic compounds analyzed for by the EPA 624 and 625 methods are presented in Tables 6 and Table 7 along with the reported detection limits. Analyzed metals and other inorganic constituents are listed in Table 8 along with the respective reported detection limits.

Sample containers and holding times for analyses are listed in Appendix D of the SWAT Proposal (Golder Associates Inc., 1989) under the laboratory QA/QC Program Plan. All samples collected for metals analysis were filtered in the field through a 0.45 micron filter.

Once collected, samples were kept cool (at approximately 4°C) while awaiting transport to the analytical laboratory. Sample numbers were logged into field record and sample control sheets with purge volume, tidal information and other pertinent data also recorded. The samples were transported within 24-hours of collection under Chain-of-Custody to ENSECO California Analytical Laboratory for chemical analysis. Chain-of-Custody procedures followed are summarized in Section 7.8 of the SWAT Proposal (Golder Associates Inc., 1989).

Groundwater Sampling

Groundwater samples were collected using a dedicated submersible positive displacement bladder pump constructed of stainless steel and teflon materials. Prior to sampling, a water level measurement was taken referenced to the top of the well casing. Following water level measurements, the pump was lowered into the well to a depth consistent with the bottom portion of the well screen and well purging was initiated. Groundwater samples were collected after three to five well volumes were purged from the well (one volume equals the approximate volume of the standing water in the well casing plus the volume of water in the filter pack) and the field parameters pH, specific conductivity and temperature had stabilized.

Surface Water Sampling

Surface water samples were collected by submerging the sample container(s) approximately six inches below the water surface at each specific sample location. Samples requiring preservation were collected with clean sample jars and then poured into appropriate containers with preservative. Field parameters including pH, specific conductance, and temperature were measured at the time of sample collection. The presence of a high or low tide at the time of sample collection was noted in a field notebook.

3.3.3. Field and Laboratory QA/QC

The field QA/QC program consisted of analyzing various field blanks and duplicates to verify that the sample collection, handling and transport had not affected the quality of the samples and to check the internal consistency of laboratory procedures. Specifically, QA/QC samples included travel blanks, field blanks, and field duplicates.

Travel blanks consisting of "organic free" water in representative sample glassware were prepared by the laboratory and were transported with the sample collection glassware to and from the sample collection site. These samples were used to detect contamination from sample transport, glassware cleanings and laboratory storage. The samples were analyzed for volatile organic compounds using EPA Method 624. One travel blank sample was analyzed per transport container.

Field blank samples were used to detect contamination resulting from sampling equipment. The field blank was prepared by filling sample bottles with organic free water from the same decontaminated equipment used to collect the groundwater sample. The field blank samples were analyzed for volatile organic compounds using EPA Method 624. One field blank was prepared for each sampling round.

Field duplicate samples were collected to evaluate the reproducibility of the laboratory data. The samples were taken as a split of the actual groundwater sample but were labeled as an independent sample to remain "blind" to the laboratory. The field duplicate was analyzed for the same suite of analyses as the actual groundwater sample. One field duplicate was prepared for each round of sampling.

The laboratory QA/QC Program Plan followed by ENSECO California Laboratory is presented in Appendix D of the SWAT Proposal (Golder Associates Inc., 1989).

3.3.4. Sampling Schedule

Groundwater and surface water samples were collected over four sampling rounds during November, 1989, January, 1990, March, 1990, and, May, 1990, from each of the four monitoring wells and from each of the three surface water locations. Samples from each location were analyzed each round for the suite of constituents listed above in Section 3.3.2. with the exception of samples obtained from surface water location SW-3 in which the full suite of constituents were analyzed for only during the November, 1989 sampling event. Subsequent to the first quarter, samples collected from SW-3 were analyzed only for total petroleum hydrocarbons.

3.3.5. Water Level Measurements

Static water level measurements have been measured eight times for each of the four monitoring wells and five times for each of seven piezometers since their respective installations. The hydrographs for each of the wells or piezometers are presented in Appendix E. A summary of water level measurements for the monitoring wells and piezometers is given as Table 5.

The potentiometric surface of the uppermost water-bearing zone beneath the site for each of four rounds of water quality monitoring are shown in Figures 9 through 12. The most recent water level measurements (May, 1990) indicated a groundwater flow direction toward the southeast with a hydraulic gradient of approximately 0.0004 ft/ft (considering the difference in water level elevations and the linear distance between wells MW-2 and MW-4). Groundwater flow characteristics from the November 1989, January 1990, and March 1990 are similar with principal groundwater flow directions toward the east and southeast. The range of hydraulic gradients range from a low of 0.0004 ft/ft in May 1990 to a high of 0.0009 ft/ft in November 1989. The higher gradients occur most often during periods of incoming to high tide.

3.4 Data Interpretation and Discussion

The water quality results from each of the four rounds of sampling are summarized in Tables 9 through 17. Field parameter values for groundwater and surface water samples are listed in Table 9. The results for the volatile and semi-volatile Target List compounds are presented in Table 10 for the groundwater samples and in Table 14 for the surface water samples, and the tentatively identified detected volatile and semi-volatile organic compounds are presented in Table 11 for the groundwater samples and in Table 15 for the Surface Water samples. Tables 12 and 13 present the laboratory results for the concentrations of metals and other inorganic constituents in the groundwater samples, respectively, with the measured concentrations of the metals and other inorganic in the surface water samples presented in Tables 16 and 17. The results of the field duplicate analyses are shown in Table 18 and the results of the field QA/QC samples are listed in Table 19. For comparison, the results of the preliminary water quality samples taken as grab samples from boreholes are presented in Table 20 (described in the SWAT Proposal). Laboratory chemical analysis reports for each round of sampling are included in Appendix E.

3.4.1 Groundwater Samples

Groundwater samples from four monitoring wells were collected during the four sampling periods during November, 1989, January 1990, March, 1990 and May, 1990. The samples represent groundwater quality conditions in two upgradient monitoring wells (MW-1 and

MW-2) and two downgradient monitoring wells (MW-3 and MW-4). Groundwater samples were analyzed for volatile organic and semi-volatile organic compounds, metals, and general inorganic parameters.

Volatile and Semi-volatile Organic Compounds

The laboratory groundwater results from the EPA Method 624 volatile organic compound analyses are presented in Table 10. Six Target List compounds–1,2-Dichloroethane (cis/trans), trichloroethene, benzene, total xylene, 4-methyl-2-pentanone, and 2-hexanone–have been detected sporadically since the inception of monitoring, however, no volatile organic compounds were detected in samples collected during the May 1990 sampling event. Two of the detected compounds–4-methyl-2-pentanone and 2-hexanone–show maximum detected concentrations of 12.0 μg/L and 16.0 μg/L in well MW-1 (November 1989), respectively. These compounds are, however, common laboratory contaminants whose detection is not considered significant unless the reported concentration of the respective compound is at least five times the detection limit (5.0 μg/L) (U.S. Environmental Protection Agency, 1988). Since the presence of these compounds is also not confirmed in successive monitoring rounds, their presence is not reflective of environmental conditions.

The four additional detected volatile organic compounds also do not show a consistent pattern of occurrence. 1,2 dichloroethane has only been detected in the November 1989 sample from well MW-3 (24.0 μg/L), trichloroethene was detected twice in January 1990 (18.0 μg/L in well MW-1 and 7.1 μg/L in well MW-2), benzene was detected twice in well MW-4 (7.8 μg/L in January 1990 and 5.5 μg/L in March 1990), and total xylene was detected only during the January 1990 sampling of well MW-4 (8.1 μg/L). The established MCLs for 1,2-dichloroethane, trichloroethene, and benzene are each 5 μg/L. The MCL goal for total xylene is 1750 μg/L (Marshak, 1989). Similar to the compounds discussed above, the presence of these constituents is also not confirmed in successive monitoring rounds suggesting their presence is not reflective of environmental conditions.

In addition to the target list compounds, the results of the EPA 624 and 625 analyses for volatile and semi-volatile organic compounds also show the presence of additional organic compounds as indicated by peaks on the chromatogram for which an identification standard has not been prepared. Under the Contract Laboratory Program (CLP), the laboratory must attempt to identify the 30 highest peaks using computerized searches of a library containing mass spectra for particular compounds (U.S. Environmental Protection Agency, 1989). When the mass spectra match the unidentified peak, the compound is named; however, the assigned identity is often highly uncertain and the procedure used to obtain a rough estimate of the concentration of the compound may give values which could be order of magnitude higher or lower than the actual concentration. (U.S. Environmental Protection Agency, 1989). Therefore, unless other site or historical information is available which suggests that the tentatively identified compound (TIC) may actually be present, or unless many TICs are present relative to the Target Compound List, the TICs should not be considered a potential concern.

A total of 13 EPA Method 624 volatile TICs was detected in the groundwater samples from well MW-4 (Table 11). No EPA Method 624 TICs were reported in wells MW-1, MW-2 and levels of iron and manganese, two common constituents of bay water, are not considered significant. No heavy metals were detected in the groundwater samples.

The results of additional inorganic groundwater analyses are summarized in Table 13. The reported concentrations of chloride, which exceed the secondary MCL of 250 mg/L in all samples, indicate the significant influence of bay water on the groundwater regime. Concentrations of chloride for the most recent sampling event in May 1990 range from a low of 1,380 mg/L in well MW-1 to a high of 14,100 mg/L in well MW-3. As noted previously, the groundwater tapped by well MW-3 is believed to be the most affected of all the wells by tidal influences and bay water intrusion. The effect of bay water is also shown in the high reported values of TDS and specific conductance (maximum of 23,400 mg/L and 27,900 umhos/cm, respectively, in well MW-3 during the May 1990 sampling event). The MCL for TDS is 500 mg/L. Total cyanide was detected in the sample from well MW-4 in the November 1989 sampling event (0.012 mg/L) which is below the MCL of 0.2 mg/L. The concentrations of all other analyzed metals were below the respective MCL for that constituent.

3.4.2 Surface Water Samples

Surface water samples from three locations were collected over the four sampling periods from November 1989 through May 1990. Of these samples two (SW-1 and SW-2) were collected from the drainage ditch bounding the northern edge of the site. The third sample (SW-3) was collected from a small drainage ditch located at the southeast corner of the site. Surface water samples were analyzed for volatile organic, semi-volatile organics and metals and general inorganic parameters. Following the initial sampling event in November 1989 sample SW-3 was analyzed for total petroleum hydrocarbons only.

Volatile and Semi-volatile Organic Compounds

The laboratory surface water sample results for the EPA Method 624 volatile organic compound analyses are presented in Table 14. No volatile organic compounds were detected above their respective reporting limit in any of the samples collected from the northern drainage ditch (SW-1 and SW-2). Several halogenated and aromatic volatile organic compounds were detected in the single sample collected during the November 1989 sampling event from the southeast drainage (SW-3). These compounds included 1, 1, 1-trichloroethane (62 μg/L), toluene (270 μg/L), ethyl benzene (84 μg/L) and total xylene (500 μg/L). The MCL's for these constituents are 200μg/L, 2000 μg/L (proposed), 680 μg/L, and 1750 μg/L, respectively.

A total of 21 EPA Method 624 volatile TICs was reported for the surface water samples over the four rounds of sampling (Table 15). Ten of these compounds were reported for the November 1989 sample of SW-3. The TICs generally include a number of benzene isomers, alkanes and unknown compounds. Because the TICs identified as being present in samples from SW-1 and SW-2 are not consistently reported for each subsequent sampling round, and because no Target List volatile organic compounds were detected in SW-1 or SW-2, the presence of these compounds may not be reflective of actual environmental conditions and may represent laboratory contamination products or by-products. The high number (10) of identified TICs in the November 1989 sample from SW-3, however, may represent actual environmental conditions as several Target List compounds were also identified in this sample.

Concentrations of EPA Method 625 Target List semi-volatile organic compounds were also generally below the respective method detection limits for the analyzed constituents in samples obtained from SW-1 and SW-2. One exception, bis (2-ethylhexyl)-phthalate, a common laboratory contaminant, was observed in samples SW-1 and SW-2 during the November 1989 and January 1990 sampling episodes. This compound is a common plasticizer often found in rubber gloves, rubber septa seals used on the GC/MS instruments, and container caps. This compound was also detected in the method blank run as part of the laboratory quality control program further suggesting laboratory contamination. Two polynuclear aromatic hydrocarbon compounds, naphthalene and 2- methylnapthalene, were detected in sample SW-3 collected in November 1989 at concentrations of 4600 and 1700 $\mu g/L$, respectively.

Table 15 also presents the results of the EPA Method 625 library search for tentatively identified compound. A total of 32 semivolatile TICs was identified over the four sampling episodes. Similar to the EPA Method 624 library search, a number of benzene (or benzene isomers), alkanes, and unknown compounds were reported. Additionally, several other compounds were identified including substituted alkanes, benzenes and ethanol. The compounds reported in samples SW-1 and SW-2 are near the reporting limit of similar compounds (e.g. benzene), are not consistently observed in each of the four sampling rounds and, therefore, may not represent actual compounds present at the site but may be reflective of laboratory contamination. The TIC concentrations reported in Table 11 for sample SW-3 are significantly greater when compared to similar organic species (e.g. benzene) and, therefore, may be more reliable in terms of the actual presence of these compounds at the SW-3 location.

Total petroleum hydrocarbon analysis was performed on samples collected from southeast drainage (SW-3) during the January, March and May 1990 sampling episodes. The results of the analysis as indicated in Table 14 indicate the presence of an unknown hydrocarbon in the range of C7 to C27 quantified on the basis of diesel, stoddard and kerosene standards. The results of the May, 1990 sample analysis indicate the presence of aviation fuel comparable to JP4.

Total organic carbon analysis was performed on samples collected from the northern drainage (SW-1 and SW-2) during the four rounds of sampling and on the sample collected from the southeast drainage (SW-3) during the initial November 1989 sampling only. The results of the TOC analyses show values ranging from less than 2.0 $\mu g/L$ to 696 $\mu g/L$. The high value reported for sample SW-3 is consistent with the reporting of other organic compounds in this sample. The value of 314.0 $\mu g/L$ for the November 1989 sample in SW-1 is not maintained during subsequent sampling rounds. A comparable concentration of TOC is observed in the sample collected from well MW-2 located adjacent to SW-1. The relatively high concentration of TOC observed during November 1989 mat this location may be a result of surface run-off of hydrocarbons from adjacent roadways.

Metals and Inorganic Analyses

Total metal and general inorganic analyses were performed on surface water samples collected from the northern and southeastern drainages during the initial sampling and from the northern drainage (SW-1 and SW-2) during the three subsequent sampling rounds. The results of the metal analyses and the general inorganic parameters are indicated in Tables 16 and 17,respectively.

The results show that for analyzed metals, only the secondary drinking water MCLs of iron and manganese (0.3 mg/L and 0.05 mg/L, respectively) have been exceeded in samples from location SW-1 while only manganese has been exceeded in samples from location SW-2. However, for location SW-3, several constituents exceed established MCLs including aluminum, cadmium, iron and mercury. The established MCLs for these constituents are 1 mg/L, 0.01 mg/L, 0.3 mg/L, and 0.002 mg/L, respectively.

The samples obtained from locations SW-1 and SW-2 show the influence of bay water intruding into the surface water catchments. This is concluded form the relatively high metal concentrations of sodium (792.0 mg/L to 9,480.0 mg/L), magnesium (96.0 mg/L to 1,050.0 mg/L), calcium (61.6 mg/L to 373.0 mg/L) and potassium (76.8 mg/L to 376.0 mg/L). The sample from SW-3, however, shows significantly lower concentrations of the same analytes (16.9 mg/L sodium, 4.1 mg/L magnesium, 20.0 mg/L calcium, and 5.0 mg/L potassium). The observed dilute concentrations of these parameters in SW-3 suggest a source of water isolated from the effects of bay water as they are consistent with a domestic water supply.

Table 17 summarizes the additional inorganic chemical results for the surface water samples. Similar to the results of metals analyses, the high values of chloride, total dissolved solids, and specific conductance in samples SW-1 and SW-2 show the influence of bay water on surface water quality. The effects of tidal behavior on water quality are observed directly in the values of chloride for sample SW-1 as both the November, 1989 and January, 1990 samples show significantly lower values (1,420 mg/L and 1,600 mg/L, respectively) than the March, 1990 and May, 1990 samples (10,200 mg/L and 15,800 mg/L, respectively) indicating the presence of a low tide during the first two sampling events, and the presence of a high tide during the last two sampling events. Similar to the results of the metals analysis, the significantly lower values of chloride, specific conductance and TDS (5.5 mg/L, 188 umhos/cm and 150 mg/L, respectively) in sample SW-3 indicate a source of water not affected by bay water and one which is similar to a domestic water supply.

3.4.3 Data Validation

The validation and evaluation of laboratory data were accomplished through the use of field QA/QC samples and the evaluation of laboratory analytical techniques. The type and number of field QA/QC samples used in the SWAT Investigation, including field (equipment) blanks, trip blanks, and duplicate samples were discussed above in Section 3.3.3. The evaluation of the analytical results from these samples are presented in the following paragraphs. Also presented is a discussion on laboratory performance quality control checks and conditions such as laboratory control samples (LCS), matrix spikes, and holding times.

To evaluate the precision of laboratory analytical techniques, the Relative Percent Difference (RPD) between groundwater samples and duplicate samples was calculated for each of the inorganic parameters analyzed following procedures established by the Environmental Protection Agency (Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, Office of Emergency and Remedial Response, 1988). As a guideline, a control limit RPD of 20% has been established.

The results of the RPD evaluation indicates the majority of the compounds were within the 20% control limit. An evaluation of the duplicate sample data indicates the RPD control limit of 20% was exceeded on six occasions. The control limit is computed to be greater for: 1) the zinc analysis from the November 1989 sample of MW-4 (sample concentration of 0.23 mg/L; duplicate concentration non-detected); 2) the chloride analysis from the November 1989 sample of MW-4 (sample concentration of 2430 mg/L; duplicate concentration of 1860 mg/L); 3) the total dissolved solids analysis from the November sample of MW-4 (sample concentration of 4850 mg/L; duplicate concentration of 3550 mg/L); 4) the iron analysis from the November 1989 analysis of MW-3 (sample concentration of 0.31 mg/L; duplicate concentration of 0.42 mg/L); 5) the tin analysis from the May 1990 sample of MW-2 (sample concentration of 0.43 mg/L; duplicate concentration of 0.11 mg/L).

Laboratory Control Samples (LCS) are typically used to monitor the overall performance of all steps in an analytical procedure. A review of the LCS analysis of the ENSECO quality control lot "20 NOV 89-B" run on November 20, 1989 for the November 1989 field samples showed that for duplicate control samples (DCS) fluoride was recovered at a concentration which showed an RPD greater than the 105% quality control limit. A review of the quality control sample lot "19 JAN 90-A" run on January 29, 1990 reported acenaphthene with an RPD greater than the 107% quality control limit set for the compound. Acenapathene was not detected in any samples collected at the site. A Method Blank ran from quality control lot "19 JAN 90-A" on January 29, 1990 showed a detected concentration of bis(2-Ethylhexyl)-phthalate. This LCS was part of a quality assurance check used for the January 1990 samples MW-3, MW-4, duplicate MW-4, SW-3, and the field QA/QC samples. The presence of this compound in these samples is judged to be due to laboratory contamination and, therefore, is not interpreted to be present at the site.

A review of holding times for the analytical analyses indicates that holding time criteria were met for all constituents throughout the sampling program with the exception of cyanide and mercury for the November 1989 samples. Cyanide and Mercury were not detected in samples subsequent to the November 1989 sampling round. Cyanide and mercury are, however, not likely to be found as major compounds in the groundwater beneath the site.

4.0 CONCLUSIONS

The results of the SWAT Investigation indicate that the closed North Port of Oakland Refuse Disposal Site has not contributed hazardous wastes to the shallow ground water nor adjacent surface water. No records of hazardous waste disposal have been identified that would suggest the presence of hazardous waste at the site.

The results of the water quality analyses performed in upgradient wells MW-1 and MW-2 and surface water sample SW-1 indicate that secondary MCLs for iron, manganese, chloride and TDS were exceeded. Comparison of these constituents with downgradient wells MW-3 and MW-4 and surface water samples SW-2 and SW-3 indicate similar compounds exceeding secondary MCLs. The observed high concentrations of these compounds are interpreted to be caused by salt water intrusion of bay water under the landfill. Correspondingly, increased TDS concentrations along the northern and eastern areas of the site are also interpreted to be caused by migration of salt water from San Leandro Bay under the landfill. This interpretation is also supported by the results of tidal monitoring conducted during previous investigations performed at the site.

Six Target List volatile organic compounds were detected sporadically in groundwater samples collected during the four rounds of sampling conducted at the site. Two of the compounds, 4-methyl-2-pentanone, and 2-hexanone, detected only during the first sampling round, are common laboratory contaminants and therefore, are not thought to be reflective of environmental conditions at the site. Four additional detected volatile organic compounds also do not show a consistent pattern of occurrence. 1, 2 dichloroethane was detected in upgradient well MW-1 during the initial November 1989 sampling. Trichloroethene was detected once in upgradient wells MW-1 and MW-2 during the January 1990 sampling. The presence of these compounds is not confirmed in successive monitoring rounds suggesting their presence is not reflective of environmental conditions.

Benzene and xylene were detected in samples collected from downgradient well MW-4 during the January 1990 sampling round. Benzene was also detected in samples collected from well MW-4 during the March 1990 sampling. Surface water samples collected from the southeast drainage at location SW-3 show the presence of several halogenated and aromatic volatile organic compounds. In addition, two polynuclear aromatic hydrocarbon compounds were detected in the initial sampling of SW-3. A number of unknown hydrocarbons was detected in the subsequent three rounds of sampling. The most recent May 1990 sampling round indicates the presence of aviation fuel comparable to JP4 jet fuel. The absence, at other locations of the site, of the compounds detected in samples from MW-4 and SW-3 further suggests that other sources, not associated with the landfill, are responsible for the presence of these compounds. A close correlation exists among constituents detected in surface water samples from the southeast drainage (SW-3) and the groundwater samples from the nearby well MW-4. The similarities in detected compounds tend to suggest that the compounds are being transported from the ground surface rather than being generated in the landfill area. The presence of these compounds at this location and the absence of these compounds in other areas at the landfill suggests a nearby off-site source is responsible for the presence of these compounds.

No volatile organic Target List compounds were detected in surface water samples SW-1 and SW-2. Additionally, no semi-volatile organic compounds were detected in any of the surface water or groundwater samples with the exception of bis (2-ethylnexyl)-phthalate. The sporadic occurrence of this component is interpreted to be due to contamination resulting from sample handling or laboratory contamination and is not reflective of environmental conditions.

5.0 REFERENCES

Golder, Associates Inc., 1989. "Swat Proposal and Preliminary Hydrogeologic Investigation Report for the North Port of Oakland Refuse Disposal Site," Report 893-7020 submitted to Waste Management of North America, Inc., San Jose, California.

Helley, E. J., K. R. Lajoie, and D. B. Burke, 1972. Geologic Map of Late Cenozoic Deposits, Alameda County, California, U. S. Geological Survey Misc. Field Studies Map MF-429, 1:62,500.

Hickenbottom, K., and K. Muir, 1988. Geohydrology and Groundwater-Quality Overview, of the East Bay Plain Area, Alameda County, California, 205(J) Report, submitted to the California Regional Water Quality Control Board, San Francisco Region, Alameda County Flood Control and Water Conservation District.

Marshak, Jon B., 1989. "A Compilation of Water Quality Goals," California Regional Water Quality Control Board, Central Valley Region.

Maslonkowski, D. P., 1984. Groundwater in the San Leandro and San Lorenzo Alluvial Cones of the East Bay Plain of Alameda County, Alameda County Flood Control and Water Conservation District.

State Water Resources Control Board, 1986. Technical Guidance Manual, Solid Waste Water Quality Assessment Test (SWAT), Proposals and Reports, Solid Waste Disposal Program, Hydrogeology Section, Land Disposal Branch, Division of Water Quality.

U. S. Department of Agriculture Soil Conservation Service, 1981. "Soil Survey of Alameda County, California, Western Part," March, 1981.

U. S. Environmental Protection Agency, 1986. RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, Document OSWER-9950.1, Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response.

U.S. Environmental Protection Agency, 1988. Risk Assessment Guidance for Superfund; Human Health Evaluation Manual, Part A, Interim Final. Office of Solid Waste and Emergency Response, Washington, D.C.ri

TABLE 1
INVENTORY OF WELLS WITHIN ONE MILE

Well Number(1)	Total Well Depth (ft)	Diameter (in)	Log(2)	Well Use(3)
2S/3W 18H1	120	Unknown	D	CAT
2S/3W 18M1	120	Unknown	D	CAT
2S/3W 18M2	40	4	D	IRR
2S/3W 18N1	50	Unknown	D	CAT
2S/3W 18N2	65	Unknown	D	CAT
2S/3W 18P1	50	4	D	IRR
2S/3W 18P2	50	Unknown	D	CAT
2S/3W 19A1	Unknown	Unknown	G	MON
2S/3W 19A2	Unknown	Unknown	G	MON
2S/3W 19B1	Unknown	Unknown	G	MON
2S/3W 19B2	Unknown	Unknown	G	MON
2S/3W 19B3	Unknown	Unknown	G	MON
2S/3W 19C1	73	Unknown	G	GEO
2S/3W 19D1	86	Unknown	G	GEO
2S/3W 19F1	100	Unknown	G	GEO
2S/3W 19H1	Unknown	Unknown	Unknown	MON
2S/3W 19K1	619	14	D	IRR
2S/3W 19M1	75	Unknown	G	GEO
2S/3W 19N1	744	14	D	IRR
2S/3W 19N2	75	Unknown	G	GEO
2S/3W 19Q1	518	14	D	IRR
2S/3W 19Q2	14	2	G	MON
2S/3W 20L1	91	Unknown	G	Unknown
2S/3W F1	17	N/A	N/A	Unknown

Source: Alameda County Flood Control District 205(J) Report June, 1988.
(1) – Well numbers are based on the state well numbering system used by the State of California Department of Water Resources.
(2) – Log type: D = drillers log; G = geologists log;
(3) – Well use: MON = monitoring; IRR = irrigation; CAT = cathodic protection; GEO = geotechnical boring
See Figure 7 for well locations.

TABLE 2

PIEZOMETER AND WELL CONSTRUCTION SUMMARY

Construction Details by Depth Interval (1)

Well/ Piezometer#	Total (2) Depth	Solid(3) Casing	Screen(4)	Sand(5) Pack	Bentonite(6) Pack	Grout(7) Seal	Ref.Point(8) Elevation
MW-1	15.0	0-5.0	5.0-15.0	3.0-15.0	1.5-3.0	0-1.5	103.48
MW-2	15.0	0-4.5	4.5-15.0	2.5-15.0	1.0-2.5	0-1.0	102.19
MW-3	18.0	0-3.0	3.0-18.0	2.5-18.0	1.5-2.5	0-1.5	102.48
MW-4	15.0	0-4.0	4.0-12.0	3.0-12.0	1.5-3.0	0-1.5	100.41
P-6	10.5	0-3.5	3.5-9.0	3.0-9.0	1.0-3.0 9.0-10.5	0-1.0	99.81
P-6A	52.5	0-32.0	32.0-42.0	30.0-42.0	28.0-30.0 42.0-52.5	0-28.0	102.52
P-7	14.0	0-4.0	4.0-14.0	3.0-14.0	1.0-3.0	0-1.0	100.54
P-7A	50.0	0-30.0	30.0-45.0	28.0-45.0	26.0-28.0 45.0-50.0	0-26.0	100.62
P-8	12.5	0-3.0	3.0-9.0	2.0-9.0	1.0-2.0 9.0-12.5	0-1.0	96.06
P-9	7.5	0-2.5	2.5-7.5	2.0-7.5	1.0-2.0	0-1.0	101.90
P-9A	47.5	0-20.0	20.0-35.0	18.0-38.0	15.0-18.0 38.0-47.5	0-15.0	101.65
P-10	17.5	0-2.0	2.0-17.0	1.5-17.0	0.5-1.5	0-0.5	100.25

(1) - All values describe construction details in feet below ground surface.

(2) - Depth of boring.

(3) - All wells constructed with 4.00" I.D. schedule 40 PVC and all Piezometers constructed with 1.00" I.D., schedule 40 PVC.

(4) - Piezometer screens are 1.00" I.D. schedule 40 PVC with 0.020" slots.
Wells constructed with 4.00" I.D. schedule 40 PVC with 0.010" slots.

(5) - All sand pack grades are Lonestar Lapis Lustre 2/12 for piezometers and 1/20 for wells.

(6) - 3/8" Volclay Bentonite pellets.

(7) - Piezometers and wells backfilled with cement grout consisting of 94 lbs. type I-II cement and 10 gallons of water; exploratory boreholes backfilled with cement-sand slurry.

(8) - Reference points are top of PVC surveyed with respect to City of Alameda Datum.

TABLE 3
BOREHOLE SOIL PROPERTIES

Well	Interval (ft bgs) (1)	Specific Gravity	Permeability (cm/sec)	Natural Moisture Content (%)	Description
MW-1	5.0-5.5	2.76	3.0E-08	42.1	Olive black, SILTY CLAY, some coarse to fine sand, little fine gravel (CL)
MW-1	14.5-15.0	2.80	5.0E-08	Oversaturated	Olive gray CLAY, trace fine sand organic material present (CH)
MW-2	14.5-15.0	2.80	6.0E-08 (2)	33.1	Olive gray, SILTY CLAY, some fine sand (CL)
MW-3	9.5-10.5	2.78	4.0E-08	16.9	Dark gray, fine SAND and SILT some fine gravel (SM)

Notes:

(1) - BGS = below ground surface

(2) - Permeability determined for the interval 13 5 - 14 0 ft bgs

TABLE 4
SLUG TEST DATA

Well	Test No.	Test Type (1)	Time Lag (sec)	Hydraulic Conductivity (cm/sec)
MW-1	1	FH	49	4.0E-03
	2	RH	72	3.0E-03
	3	FH	39.5	5.0E-03
	4	RH	73	3.0E-03
MW-2	1	FH	10.5	2.0E-03
	2	RH	60.5	3.0E-03
MW-3	1	FH	5.5	4.0E-03
	2	RH	9	2.0E-03
MW-4	1	FH	4.5	5.0E-03
	2	RH	8.5	2.0E-03

Notes:

(1) Test type refers to a falling head test (FH) or a rising head test (RH).

TABLE 5
GROUNDWATER LEVEL ELEVATIONS

Well Number	Well Elevation(1)	Water Level Elevations(2)								
		06/15/89	10/13/89	11/07/89	01/24/90	02/02/90	03/15/90	03/17/90	05/07/90	05/09/90
MW-1	103.48	----	98.13	98.18	98.38	98.23	97.78	98.39	98.32	98.32
MW-2	102.19	----	98.22	98.28	98.34	98.29	98.53	98.44	98.50	98.51
MW-3	102.48	----	97.67	97.53	97.92	97.53	97.80	97.68	98.09	98.00
MW-4	100.41	----	97.35	97.38	97.46	97.36	97.88	97.76	98.03	98.05
P-6	102.52	98.55	98.22	----	----	98.32	----	98.50	----	98.58
P-6a	99.81	97.48	97.20	----	----	97.76	----	97.87	----	97.88
P-7	100.54	97.33	97.42	----	----	97.16	----	97.67	----	97.47
P-7a	100.62	96.52	94.54	----	----	95.09	----	95.31	----	95.44
P-9	101.9	98.26	98.05	----	----	98.02	----	98.14	----	98.13
P-9a	101.65	96.58	96.11	----	----	96.40	----	96.48	----	96.52
P-10	100.25	97.44	97.40	----	----	96.92	----	97.12	----	97.41

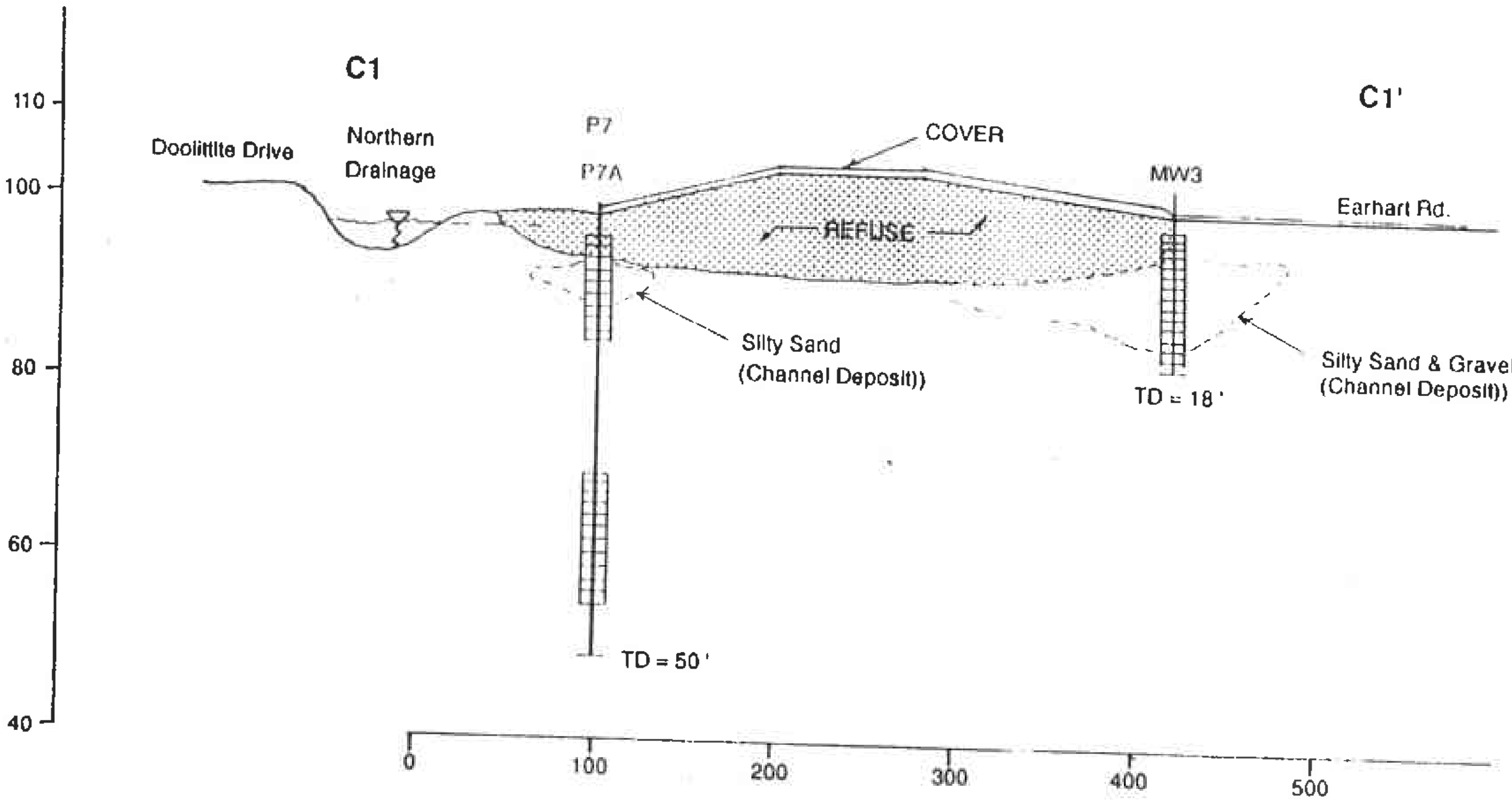
(1) – Top of PVC.
(2) – Feet above City ofAlameda Datum.
(3) – Measured 11/06/89.
(4) – Measured 01/23/90
(5) – Measured 03/14/90
(6) – Measured 05/08/90

Golder Associates

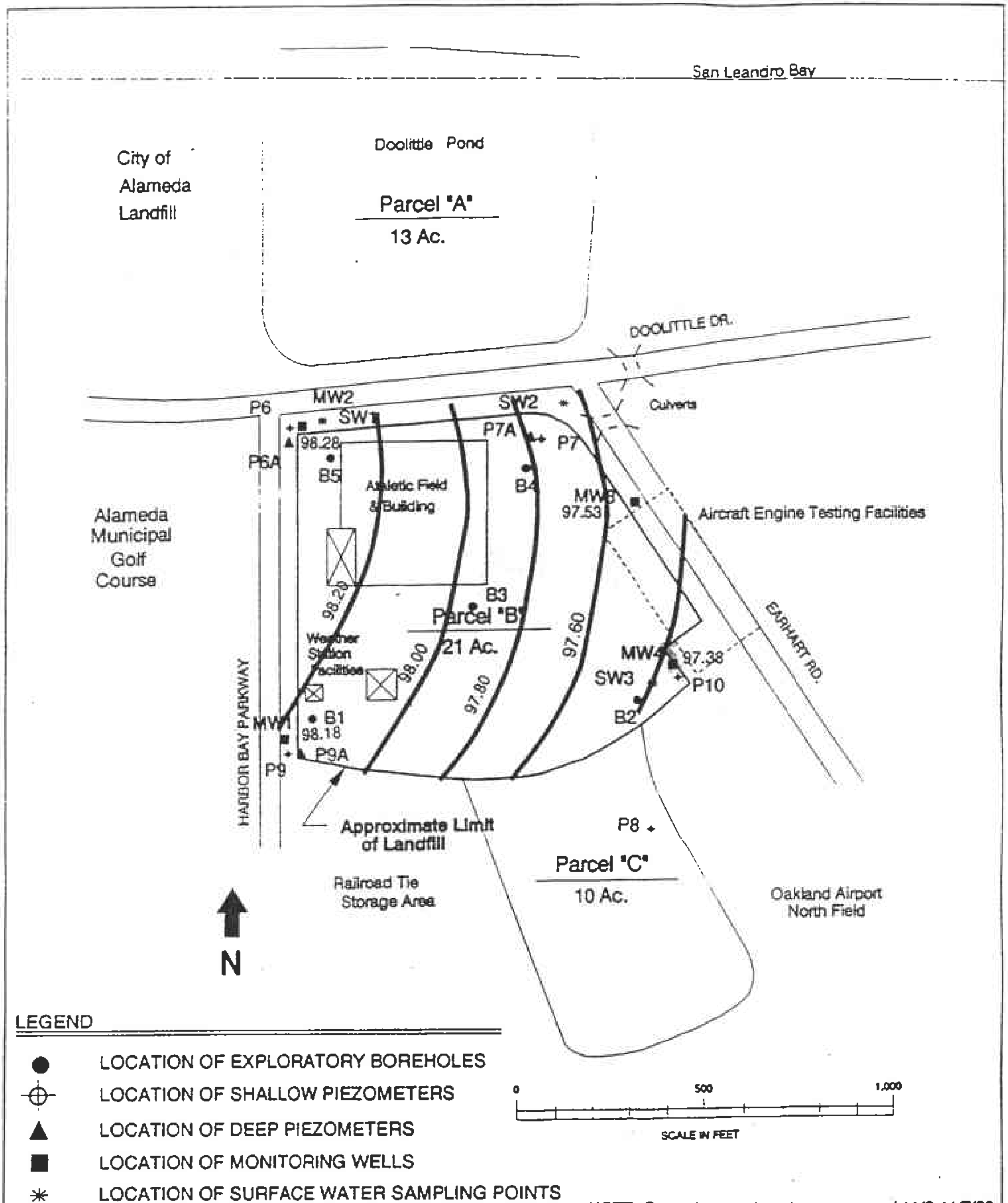
TABLE 6

LIST OF EPA METHOD 624 TARGET LIST VOLATILE ORGANIC COMPOUNDS

PARAMETER	REPORTING LIMIT
Chloromethane	10 ug/L
Bromomethane	10 ug/L
Vinyl Chloride	10 ug/L
Chloroethane	10 ug/L
Methylene chloride	5 ug/L
Acetone	10 ug/L
Carbon disulfide	5 ug/L
1,1-Dichloroethene	5 ug/L
1,1-Dichloroethane	5 ug/L
1,2-Dichloroethene (cis/trans)	5 ug/L
Chloroform	5 ug/L
1,2-Dichloroethane	5 ug/L
2-Butanone	10 ug/L
1,1,1-Trichloroethane	5 ug/L
Carbon tetrachloride	5 ug/L
Vinyl acetate	10 ug/L
Bromodichloromethane	5 ug/L
1,2-Dichloropropane	5 ug/L
cis-1,3-Dichloropropane	5 ug/L
Trichloroethene	5 ug/L
Dibromochloromethane	5 ug/L
1,1,2-Trichroethane	5 ug/L
Benzene	5 ug/L
trans-1,3-Dichloropropene	5 ug/L
2-Chloroethyl vinyl ether	10 ug/L
Bromoform	5 ug/L
4-Methyl-2-pentanone	10 ug/L
2-Hexanone	10 ug/L
1,1,2,2-Tetrachloroethane	5 ug/L
Tetrachloroethene	5 ug/L
Toluene	5 ug/L
Chlorobenzene	5 ug/L
Ethyl benzene	5 ug/L
Styrene	5 ug/L
Xylenes (total)	5 ug/L

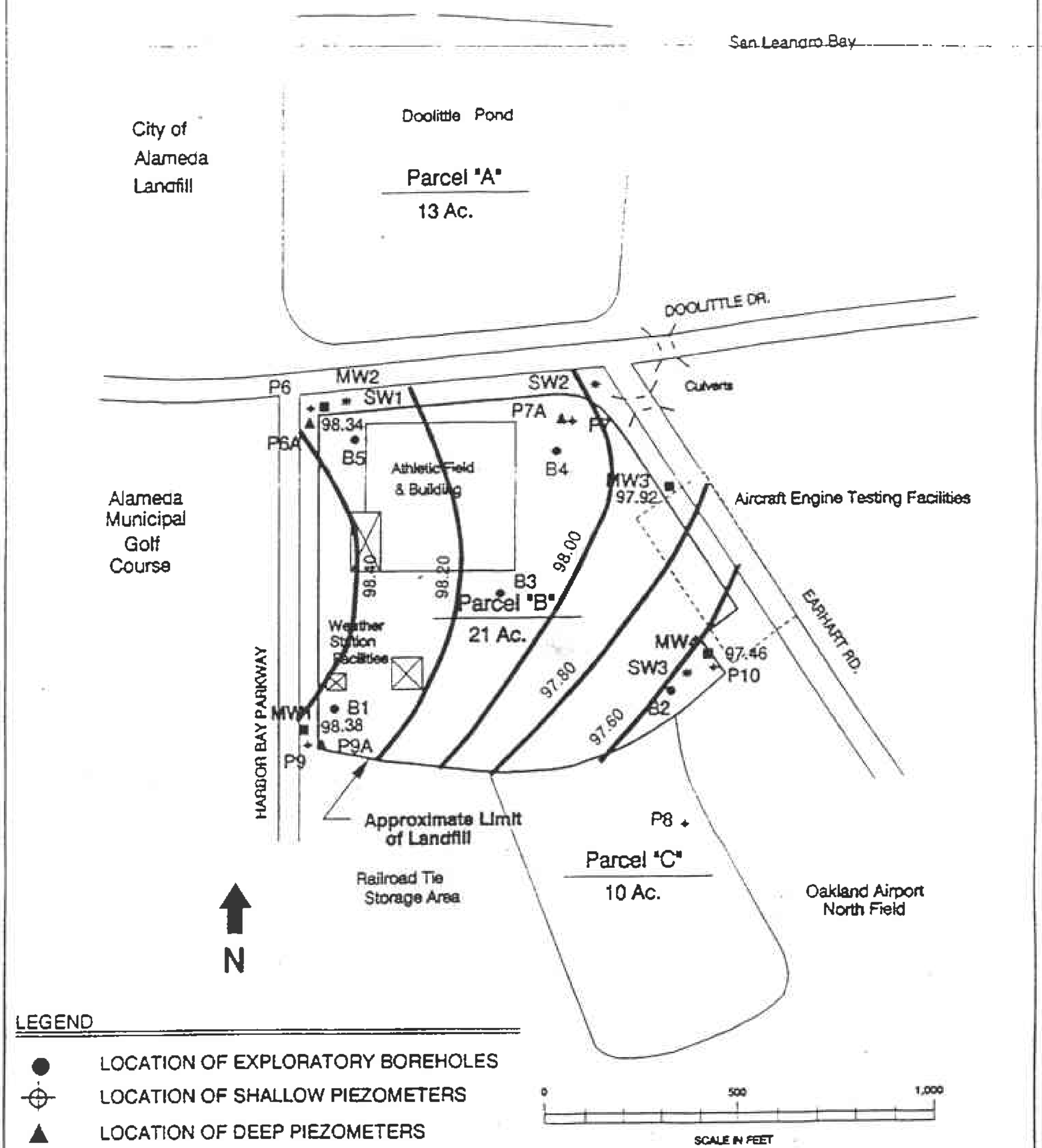


Job No	893-7039	Scale	As Shown	**GEOLOGIC CROSS SECTION C1 - C1 '**
Drawn	DVR	Date	June 1990	**North Port of Oakland Disposal Site**
Checked	KRR	Dwg No		
Golder Associates Inc.				Waste Management of North America, Inc.



NOTE: Groundwater elevations measured 11/6-11/7/89.

Job No 893-7039	Scale As Shown	**POTENTIOMETRIC SURFACE - NOVEMBER 1989**
Drawn DVR	Date June 1990	**North Port of Oakland Disposal Site**
Checked KRR	Dwg No	
Golder Associates Inc.		Waste Management of North America, Inc. — FIGURE 9

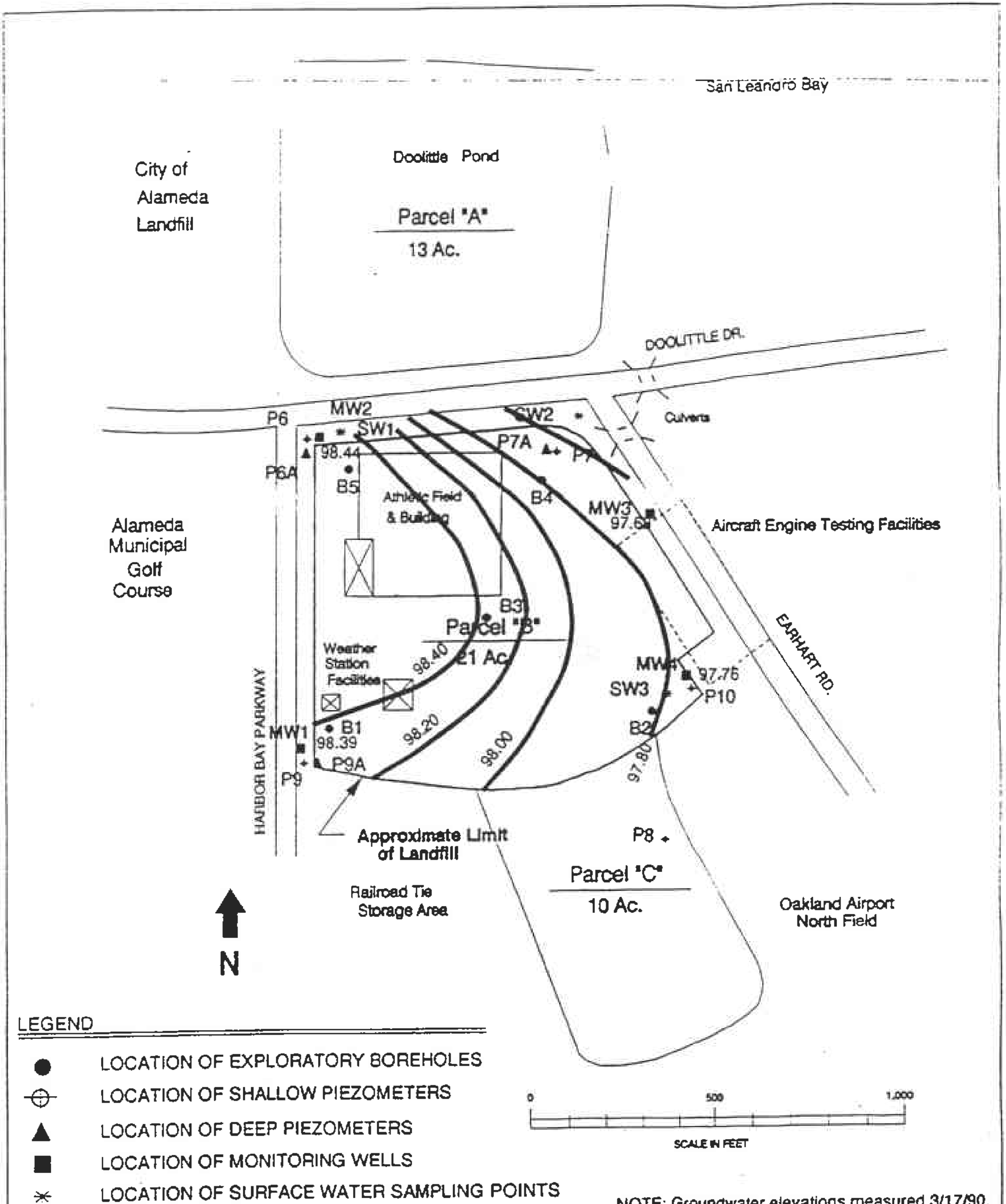


LEGEND

- ● LOCATION OF EXPLORATORY BOREHOLES
- ⌖ LOCATION OF SHALLOW PIEZOMETERS
- ▲ LOCATION OF DEEP PIEZOMETERS
- ■ LOCATION OF MONITORING WELLS
- ✳ LOCATION OF SURFACE WATER SAMPLING POINTS

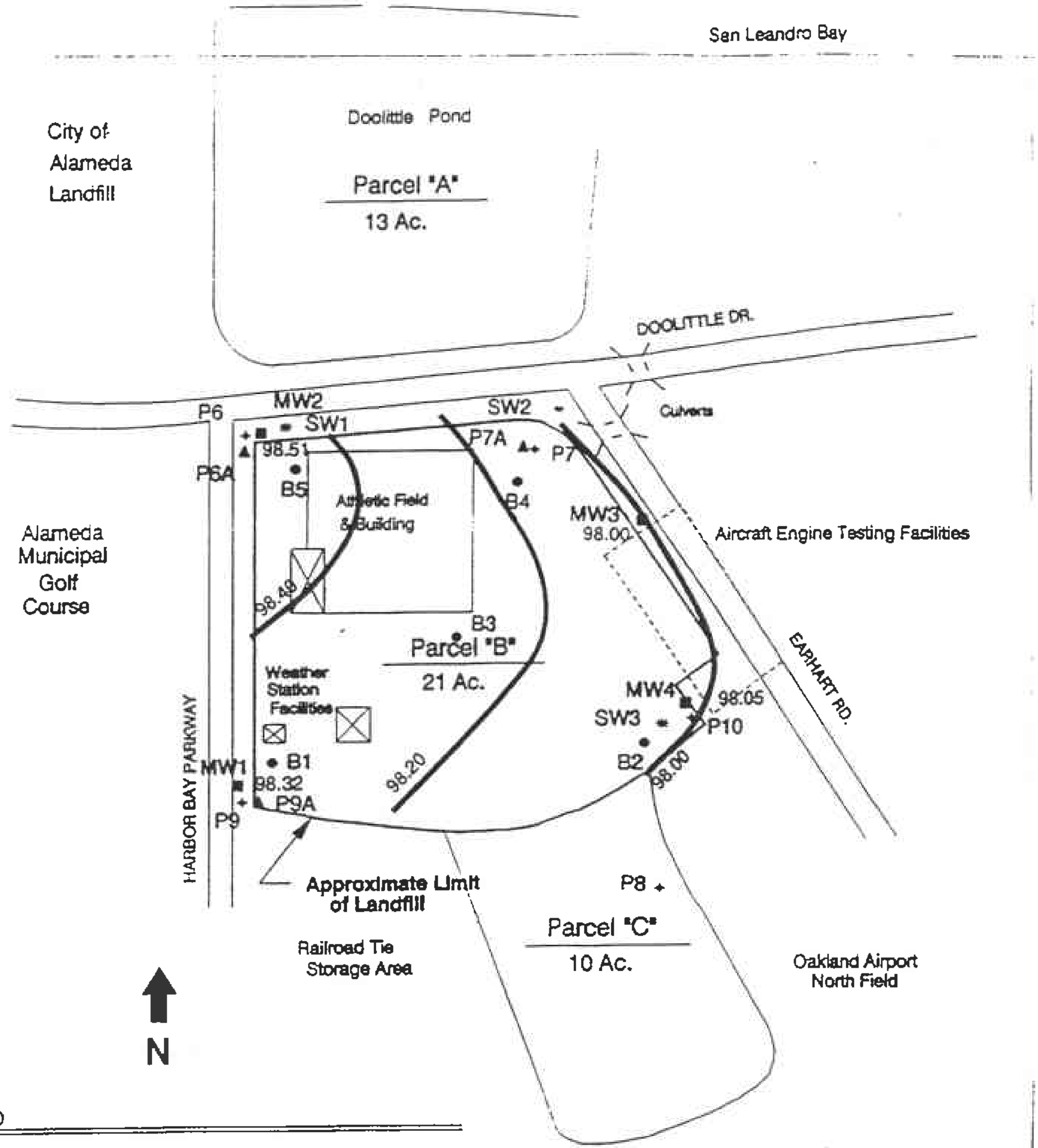
NOTE: Groundwater elevations measured 1/23/90.

Job No 893-7039	Scale As Shown	**POTENTIOMETRIC SURFACE - JANUARY 1990**
Drawn DVR	Date June 1990	**North Port of Oakland Disposal Site**
Checked KRR	Dwg. No	
Golder Associates Inc.		Waste Management of North America, Inc. — FIGURE 10



NOTE: Groundwater elevations measured 3/17/90.

Job No 893-7039	Scale As Shown	**POTENTIOMETRIC SURFACE - MARCH 1990**
Drawn DVR	Date June 1990	**North Port of Oakland Disposal Site**
Checked KRR	Dwg No	
Golder Associates Inc.		Waste Management of North America, Inc. FIGURE 11



LEGEND

- ● LOCATION OF EXPLORATORY BOREHOLES
- ⊕ LOCATION OF SHALLOW PIEZOMETERS
- ▲ LOCATION OF DEEP PIEZOMETERS
- ■ LOCATION OF MONITORING WELLS
- ✳ LOCATION OF SURFACE WATER SAMPLING POINTS

NOTE: Groundwater elevations measured 5/9/90.

Job No 893-7039	Scale As Shown	**POTENTIOMETRIC SURFACE - MAY 1990**
Drawn DVR	Date June 1990	**North Port of Oakland Disposal Site**
Checked KRR	Dwg. No	
Golder Associates Inc.	Waste Management of North America, Inc.	FIGURE 12

TABLE 7
LIST OF EPA METHOD 625 TARGET LIST SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	REPORTING LIMIT	PARAMETER	REPORTING LIMIT
Phenol	10 ug/L	3-Nitroaniline	50 ug/L
bis(2-Chloroethyl) ether	10 ug/L	Acenaphthene	10 ug/L
2-Chlorophenol	10 ug/L	2,4-Dinitrophenol	50 ug/L
1,3-Dichlorobenzene	10 ug/L	4-Nitrophenol	50 ug/L
1,4-Dichlorobenzene	10 ug/L	Dibenzofuran	10 ug/L
Benzyl alcohol	10 ug/L	2,4-Dinitrotoluene	10 ug/L
1,2-Dichlorobenzene	10 ug/L	2,6-Dinitrotoluene	10 ug/L
2-Methlyphenol	10 ug/L	Diethyl phthalate	10 ug/L
bis(2-Chloroisopropyl)-ethe	10 ug/L	4-Chlorophenyl phenyl ether	10 ug/L
4-Methylphenol	10 ug/L	Fluorene	10 ug/L
N-Nitroso-di-n-propylamin	10 ug/L	4-Nitroaniline	50 ug/L
Hexachloroethene	10 ug/L	4,6-Dinitro-2-methylphenol	50 ug/L
Nitrobenzene	10 ug/L	N-Nitrosodiphenylamine	10 ug/L
Isophorone	10 ug/L	4-Bromophenyl phenyl ether	10 ug/L
2-Nitrophenol	10 ug/L	Hexachlorobenzene	10 ug/L
2,4-Dimethylphenol	10 ug/L	Pentachlrophenol	50 ug/L
Benzoic acid	50 ug/L	Phenanthrene	10 ug/L
bis(2-Chloroethoxy)-methan	10 ug/L	Anthracene	10 ug/L
2,4-Dichlorophenol	10 ug/L	Di-n-butyl phthalate	10 ug/L
1,2,4-Trichlorobenzene	10 ug/L	Fluoranthene	10 ug/L
Naphthalene	10 ug/L	Pyrene	10 ug/L
4-Chloroaniline	10 ug/L	Butyl benzyl phthalate	10 ug/L
Hexachlorobutidiene	10 ug/L	3,3-Dichlorobenzidine	20 ug/L
4-Chloro-3-methylphenol	10 ug/L	Benzo(a)anthracene	10 ug/L
2-Methylnaphthalene	10 ug/L	bis(2-Ethylhexyl)-phthalate	10 ug/L
Hexachlorocyclopentadiene	10 ug/L	Chrysene	10 ug/L
2,4,6-Trichlorophenol	10 ug/L	Di-n-octyl phthalate	10 ug/L
2,4,5-Trichlorophenol	50 ug/L	Benzo(b)fluoranthene	10 ug/L
2-Chloronaphthalene	10 ug/L	Benzo(k)fluoranthene	10 ug/L
2-Nitroaniline	50 ug/L	Benzo(a)pyrene	10 ug/L
Dimethyl phthalete	10 ug/L	Indeno(1,2,3-cd)pyrene	10 ug/L
Acenaphthylene	10 ug/L	Dibenz(a,h)anthracene	10 ug/L
		Benzo(g,h,i)perylene	10 ug/L

TABLE 8
LIST OF INORGANIC AND METAL PARAMETERS

Method	Parameter	Reporting Limit	
150.1	pH		(-)
300.0	Chloride	500	mg/L
7196	Chromium (VI)	0.010	mg/L
335.3	Cyanide, Total	0.010	mg/L
120.1	Specific Conductance at 25 deg. C	1.0	umhos/cm
160.1	Total Dissolved Solids	100	mg/L
351.3	Total Kjeldahl Nitrogen as N	0.50	mg/L
415.1	Total Organic Carbon	0.50	mg/L
200.7	Aluminum	0.50	mg/L
200.7	Antimony	0.30	mg/L
206.2	Arsenic	0.0050	mg/L
200.7	Barium	0.050	mg/L
200.7	Beryllium	0.010	mg/L
200.7	Boron	0.50	mg/L
200.7	Cadmium	0.025	mg/L
200.7	Calcium	2.5	mg/L
200.7	Chromium	0.50	mg/L
200.7	Cobalt	0.50	mg/L
200.7	Copper	0.10	mg/L
200.7	Iron	0.50	mg/L
200.7	Lead	0.25	mg/L
200.7	Lithium	0.25	mg/L
200.7	Magnesium	2.5	mg/L
200.7	Manganese	0.050	mg/L
245.1	Mercury	0.0002	mg/L
200.7	Molybdenum	0.10	mg/L
200.7	Nickel	0.20	mg/L
200.7	Potassium	25.0	mg/L
270.2	Selenium	0.050	mg/L
200.7	Silver	0.050	mg/L
200.7	Sodium	100	mg/L
200.7	Thallium	10.0	mg/L
200.7	Tin	0.50	mg/L
200.7	Titanium	0.025	mg/L
200.7	Vanadium	0.050	mg/L
200.7	Zinc	0.10	mg/L

TABLE 9

GROUNDWATER AND SURFACE WATER FIELD SAMPLING PARAMETERS

Well	Date Month/Year	pH	Specific Conductivity (umhos/cm)	Temperature (C)
MW-1	11/89	7.37	2680	18.9
	1/90	7.49	2680	16.6
	3/90	7.14	3610	NT
	5/90	7.84	5330	16.5
MW-2	11/89	7.66	3670	17.8
	1/90	6.87	3390	14.9
	3/90	7.02	8160	15.5
	5/90	7.32	31,600	16.1
MW-3	11/89	6.98	17,300	18.9
	1/90	6.62	18,300	18.3
	3/90	7.00	15,270	18.0
	5/90	6.96	36,200	17.2
MW-4	11/89	6.46	3970	20.0
	1/90	6.13	5300	14.8
	3/90	6.55	5520	17
	5/90	6.50	17,720	15
SW-1	11/89	7.15	28,600	18.9
	1/90	7.64	3120	NT
	3/90	7.35	11,760	18.0
	5/90	7.14	4200	16.5
SW-2	11/89	6.86	23,000	18.9
	1/90	7.02	1850	NT
	3/90	7.15	22,100	17.0
	5/90	6.80	5060	16.5
SW-3	11/89	NT	NT	NT
	1/90	NT	NT	NT
	3/90	6.38	420	16.0
	5/90	5.66	370	15.0

NT = Not tested

TABLE 10
SUMMARY OF GROUNDWATER ORGANIC ANALYSIS

(Concentrations in micrograms/Liter unless otherwise indicated)

METHOD	COMPOUND	WELL	W-1			W-2				MW ?				MW-4			
		DATE 11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90
624	1,2-Dichloroethane (cis/trans)	ND	ND	ND	ND	ND	ND	ND	ND	24.0	ND	ND	ND	ND	ND	ND	ND
	Tricloroethene	ND	18.0	ND	ND	ND	7.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.8	5.5	ND
	Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.1	ND	ND
	(2) 4-Methyl-2-pentanone	12.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	(2) 2-Hexanone	16.0	ND	ND	ND	14.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
625	(2) bis(2-Ethylhexyl)-phthalate	24.0	ND	ND	ND	39.0	ND	ND	ND	ND	18.0 (1)	15.0	ND	38.0	21.0 (1)	ND	ND
415.1	Total Organic Carbon	21.3	23.3	15.1	18.2	271.0	27.8	11.0	10.8	1.7	2.0	1.2	2.1	421.0	44.3	38.6	39.6

Notes:

ND = Not Detected

NT = Not Tested

(1) - Compound is also detected in the method blank.

(2) - Analytical results should not be considered reliable for this common lab contaminant unless the sample result exceeds 5 times the reporting limit or 10 times the blank result.

mw-4

TABLE 11
DETECTED TENTATIVELY IDENTIFIED ORGANIC COMPOUNDS – GROUNDWATER SAMPLES

(Concentrations in micrograms/Liter unless otherwise indicated)

METHOD	COMPOUND		WELL	MW-1				MW-2				MW-3				MW-4			
			DATE	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90
EPA 624	VOLATILE ORGANIC COMPOUNDS																		
	Cyclohexane, 1-Ethyl-4-Methyl-			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6 0	ND	ND	ND
	1H-Indene, Octahydro-			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.0	ND	ND	ND
	Benzene, 1-Ethyl-3-Methyl-	(or Isomer)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7 9	ND
	Benzene, 1,2-Diethyl-	(or Isomer)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.0	ND	ND	ND
	Benzene, 1,3-Diethyl-	(or Isomer)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10 0	ND	ND	ND
	Benzene, 1,2,4-Trimethyl-	(or Isomer)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.0	ND	ND	ND
	Benzene, 1,2-Dichloro-	(or Isomer)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.0	ND	15	ND
	Benzene, Propyl-			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.0	ND	ND	ND
	Benzene, 2-Propenyl-			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	16.0	ND	ND	ND
	Benzene, 1-methyl-3-(1-methylethyl)-(or Isomer)			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35 0
	Benzene, 1,2,3,5-tetramethyl- (or Isomer)			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
	Benzene, 1,2,3,4-tetramethyl- (or Isomer)			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	73 0
	Unknown Alkane			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0	ND	ND	ND

TABLE 11 (Cont'd.)

METHOD	COMPOUND	WELL / DATE	MW-1 11/89	MW-1 1/90	MW-1 3/90	MW-1 5/90	MW-2 11/89	MW-2 1/90	MW-2 3/90	MW-2 5/90	MW-3 11/89	MW-3 1/90	MW-3 3/90	MW-3 5/90	MW-4 11/89	MW-4 1/90	MW-4 3/90	MW-4 5/90
EPA 625	SEMIVOLATILE ORGANIC COMPOUNDS																	
	Benzene, 2-Ethyl-1,4-Dimethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	72	63	ND	23
	Benzene, 1,2,3,5-Tetramethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	71	49	48	49
	Benzene, 1,2,3,5-Tetramethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	96	37	33	39
	Benzene, 1-Ethyl-2,4,5-Trimethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18	ND	ND	ND
	Benzene, 1-Ethyl-2,3-Dimethyl	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.2	ND
	Benzene, 1-Ethyl-2,3-Dimethyl	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	47	ND
	Benzene, Diethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.1	ND	ND
	Benzene, 1,3-Dimethyl-5-(1-Methylethyl))-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	ND
	Benzene, (1-Methyl-1-Propenyl)-, (E)-		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Benzoic Acid, 2,4,5-Trimethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36	11	ND	ND
	Benzoic Acid, 2,4,6-Trimethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.6	ND	ND
	Benzoic Acid, 2,4,6-Trimethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	31	ND	ND
	Benzeneacetic Acid, Ar-Ethenyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	ND	ND
	Benzenesulfonamide, N-Butyl-4-Methyl-		ND	ND	ND	ND	8.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Ethanol, 2-(2-Butoxyethoxy)-	(I)	ND	27	ND	ND	22	24	ND	ND	ND	14	ND	ND	ND	100	ND	ND
	Ethanol, 2-(2-Butoxyethoxy)-, Acetate	(I)	420	ND	ND	ND	410	ND	ND	ND	260	ND	ND	ND	100	8	ND	ND
	Ethanol, 2-(9-Octadecenyloxy)-, (Z)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.4	ND	ND
	Hexanedionic Acid, Mono(2-Ethylhexyl)Ester		ND	ND	ND	ND	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1H-Indene, 2,3-Dihydro-4-Methyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	21	ND	ND	ND
	1H-Indene, 2,3-Dihydro-5-Methyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	ND	ND
	Phenol, 2,4-Bis(1,1-Dimethylethyl)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.5	ND	ND
	Phenol, 3-(1,1-Dimethylethyl)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11	8.2	ND
	Phenol, 4-(2,2,3,3-Tetramethylbutyl)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	80	73	64	56
	Phenol, 4-(2,2,3,3-Tetramethylbutyl)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.4	ND
	Phenol, 4,4-Butylidenebis(2-Dimethylethl)-5-Methyl-		9.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Phenol, 4-Nonyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	12	ND
	Sulfur, Mol. (S8)		ND	ND	ND	ND	15	ND	ND	ND	ND	ND	ND	ND	990	600	1040	8000
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	19	ND	ND	ND

Notes: (I) = or Isomer.

TABLE 11 (Cont'd.)

METHOD	COMPOUND	WELL: MW-1 11/89	MW-1 1/90	MW-1 3/90	MW-1 5/90	MW-2 11/89	MW-2 1/90	MW-2 3/90	MW-2 5/90	MW-3 11/89	MW-3 1/90	MW-3 3/90	MW-3 5/90	MW-4 11/89	MW-4 1/90	MW-4 3/90	MW-4 5/90
EPA 625	SEMIVOLATILE ORGANIC COMPOUNDS																
	Unknown Alkene	ND	ND	ND	ND	21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Oxygenated Compound	ND	ND	ND	ND	ND	14	ND	ND	ND	ND	ND	ND	ND	27	ND	ND
	Unknown Substituted Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	8.5	ND
	Unknown Substituted Benzoic Acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Substituted Benzoic Acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Substituted Benzoic Acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Carboxylic Acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	ND
	Unknown Substituted Carboxylic Acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	ND
	Unknown Substituted Oxirane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	19	ND
	Unknown Unsaturated Hydrocarbon	ND	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Unsaturated Compound	ND	ND	ND	ND	ND	8.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Ketone	ND	ND	8.6	ND	23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Cyclic	ND	ND	ND	ND	ND	ND	ND	ND	ND	54	44	ND	ND	ND	ND	ND
	Unknown Cyclic Hydrocarbon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35	ND	ND	ND	ND
	Unknown Cyclic Hydrocarbon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33	ND	ND	ND	ND
	Unknown Cycloalkane	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.1	ND	ND	ND	ND	ND	ND
	Unknown Cyclohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	52	ND	ND	ND	ND	ND	ND
	Unknown Alkyl Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18	ND	ND	13
	Unknown Alkyl Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	15
	Unknown Alkyl Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Substituted Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown (1)	44	ND	8.9	ND	10	ND	17	ND	ND	11	47	ND	18	9	20	ND
	Unknown (1)	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.5	8.3	ND
	Unknown (1)	36	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.3	ND	ND
	Unknown (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11	ND	ND
	Unknown (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.1	ND	ND

Notes:
ND = Not Detected
(1) – Identification of unknown compound not possible by spectral match

TABLE 12
DISSOLVED METALS ANALYSIS – GROUNDWATER SAMPLES

METHOD	COMPOUND	MW-1				MW-2				MW-3				MW-4			
		11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90
200.7	Aluminum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	ND
200.7	Antimony	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
206.2	Arsenic	ND	ND	ND	ND	ND	0.0064	ND	0.0073	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Barium	0.63	0.6	0.56	0.62	0.33	0.35	0.53	0.41	0.15	0.093	0.097	0.11	0.54	0.44	0.65	0.98
200.7	Beryllium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Boron	3.2	2.7	2.7	2.9	1.3	1.3	1.4	2.0	2.9	2.2	2.1	2.3	1.4	1.2	1.2	1.4
200.7	Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Calcium	58.0	65.4	73.6	68.0	57.7	77.5	167	260	359	268	282	304	171	147	191	261
200.7	Chromium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7196	Chromium (VI)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Cobalt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Copper	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Iron	0.35	3.3	3.3	0.52	0.15	5.4	4.9	3.7	ND	0.31	0.24	0.59	0.56	0.49	1.9	ND
200.7	Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Lithium	ND	ND	ND	ND	ND	ND	ND	0.080	ND	0.090	0.073	0.083	ND	ND	ND	ND
200.7	Magnesium	90.9	107.0	121.0	107.0	85.6	142.0	290.0	575.0	842.0	621.0	692.0	707.0	178.0	178.0	216.0	322.0
200.7	Manganese	0.099	0.12	0.14	0.13	0.84	0.88	1.4	1.5	5.0	4.2	4.3	4.1	1.1	0.93	1.1	1.4
245.1	Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Molybdenum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Nickel	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Potassium	141.0	131.0	132.0	132.0	83.3	89.6	137.0	238.0	263.0	235.0	228.0	251.0	66.2	58.9	72.8	100.0
270.2	Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Sodium	736.0	837.0	1030.0	833.0	790.0	1270.0	2610.0	5930.0	7190.0	6200.0	6540.0	7340.0	1400.0	1600.0	2080.0	2020.0
200.7	Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Tin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.43
200.7	Titanium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Vanadium	ND	ND	ND	ND	ND	ND	0.016	0.030	ND	0.031	0.037	0.040	ND	ND	ND	0.012
200.7	Zinc	0.014	ND	ND	ND	0.024	ND	ND	ND	0.054	ND	ND	ND	0.23	ND	ND	ND

Notes:

ND = Not Detected

TABLE 13
SUMMARY OF INORGANIC ANALYSIS – GROUNDWATER SAMPLES

(Concentrations in milligrams/Liter unless otherwise indicated)

METHOD	COMPOUND	WELL	MW-1				MW-2				MW-3				MW-4			
		DATE	11/89	1/90	3/90	5/90	11/90	1/90	3/90	5/90	11/90	1/90	3/90	5/90	11/89	1/90	3/90	5/90
300.0	Chloride		1360	1570	2110	1380	1580	2180	6630	116000	14600	13900	16200	14100	2430	2690	4020	5870
335.3	Total Cyanide		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.012	ND	ND	ND
150.1	pH (Standard Units)		8.1	7.6	7.5	7.9	8.1	7.3	7.4	7.4	7.2	7.1	7.2	7.2	6.7	6.8	7.0	7.0
120.1	Specific Conductance at 25 deg. C (umhos/c)		4460	5490	7760	4550	4800	7500	14300	26900	33300	31200	30100	27900	8450	8940	11200	13700
160.1	Total Dissolved Solids		2710	3040	3940	2620	2880	4090	9580	18600	22700	21800	22200	23400	4850	5210	7280	11000
351.3	Total Kjeldahl Nitrogen		17.1	18.9	20.4	19.8	40.1	39.3	45.0	30.8	3.0	2.5	3.0	5.0	10.2	11.2	8.3	7.4

Notes:

ND = Not Detected

TABLE 14
SUMMARY OF SURFACE WATER ORGANIC ANALYSIS (TARGET LIST COMPOUNDS)

(Concentrations in micrograms/Liter unless otherwise indicated)

METHOD	COMPOUND	SAMPLE	SW-1				SW-2				SW-3			
		DATE	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90
624	1,1,1-Trichloroethane		ND	ND	ND	ND	ND	ND	ND	ND	62	NR	NR	NR
	Toluene		ND	ND	ND	ND	ND	ND	ND	ND	270	NR	NR	NR
	Ethyl Benzene		ND	ND	ND	ND	ND	ND	ND	ND	84	NR	NR	NR
	Xylenes (total)		ND	ND	ND	ND	ND	ND	ND	ND	500	NR	NR	NR
625	(2) bis(2-Ethylhexyl)-phthalate		12	11 (1)	ND	ND	11	13 (1)	12	ND	ND	NR	NR	NR
	Naphthalene		ND	ND	ND	ND	ND	ND	ND	ND	4600	NR	NR	NR
	2-Methylnaphthalene		ND	ND	ND	ND	ND	ND	ND	ND	1700	NR	NR	NR
8015 (modified)	Gasoline (mg/L)		NR	NR	NR	NR	NR	NR	NR	NR	NL	ND	ND	ND
	Kerosene (mg/L)		NR	NR	NR	NR	NR	NR	NR	NR	ND	ND	ND	ND
	Diesel Fuel (mg/L)		NR	NR	NR	NR	NR	NR	NR	NR	ND	ND	ND	ND
	Stoddard Solvent (mg/L)		NR	NR	NR	NR	NR	NR	NR	NR	ND	ND	ND	ND
	Aviation Fuel (JP4) (mg/L)		NR	NR	NR	NR	NR	NR	NR	NR	ND	ND	ND	200.0 (6)
	Unknown Hydrocarbons (mg/L)		NR	NR	NR	NR	NR	NR	NR	NR	84.0 (3)	120.0 (4)	160.0 (5)	290.0 (7)
415.1	Total Organic Carbon		314.0	30.5	7.2	5.6	2.9	6.8	1.8	3.7	696.0	NR	NR	NR

Notes:
ND = Not Detected
NR = Not Required
NL = Not Listed

(1) – Compound is also detected in the method blank.
(2) – Analytical results should not be considered reliable for this common lab contaminant unless the sample result exceeds 5 times the reporting limit or 10 times the blank concentration.
(3) – Hydrocarbons present in this sample represent an unknown mixture in the range of approximately C8 to C27. Quantitation is based on a diesel standard.
(4) – Hydrocarbons present in this sample represent an unknown mixture in the range of about C9 to C14. Quantitation is based on a Stoddard reference.
(5) – Hydrocarbons present in this sample represent an unknown mixture in the range of about C7 to C18. Quantitation is based on a kerosene reference.
(6) – This sample appears to contain weathered aviation fuel.
(7) – Hydrocarbons present in this sample represent an unknown mixture in the range of about C9 to C12. Quantitation based on a Stoddard reference.

TABLE 15
DETECTED TENTATIVELY IDENTIFIED ORGANIC COMPOUNDS – SURFACE WATER SAMPLES

(Concentrations in micrograms/Liter unless otherwise indicated)

METHOD	COMPOUND	SAMPLE DATE	SW-1 11/89	SW-1 1/90	SW-1 3/90	SW-1 5/90	SW-2 11/89	SW-2 1/90	SW-2 3/90	SW-2 5/90	SW-3 11/89
EPA 624	VOLATILE ORGANIC COMPOUNDS										
	Cyclohexane, 1-Ethyl-4-Methyl-Trans-		ND	ND	ND	ND	ND	ND	ND	ND	17.0
	1H-Indene, 2,3-Dihydro-4-Methyl-		ND	ND	ND	ND	3.0	ND	ND	ND	ND
	Benzene, 1-Ethyl-3-Methyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	38.0
	Benzene, 1-Ethyl-4-Methyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	34.0
	Benzene, 1-Ethyl-4-(1-Methylethyl)		ND	ND	13	ND	ND	ND	ND	ND	ND
	Benzene, 1-Ethenyl-2-Methyl-	(or Isomer)	5.0	ND	ND	ND	ND	ND	ND	ND	ND
	Benzene, 1,3-Dichloro-	(or Isomer)	ND	ND	13	ND	ND	ND	ND	ND	ND
	Benzene, 1,4-Dichloro-	(or Isomer)	6.0	ND	ND	ND	ND	ND	ND	ND	ND
	Benzene, Methyl (1-Methylethyl)-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	200.0
	Benzene, 1-Methyl-3-Propyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	160.0
	Benzene, Propyl-		ND	ND	ND	ND	ND	ND	ND	ND	ND
	Decane, 4-Methyl-		ND	ND	ND	ND	ND	ND	ND	ND	18.0
	Nonane, 4-Methyl-		ND	ND	ND	ND	ND	ND	ND	ND	24.0
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	66.0
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	32.0
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	18.0
	Unknown (I)		ND	ND	32	5.6	ND	ND	ND	ND	ND
	Unknown		ND	ND	21	ND	ND	ND	ND	ND	ND
	Unknown		ND	ND	28	ND	ND	ND	ND	ND	ND
	Unknown		ND	ND	8.5	ND	ND	ND	ND	ND	ND
	Unknown		ND	ND	8	ND	ND	ND	ND	ND	ND

TABLE 15 (Cont'd.)

METHOD	COMPOUND	SAMPLE DATE	SW-1 11/89	SW-1 1/90	SW-1 3/90	SW-1 5/90	SW-2 11/89	SW-2 1/90	SW-2 3/90	SW-2 5/90	SW-3 11/89
EPA 625	SEMIVOLATILE ORGANIC COMPOUNDS										
	Benzene, 2-Ethyl-1,4-Dimethyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	5700
	Benzene, 2-Ethyl-1,4-Dimethyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	6000
	Benzene, 1,2,3,5-Tetramethyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	5000
	Benzene, 1-Ethyl-2,4,5-Trimethyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	3600
	Benzene, 2-Ethyl-1,4-Dimethyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	7400
	Benzene, 1-Methyl-2-(2-Propenyl)-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	8000
	Ethanol, 2-[2-[4-(1,1,3,3-Tetramethylbutyl) Phenoxy]Ethoxy]		ND	ND	ND	ND	ND	ND	ND	ND	4700
	Dodecane		ND	ND	ND	ND	ND	ND	ND	ND	5200
	Undecane		ND	ND	ND	ND	ND	ND	ND	ND	5900
	Hexadecanoic Acid		ND	ND	ND	ND	ND	ND	ND	ND	5200
	1H-Indene, 2,3-Dihydro-4-Methyl-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	3200
	Phenol, 4-(2,2,3,3-Tetramethylbutyl)-	(or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND	5400
	Substituted Ethanol		ND	ND	ND	ND	ND	ND	ND	ND	3900
	Substituted Octadecene		ND	17	ND	ND	ND	ND	ND	ND	ND
	Sulfur, Mol. (S8)		ND	83	17	110	ND	1200	9.4	240	ND
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	17000
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	38000
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	41000
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	35000
	Unknown Alkane		ND	ND	ND	ND	ND	ND	ND	ND	40000

TABLE 15 (Cont'd.)

METHOD	COMPOUND	SW-1 11/89	SW-1 1/90	SW-1 3/90	SW-1 5/90	SW-2 11/89	SW-2 1/90	SW-2 3/90	SW-2 5/90	SW-3 11/89
EPA 625	SEMIVOLATILE ORGANIC COMPOUNDS									
	Unknown Alkane	ND	ND	ND	ND	ND	ND	ND	ND	20000.0
	Unknown Alkane	ND	ND	ND	ND	ND	ND	ND	ND	11000.0
	Unknown Alkene/Alkyne	ND	14.0	ND	ND	ND	ND	ND	ND	ND
	Unknown Aromatic	ND	ND	ND	ND	ND	ND	ND	ND	6300.0
	Unknown Substituted Alkane	9.0	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Substituted Benzene	ND	ND	ND	ND	ND	ND	ND	ND	6800.0
	Unknown Substituted Benzene Sulfonamide	13.0	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Unsaturated Hydrocarbon	ND	ND	ND	ND	ND	13.0	ND	ND	ND
	Unknown Ketone	ND	24.0	ND	ND	ND	ND	ND	ND	3400.0
	Unknown Cyclic Alkylatated Ketone	22.0	ND	ND	ND	ND	ND	ND	ND	ND
	Unknown (1)	15.0	9.2	9.0	ND	ND	8.7	ND	ND	ND
	Unknown (1)	ND	9.2	ND	ND	ND	ND	ND	ND	ND

TABLE 16
DISSOLVED METALS ANALYSIS – SURFACE WATER SAMPLES

(Concentrations in milligrams/Liter unless otherwise indicated)

METHOD	COMPOUND	WELL	SW-1				SW-2				SW-3
		DATE	11/89(1)	1/90	3/90	5/90	11/89(1)	1/90	3/90	5/90	11/89(1)
200.7	Aluminum		ND	0.51	ND	ND	ND	ND	ND	ND	3.2
200.7	Antimony		ND	ND	ND	ND	ND	ND	ND	ND	ND
206.2	Arsenic		0.014	0.012	ND	ND	ND	ND	ND	ND	0.007
200.7	Barium		0.56	0.52	0.29	0.23	ND	0.38	0.12	0.21	0.46
200.7	Beryllium		ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Boron		1.3	1.1	1.9	2.8	3.5	2.4	3.2	3.3	0.7
200.7	Cadmium		ND	ND	ND	ND	ND	ND	ND	ND	0.14
200.7	Calcium		70.4	61.6	208.0	314.0	361.0	281.0	339.0	373.0	20.9
200.7	Chromium		ND	0.01	ND	ND	ND	ND	ND	ND	0.049
7196	Chromium (VI)		ND	ND	ND	ND	ND	ND	ND	ND	0.02
200.7	Cobalt		ND	ND	ND	ND	ND	ND	ND	ND	0.024
200.7	Copper		ND	ND	ND	ND	ND	ND	ND	ND	0.01
200.7	Iron		5.8	11.2	3.1	2.3	ND	0.25	ND	ND	6.8
200.7	Lead		ND	ND	ND	ND	ND	ND	ND	ND	0.3
200.7	Lithium		ND	ND	0.077	ND	ND	0.14	ND	ND	ND
200.7	Magnesium		101.0	96.0	444.0	804.0	1050.0	611.0	883.0	932.0	4.1
200.7	Manganese		0.74	0.53	0.6	0.51	0.053	0.48	0.16	0.32	0.092
245.1	Mercury		ND	ND	ND	ND	ND	ND	ND	ND	0.021
200.7	Molybdenum		ND	ND	ND	ND	ND	ND	ND	ND	0.041
200.7	Nickel		ND	ND	ND	ND	ND	ND	ND	ND	0.074
200.7	Potassium		87.4	76.8	200	265	376	267	307	300	5.0
270.2	Selenium		ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Silver		ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Sodium		896.0	792.0	4580.0	7430.0	9480.0	6470.0	8370.0	8340.0	16.9
200.7	Thallium		ND	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Tin		ND	ND	ND	ND	ND	ND	ND	ND	0.055
200.7	Titanium		ND	ND	ND	ND	ND	ND	ND	ND	0.031
200.7	Vanadium		ND	ND	0.025	0.062	ND	0.023	0.056	0.069	0.015
200.7	Zinc		0.12	0.079	ND	ND	0.14	ND	ND	ND	2.2

Notes:

ND = Not Detected

(1) – Samples unfiltered; total suspended metals

TABLE 17
SUMMARY OF INORGANIC ANALYSIS – SURFACE WATER SAMPLES

(Concentrations in milligrams/Liter unless otherwise indicated)

METHOD	COMPOUND	WELL	SW-1				SW-2				SW-3
		DATE	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90	11/89
300.0	Chloride		1420	1600	10200	15800	17300	13600	21100	16900	5.5
335.3	Total Cyanide		ND	ND	ND	ND	ND	ND	ND	ND	ND
150.1	pH (Standard Units)		7.5	7.5	7.6	7.3	7.5	7.0	7.8	7.0	6.2
120.1	Specific Conductance at 25 deg. C (umhos/c)		5420	5430	21300	30800	42300	31400	38000	36800	188
160.1	Total Dissolved Solids		2950	2930	14600	22500	27300	22100	29100	25800	150
351.3	Total Kjeldahl Nitrogen		41.70	41.60	21.30	13.40	0.64	7.80	2.20	2.10	5.00

Notes:

ND = Not Detected

TABLE 18
COMPARISON OF PRIMARY AND DUPLICATE SAMPLES

PARAMETER	MW-2		MW-3		MW-4			
	3/90	3/90 (dup)	1/90	1/90 (dup)	11/89	11/89 (dup)	5/90	5/90 (dup)
pH	7.02	7.15	6.62	6.62	6.46	6.46	6.50	6.50
Specific Conductivity (umhos/cm)	8160	8500	18300	18300	3970	3970	17720	17720
Temperature (C)	15.5	15.0	18.3	18.3	20.0	20.0	15.0	15.0

TABLE 18 (Cont'd.)

(Concentrations in micrograms/Liter unless otherwise indicated)

METHOD	COMPOUND	WELL	MW-2		MW-3		MW-4			
		DATE	3/90	3/90 (dup)	1/90	1/90 (dup)	11/89	11/89 (dup)	5/90	5/90 (dup)
624	1,2-Dichloroethane (cis/trans)		ND	ND	ND	ND	ND	ND	ND	ND
	Tricloroethene		ND	ND	ND	ND	ND	ND	ND	ND
	Benzene		ND	ND	ND	ND	ND	ND	ND	ND
	Xylenes (total)		ND	ND	ND	ND	ND	ND	ND	ND
	(2) 4-Methyl-2-pentanone		ND	ND	ND	ND	ND	ND	ND	ND
	(2) 2-Hexanone		ND	ND	ND	ND	ND	ND	ND	ND
625	(2) bis(2-Ethylhexyl)-phthalate		ND	ND	18.0 (1)	11.0 (1)	38.0	27.0	ND	ND
415.1	Total Organic Carbon		11.0	11.4	2.0	1.9	421.0	411.0	39.6	38.5

Notes:

ND = Not Detected

NT = Not Tested

(1) – Compound is also detected in the method blank.

(2) – Analytical results should not be considered reliable for this common lab contaminant unless the sample result exceeds 5 times the reporting limit or 10 times the blank result.

TABLE 18 (Cont'd.)

(Concentrations in micrograms/Liter unless otherwise indicated)

METHOD	COMPOUND	MW-2 3/90	MW-2 3/90 (dup)	MW-3 1/90	MW-3 1/90 (dup)	MW-4 11/89	MW-4 11/89 (dup)	MW-4 5/90	MW-4 5/90 (dup)
EPA 624	VOLATILE ORGANIC COMPOUNDS								
	Cyclohexane, 1-Ethyl-4-Methyl-	ND	ND	ND	ND	6.0	ND	ND	ND
	1H-Indene, Octahydro-	ND	ND	ND	ND	4.0	ND	ND	ND
	1H-Indene, 2,3-Dihydro-5-Methyl-	ND	ND	ND	ND	ND	18.0	ND	ND
	Benzene, 1-Ethyl-3-Methyl- (or Isomer)	ND	ND	ND	ND	ND	ND	ND	ND
	Benzene, 2-Ethyl-1,4-Dimethy (or Isomer)	ND	ND	ND	ND	ND	18.0	ND	ND
	Benzene, Ethyl-1,2,4-Trimethyl-	ND	ND	ND	ND	ND	25.0	ND	ND
	Benzene, Diethyl- (or Isomer)	ND	ND	ND	ND	ND	13.0	ND	ND
	Benzene, 1,2-Diethyl- (or Isomer)	ND	ND	ND	ND	3.0	5.0	ND	ND
	Benzene, 1,3-Diethyl- (or Isomer)	ND	ND	ND	ND	10.0	ND	ND	ND
	Benzene, 1,3-Diethyl-5-Methyl (or Isomer)	ND	ND	ND	ND	ND	9.0	ND	ND
	Benzene, 1,2,4-Trimethyl- (or Isomer)	ND	ND	ND	ND	6.0	ND	ND	ND
	Benzene, 1,2-Dichloro- (or Isomer)	ND	ND	ND	ND	5.0	ND	ND	ND
	Benzene, 1,4-Dichloro- (or Isomer)	ND	ND	ND	ND	ND	5.0	ND	ND
	Benzene, Propyl-	ND	ND	ND	ND	6.0	ND	ND	ND
	Benzene, 2-Propenyl-	ND	ND	ND	ND	16.0	17.0	ND	ND
	Benzene, 1-methyl-3-(1-methylethyl)-(or Isomer	ND	ND	ND	ND	ND	ND	35.0	30.0
	Benzene, 1,2,3,5-tetramethyl- (or Isomer)	ND	ND	ND	ND	ND	ND	100	79.0
	Benzene, 1,2,3,4-tetramethyl- (or Isomer)	ND	ND	ND	ND	ND	ND	73.0	62.0
	Unknown Alkane	ND	ND	ND	ND	2.0	ND	ND	ND
	Unknown (1)	ND	850	ND	ND	ND	10.0	ND	ND

Notes:

(1) – Identification of unknown compound is not possible by spectral match.

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TABLE 18 (Cont'd.)

METHOD	COMPOUND	WELL / DATE	MW-2 3/90	MW-2 3/90 (dup)	MW-3 1/90	MW-3 1/90 (dup)	MW-4 11/89	MW-4 11/89 (dup)	MW-4 5/90	MW-4 5/90 (dup)
EPA 625	SEMIVOLATILE ORGANIC COMPOUNDS									
	Benzene, 2-Ethyl-1,4-Dimethyl-	(I)	ND	ND	ND	ND	72	61	23	20
	Benzene, 1,2,3,5-Tetramethyl-	(I)	ND	ND	ND	ND	71	57	49	46
	Benzene, 1,2,3,5-Tetramethyl-	(I)	ND	ND	ND	ND	96	81	39	29
	Benzene, 1-Ethyl-2,4,5-Trimethyl-	(I)	ND	ND	ND	ND	18	ND	ND	ND
	Benzene, 1-Ethyl-2,3-Dimethyl	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Benzene, 1-Ethyl-2,3-Dimethyl	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Benzene, Diethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Benzene, 1,3-Dimethyl-5-(1-Methylethyl))-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Benzene, (1-Methyl-1-Propenyl)-, (E)-		ND	ND	ND	ND	ND	19	ND	ND
	Benzoic Acid, 2,4,5-Trimethyl-	(I)	ND	ND	ND	ND	36	ND	ND	ND
	Benzoic Acid, 2,4,6-Trimethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Benzoic Acid, 2,4,6-Trimethyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Benzeneacetic Acid, Ar-Ethenyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Benzenesulfonamide, N-Butyl-4-Methyl-		ND	ND	ND	ND	ND	ND	ND	ND
	Ethanol, 2-(2-Butoxyethoxy)-	(I)	ND	ND	14	13	ND	ND	ND	ND
	Ethanol, 2-(2-Butoxyethoxy)-, Acetate	(I)	ND	ND	ND	ND	100	54	ND	ND
	Ethanol, 2-(9-Octadecenyloxy)-, (Z)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Hexanedionic Acid, Mono(2-Ethylhexyl)Ester		ND	ND	ND	ND	ND	ND	ND	ND
	1H-Indene, 2,3-Dihydro-4-Methyl-	(I)	ND	ND	ND	ND	21	ND	ND	ND
	1H-Indene, 2,3-Dihydro-5-Methyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Phenol, 2,4-Bis(1,1-Dimethylethyl)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Phenol, 3-(1,1-Dimethylethyl)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Phenol, 4-(2,2,3,3-Tetramethylbutyl)-	(I)	ND	ND	ND	ND	80	78	56	59
	Phenol, 4-(2,2,3,3-Tetramethylbutyl)-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Phenol, 4,4-Butylidenebis(2-Dimethylethl)-5-Methyl-		ND	ND	ND	ND	ND	ND	ND	ND
	Phenol, 4-Nonyl-	(I)	ND	ND	ND	ND	ND	ND	ND	ND
	Sulfur, Mol. (S8)		ND	ND	ND	ND	990	1100	8000	4200
	Unknown Alkane		ND	ND	ND	ND	19	18	ND	ND

Notes: (I) = or Isomer.

TABLE 18 (Cont'd.)

METHOD	COMPOUND	WELL	MW-2		MW-3		MW-4			
		DATE	3/90	3/90 (dup)	1/90	1/90 (dup)	11/89	11/89 (dup)	5/90	5/90 (dup)
EPA 625	SEMIVOLATILE ORGANIC COMPOUNDS									
	Unknown Alkene		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Oxygenated Compound		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Substituted Benzene		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Substituted Benzoic Acid		ND	ND	ND	ND	ND	16	ND	ND
	Unknown Substituted Benzoic Acid		ND	ND	ND	ND	ND	34	ND	ND
	Unknown Substituted Benzoic Acid		ND	ND	ND	ND	ND	17	ND	ND
	Unknown Carboxylic Acid		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Substituted Carboxylic Acid		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Substituted Oxirane		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Unsaturated Hydrocarbon		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Unsaturated Compound		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Ketone		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Cyclic		ND	ND	54	52	ND	ND	ND	ND
	Unknown Cyclic Hydrocarbon		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Cyclic Hydrocarbon		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown Cycloalkane		ND	ND	9.1	8.1	ND	ND	ND	ND
	Unknown Cyclohexane		ND	ND	52	48	ND	ND	ND	ND
	Unknown Alkyl Phenol		ND	ND	ND	ND	18	ND	13	14
	Unknown Alkyl Phenol		ND	ND	ND	ND	ND	ND	15	14
	Unknown Alkyl Phenol		ND	ND	ND	ND	ND	ND	ND	12
	Unknown Substituted Phenol		ND	ND	ND	ND	ND	17	ND	ND
	Unknown (1)		17	17	11	11	18	18	ND	ND
	Unknown (1)		ND	ND	ND	ND	ND	17	ND	ND
	Unknown (1)		ND	ND	ND	ND	ND	17	ND	ND
	Unknown (1)		ND	ND	ND	ND	ND	ND	ND	ND
	Unknown (1)		ND	ND	ND	ND	ND	ND	ND	ND

Notes:

ND = Not Detected

(1) – Identification of unknown compound not possible by spectral match.

TABLE 18 (Cont'd.)

METHOD	COMPOUND	MW-2 3/90	MW-2 3/90 (dup)	MW-3 1/90	MW-3 1/90 (dup)	MW-4 11/89	MW-4 11/89 (dup)	MW-4 5/90	MW-4 5/50 (dup)
200.7	Aluminum	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Antimony	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Barium	0.53	0.5	0.093	0.094	0.54	0.52	0.98	0.97
200.7	Beryllium	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Boron	1.4	1.4	2.2	2.1	1.4	1.4	1.4	1.4
200.7	Cadmium	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Calcium	167	167	268	265	171	167	261	260
200.7	Chromium	ND	ND	ND	ND	ND	ND	ND	ND
7196	Chromium (VI)	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Cobalt	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Copper	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Iron	4.9	3.5	0.31	0.42	0.56	0.64	ND	ND
200.7	Lead	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Lithium	ND	ND	0.090	0.089	ND	ND	ND	ND
200.7	Magnesium	290.0	291.0	621.0	620.0	178.0	173.0	322.0	321.0
200.7	Manganese	1.4	1.4	4.2	4.1	1.1	1.1	1.4	1.4
245.1	Mercury	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Molybdenum	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Nickel	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Potassium	137.0	137.0	235.0	238.0	66.2	64.0	100.0	99.7
270.2	Selenium	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Silver	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Sodium	2610.0	2730.0	6200.0	5970.0	1400.0	1280.0	2920.0	2970
200.7	Thallium	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Tin	ND	ND	ND	ND	ND	ND	0.43	0.15
200.7	Titanium	ND	ND	ND	ND	ND	ND	ND	ND
200.7	Vanadium	0.016	0.016	0.031	0.029	ND	ND	0.012	0.011
200.7	Zinc	ND	ND	ND	ND	0.23	ND	ND	ND

Notes:

ND = Not Detected

TABLE 18 (Cont'd.)

(Concentrations in milligrams/Liter unless otherwise indicated)

METHOD	COMPOUND	WELL	MW-2		MW-3		MW-4			
		DATE	3/90	3/90 (dup)	1/90	1/90 (dup)	11/89	11/89 (dup)	5/90	5/90 (dup)
300.0	Chloride		6630	6030	13900	14700	2430	1860	5870	5610
335.3	Total Cyanide		ND	ND	ND	ND	0.012	ND	ND	ND
150.1	pH (Standard Units)		7.4	7.4	7.1	7.1	6.7	6.7	7.0	6.9
120.1	Specific Conductance at 25 deg. C (umhos/c)		14300	14300	31200	30900	8450	6400	13700	14400
160.1	Total Dissolved Solids		9580	9500	21800	21200	4850	3550	11000	9950
351.3	Total Kjeldahl Nitrogen		45.0	45.5	2.5	2.2	10.2	9.2	7.4	6.8

Notes:

ND = Not Detected

Golder Associates

TABLE 19
QA/QC SAMPLES – TRIP AND FIELD BLANKS

(Concentrations in micrograms/Liter unless otherwise indicated)

	SAMPLE	TRIP BLANK				FIELD BLANK			
	DATE	11/89	1/90	3/90	5/90	11/89	1/90	3/90	5/90
EPA 624	VOLATILE ORGANIC COMPOUNDS								
	Target List Compounds (1)								
	Methylene Chloride	NT	ND	ND	ND	20	ND	ND	ND
	No other Target List Compounds found								
	Tentatively Identified Compounds								
	Unknown (2)	NT	ND	ND	ND	4.0	ND	ND	ND
	No other Tentatively Identified Compounds found.								

Notes:

NT = Not tested.
(1) – See Table 6 for list of compounds.
(2) – Identification of unknown compound is not possible by spectral match

Golder Associates

TABLE 20
PRELIMINARY WATER QUALITY ANALYSES-JUNE 1989
ORGANIC COMPOUNDS

EPA METHOD	COMPOUND	SAMPLE LOCATION										
		B-1	B-2	B-3	B-4	B-5	SW-1/SW-2 composite	P-6	P-7	P-8	P-9	HP-10
624	Acetone	ND	ND	ND	ND	ND	ND	17	ND	ND	ND	ND
	(No other EPA Method 624 compounds detected)											
625	bis(2-Ethylhexyl)phthalate	ND	15	25	ND	ND	ND	ND	ND	ND	ND	ND
	2,6-Dimethylundecane	ND	25	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7-Dethyltridecane	ND	67	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1-Methylnaphthalene	ND	37	ND	ND	ND	ND	ND	ND	ND	ND	ND
	2,7,10-Trimethyldodecane	ND	81	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1,3-Dimethylnaphthalene	ND	39	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Tricarbonyl [N-(phenyl-2-Pyridinylmethylene) Benzenamine-NN] - Iron	ND	40	ND	ND	ND	ND	ND	ND	ND	ND	ND
	2,6-Dimethylheptadecane	ND	74	ND	ND	ND	ND	ND	ND	ND	ND	ND
	M,P-DDD	ND	21	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Sulfur	14	ND	83	1400	22	100	ND	ND	ND	ND	NR
	(No other EPA Method 625 compounds detected)											
415.1	Total Organic Carbon (mg/L)	32	49	66	33	55	32	NR	NR	NR	NR	NR

Notes:
(1) ND = Not detected.
(2) NR = Not required.
(3) Concentrations in micrograms/Liter unless otherwise noted.

TABLE 20 (continued)
PRELIMINARY WATER QUALITY ANALYSES-JUNE 1989
METALS (TOTAL)

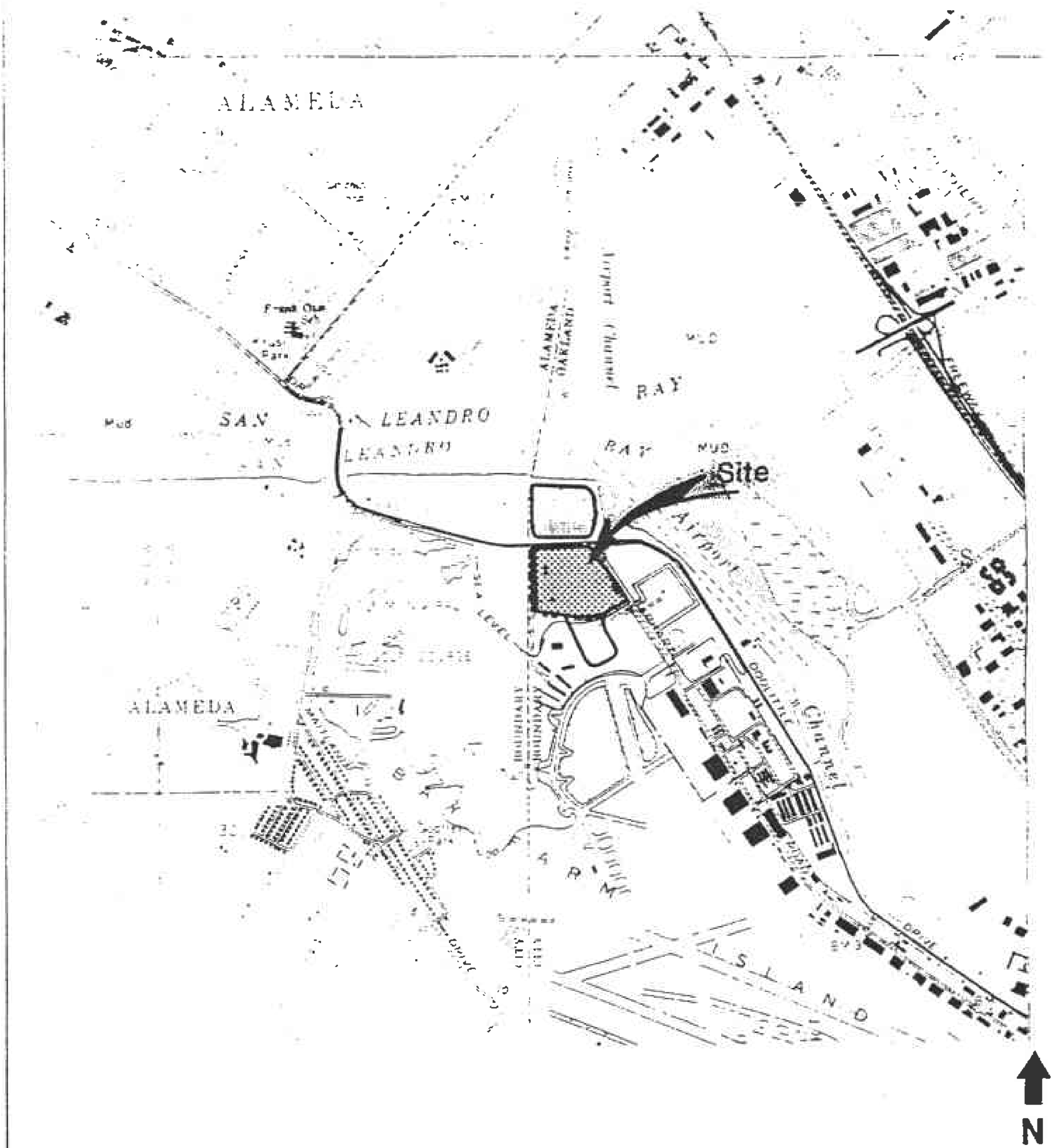
METHOD NO.	COMPOUND	SAMPLE LOCATION					
		B-1	B-2	B-3	B-4	B-5	SW-1/SW-2 composite
200.7	Aluminum	694.0	229.0	16.0	135.0	367.0	1.2
200.7	Antimony	ND	ND	0.06	ND	ND	ND
200.7	Arsenic	2.3	0.6	ND	0.6	0.9	ND
200.7	Barium	24	1.9	2	2	7.7	0.74
200.7	Beryllium	0.035	0.017	0.002	0.013	0.028	ND
200.7	Boron	2.4	0.79	2.8	1.1	1.5	1.8
200.7	Cadmium	0.44	0.093	0.016	0.2	0.086	ND
200.7	Calcium	1090	144	250	271	1190	142
200.7	Chromium	5.8	1.2	0.08	1	1.6	ND
200.7	Cobalt	0.58	0.28	0.04	0.19	0.38	ND
200.7	Copper	0.04	1.7	0.15	3.5	2.9	0.02
200.7	Iron	2720	772	47	717	585	7.7
200.7	Lead	89	3.4	1	14	20	ND
200.7	Lithium	0.57	0.42	0.05	0.12	0.32	ND
200.7	Magnesium	343	220	125	371	308	231
200.7	Manganese	18	7.2	1.7	7.9	13	0.36
200.7	Molybdenum	0.63	0.18	0.02	0.19	0.016	ND
200.7	Nickel	3.1	1.5	0.11	1.3	1.8	ND
200.7	Potassium	162	70	84	108	119	101
200.7	Selenium	ND	ND	ND	ND	ND	ND
200.7	Silver	ND	ND	ND	ND	0.02	ND
200.7	Sodium	374	557	697	2560	1030	2040
200.7	Thallium	ND	ND	ND	ND	ND	ND
200.7	Tin	0.97	0.32	ND	0.72	0.61	ND
200.7	Titanium	2.3	0.94	0.36	1.3	2.7	0.04
200.7	Vanadium	1.8	1.2	0.09	0.45	1.2	0.04
200.7	Zinc	190	16	1.3	37	38	0.12
206.2	Arsenic	0.3	0.9	0.017	0.61	0.38	0.006
245.1	Mercury	0.008	0.025	0.003	0.02	0.017	ND
270.1	Selenium	ND	ND	ND	ND	ND	ND

Notes:
(1) ND = Not detected.
(2) Concentrations in milligrams/Liter.

TABLE 20 (continued)
PRELIMINARY WATER QUALITY ANALYSES-JUNE 1989
INORGANIC PARAMETERS

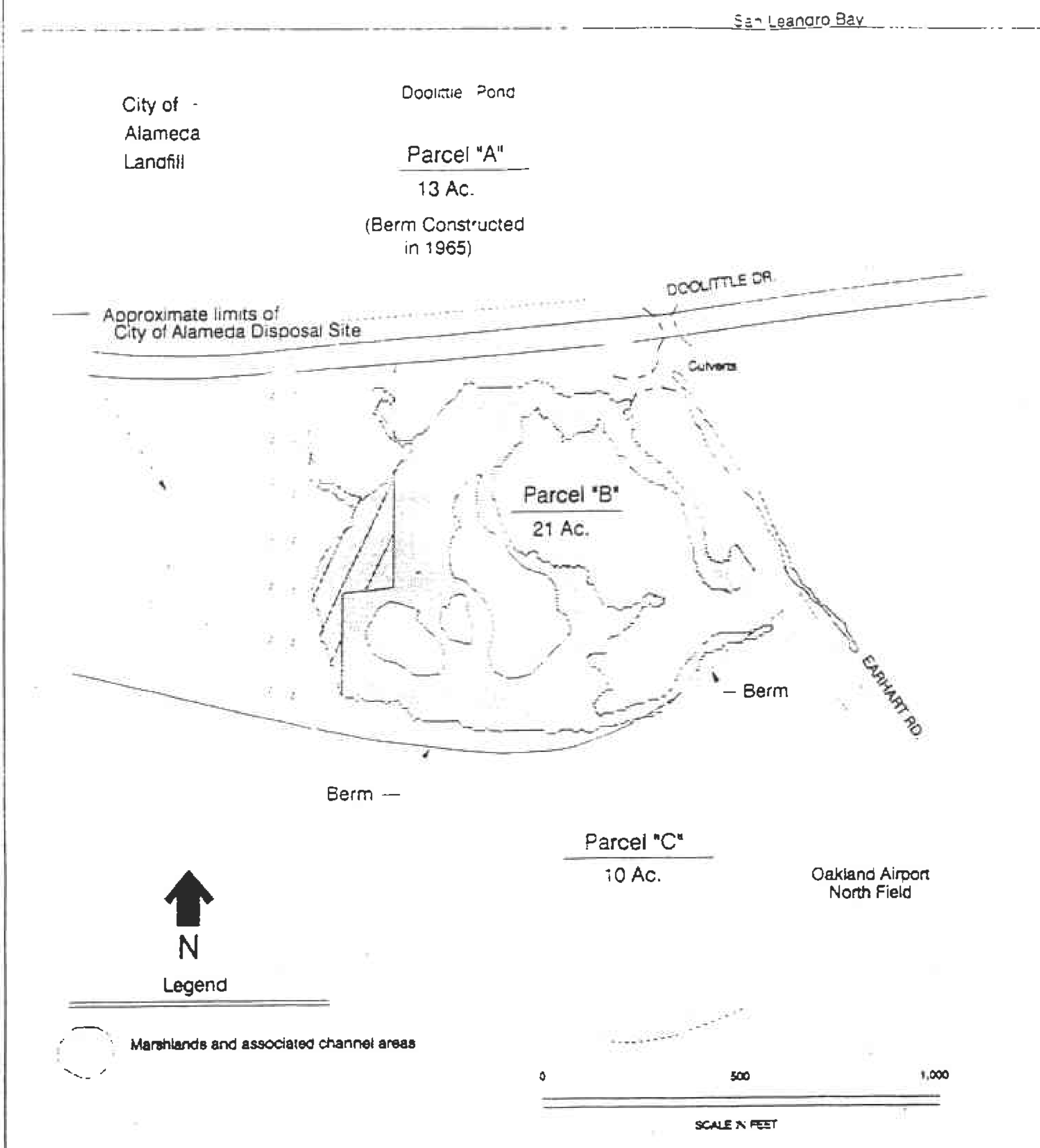
EPA METHOD	COMPOUND	SAMPLE LOCATION						
		B-1	B-2	B-3	B-4	B-5	SW-1/SW-2 composite	SW-3
353.2	Nitrate plus Nitrite as N	1.1	1.0	ND	0.7	0.7	0.08	NT
160.1	Total Dissolved Solids	2730	7200	3880	26700	6200	5880	28600
120.1	Specific Conductance at 25 deg. C (umhos/c)	4570	10600	5990	30800	9470	11200	36400
353.1	Total Kjeldahl Nitrogen	70	40	44	34	50	23	NR
352.2	Chloride	1050	3800	1400	14100	2900	3820	15800
150.1	pH (Standard Units)	7	7	7	7	7	7	8

Notes:
(1) Concentrations in milligrams per Liter unless other wise noted.



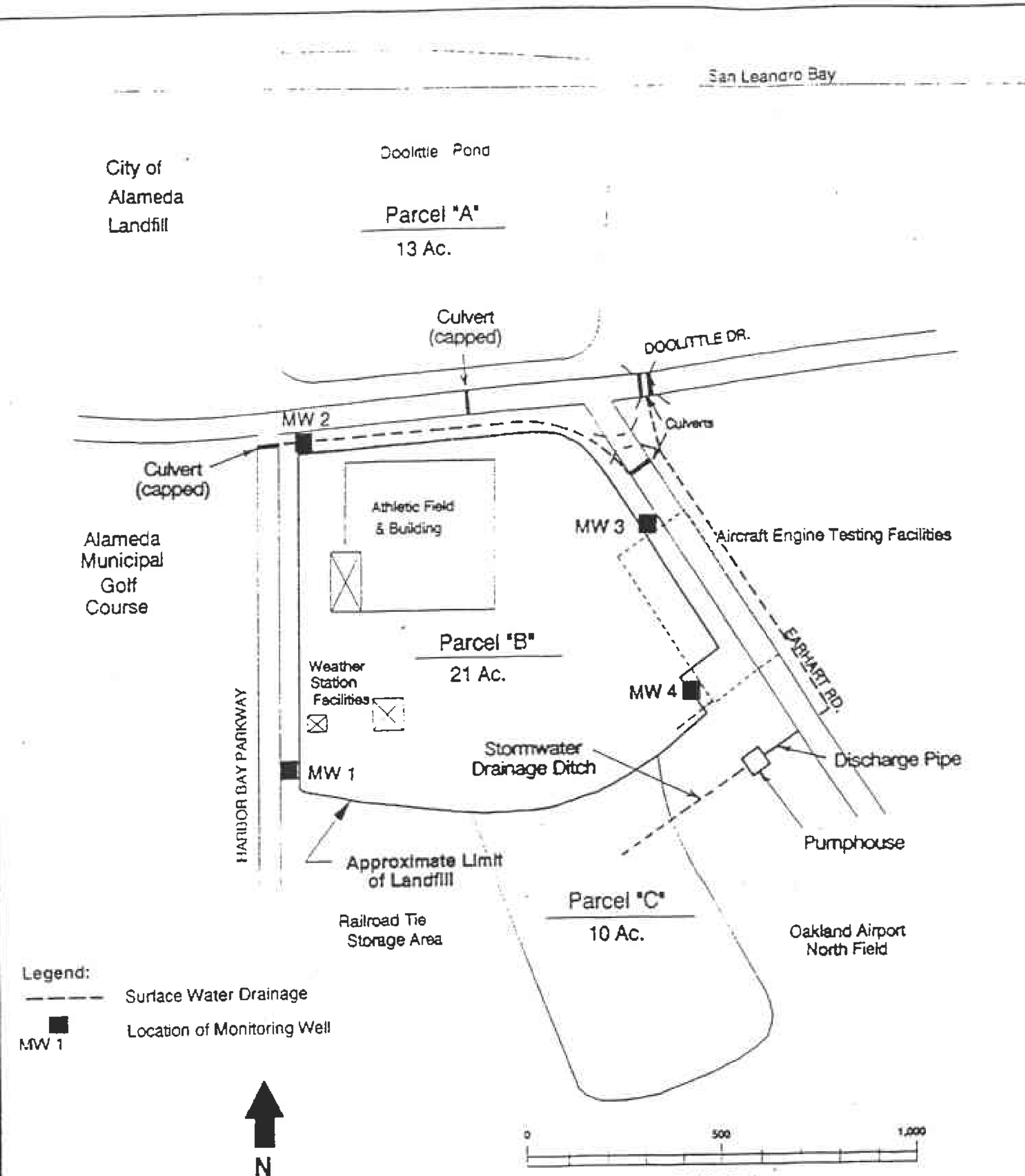
NOTE:
BASE; USGS 7.5 MIN. QUADS. SAN LEANDRO AND EAST OAKLAND.

Job No. 893-7039	Scale 1 ' = 2,000 ft.	**SITE LOCATION MAP**
Drawn DVR	Date June 1990	**North Port of Oakland Disposal Site**
Checked KRR	Dwg. No.	
Golder Associates Inc.		Waste Management of North America, Inc. — FIGURE 1



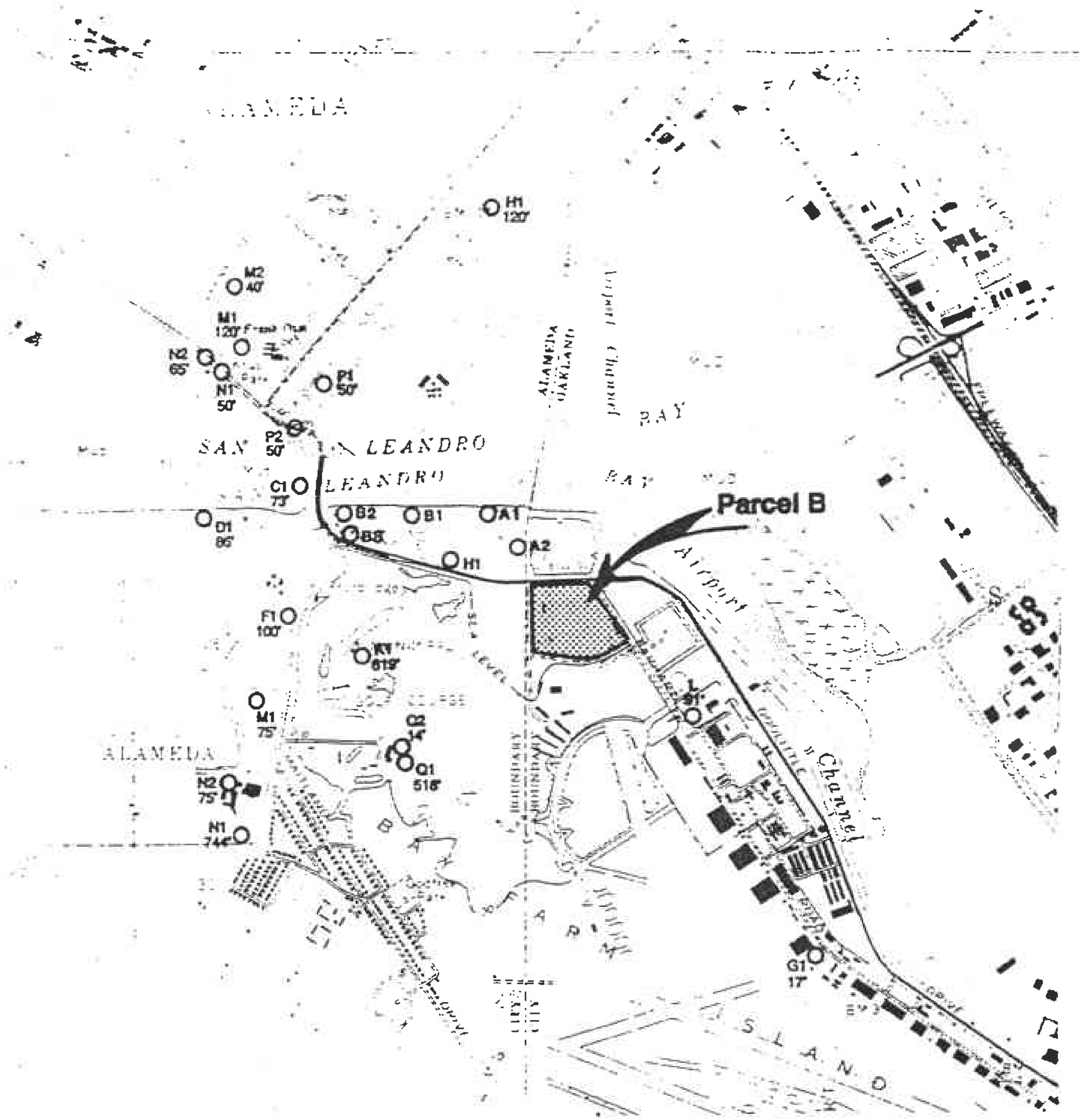
NOTE:
SOURCE: AERIAL PHOTO AV28-17-25, FLOWN ON 4/14/50.

Job No	893-7039	Scale	As Shown	SITE CONDITIONS PRIOR TO LANDFILL CONSTRUCTION North Port of Oakland Disposal Site
Drawn	DVR	Date	June 1990	
Checked	KRR	Dwg No		
Golder Associates Inc.		Waste Management of North America, Inc.		FIGURE 2



Source:
Features taken from
Port of Oakland Airport Layout Plan
(Orthographic map revised 7/26/85)

Job No 893-7039	Scale As Shown	**PRESENT LAND USE** **North Port of Oakland Disposal Site**		
Drawn DVR	Date June 1990			
Checked KRR	Dwg. No.			
Golder Associates Inc.		Waste Management of North America, Inc.	FIGURE	3

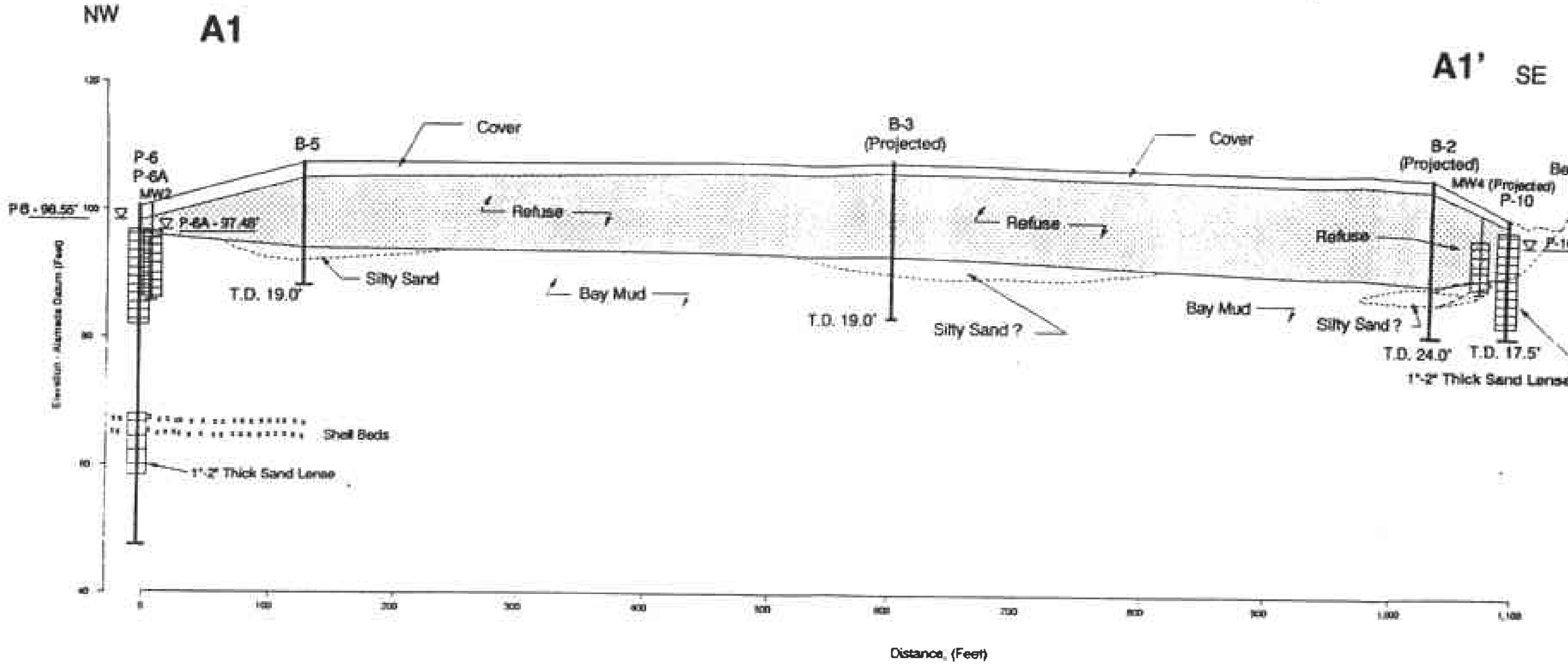


NOTES:

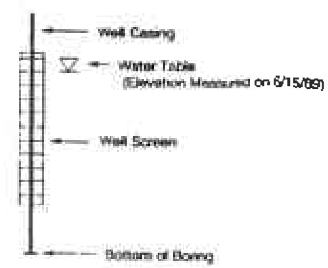
1. WELL NUMBERS ARE BASED ON THE STATE WELL NUMBERING SYSTEM USED BY THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES.
2. SEE TABLE 5-1 WELL DETAILS.

BASE: USGS 7.5 MIN. QUADS. SAN LEANDRO AND OAKLAND.
SOURCE: ALAMEDA CO. FLOOD CONTROL DISTRICT 205(J) REPORT, JUNE 1988.

Job No. 893-7039	Scale 1' = 2,000 ft.	**WELLS WITHIN A ONE MILE RADIUS OF THE SITE** North Port of Oakland Disposal Site
Drawn DVR	Date June 1990	
Checked KRR	Dwg. No.	
Golder Associates Inc.		Waste Management of North America, Inc. — FIGURE 4



LEGEND



NOTES:

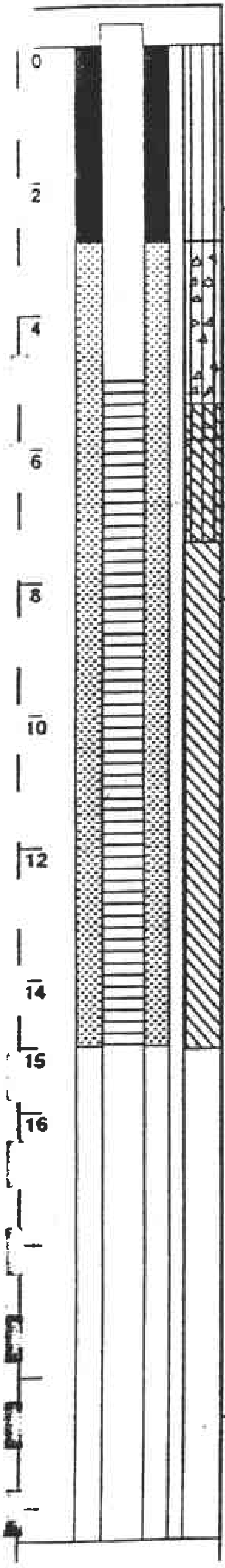
(1) See Figure 8 for location of Cross Section
(2) Piezometers P-6 & P-6A are single completion

	893-7039		As Noted
	DVR		June 1990
	KRR		

Golder Associates Inc.

GEOLOGIC CROSS S
North Port of Oaklan

Waste Management of North A



Well No. MWI

Boring No. X-Ref:

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N 457141.0174
E 1501146.4516

Elevation Ground Level 101.8 ft MSL
Top of Casing 103.48 ft MSL

Drilling Summary:

Total Depth 15.0 ft.
Borehole Diameter 10 inches
Casing Stick-up Height:
Driller Bob Eneix
All Terrain Explorations

Rig CME 750
Bit(s) 10" Hollow Stem Augers

Drilling Fluid None

Protective Casing Steel Monument

Construction Time Log: (1)

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	10-12	0930	10-12	1205
Geophys. Logging:				
Casing:	10-12	1205	10-12	1210
Filter Placement:	10-12	1210	10-12	1225
Cementing:	10-12	1230	10-12	1240
Development:				

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ___
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
0 - 5.0	C1	96.8' - 101.8'
5.0 - 15.0	S1	86.8' - 96.8'

Casing: C1 4" Dia. Sch. 40, PVC, Brainard-Kilman Tri-Loc
C2

Screen: S1 4" Dia. Sch. 40, PVC, 0.01" Slots, Brainard-Kilman Tri-Loc

Filter Pack: (3'-15') Lonestar Lapis Lustre 1/20 Sand

Grout Seal: (0'-1.5') Lonestar Types I-II Cement

Bentonite Seal: (1.5'-3.0') 3/8" Pellets

Well Development:

Surge Block, Bailing

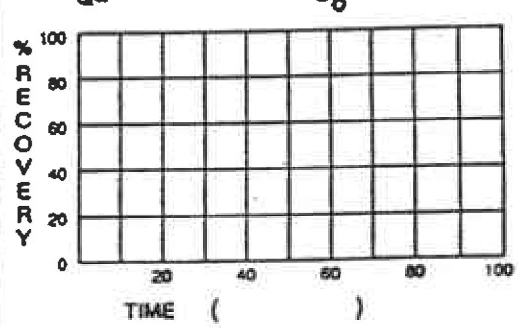
Total Gallons Removed - 55

Stabilization Test Data: 10-18-89

Time	pH	Spec. Cond.	Temp (C)
1440	6.94	7020 MS	20
1500	7.64	2420 MS	21
1530	7.69	2380 MS	21
1630	7.66	2400 MS	21

Recovery Data:

Q= S_o=



SITE NAME Port of Oakland - SWAT

LOCATION Oakland, CA

WC 03696

SUPERVISED BY Kent R. Reynolds

DATE 10/16/89

Comments: (1) All dates are 1989

SOIL BOREHOLE LOG

Golder Associates Inc.

SITE NAME AND LOCATION: Port of Oakland Disposal Site, Oakland, CA	DRILLING METHOD: Hollow Stem Auger	BORING NO. MW1
	SAMPLING METHOD: Continuous core split spoon and modified california sampler	SHEET 1 OF 2
DATUM Alameda Datum ELEVATION 103.48	WATER LEVEL: 5.35, 5.39; TIME: 1056, 1430; DATE: 10/13/89, 10/18/89; CASING DEPTH	DRILLING START TIME 0930, DATE 10/12/89; FINISH TIME 1205, DATE 10/12/89
DRILL RIG CME 750	SURFACE CONDITIONS: Located at S.W. corner of site. Dry, grassy field.	
ANGLE BEARING		
SAMPLE HAMMER TORQUE		

DEPTH IN FEET	BLOWS/6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	OTHER TESTS
0.0	6, 8, 8 (60%)		1. Loose, dark brown, SILT, some fine subangular to subrounded gravel, some sand, some refuse (plastic, glass, brick), trace organics, dry (ML). Cobbles in cuttings.	SS							
2.0	9, 5, 6 (67%)		2. Concrete chunks in shoe.	SS							
	6, 7, 13 (60%)		3. Compact, dark brown, subrounded gravelly SILT, trace clay, moist (ML). Brick, metal fitting at 3.9 ft. 0.2 ft black burned wood layer at 4.3 ft.	SS							
4.0	6, 7, 4		4.	MCS			42.1			2.76	
			Soft, dark brownish gray, clayey SILT, trace organics, trace refuse (glass), wet (MH).								
6.0	1 (67%)		5. Soft, dark brownish gray, silty CLAY, some sand, trace refuse (glass), wet (CL).	SS							
8.0	1, 1, 1 (100%)		6. Very soft, light gray, CLAY, little organics, wet (CH).	SS							
	1, 1, 2		7.	MCS							
10.0	2 (100%)		8.	SS							
12.0											

DRILLING CONTR All Terrain Explorations Bob Engix

LOGGED BY P. E. Bowers DATE 10/12/89 CHKD BY KRR

SL 9295 C

SOIL BOREHOLE LOG

Golder Associates Inc.

SITE NAME AND LOCATION: Port of Oakland Disposal Site, Oakland, CA	DRILLING METHOD: Hollow Stem Auger	BORING NO. MW1
	SAMPLING METHOD: Continuous core split spoon and modified california sampler	SHEET 2 OF 2

WATER LEVEL	5.35	5.39			DRILLING START TIME	FINISH TIME
TIME	1056	1430			0930	1205
DATE	10/13/89	10/18/89			DATE 10/12/89	DATE 10/12/89
CASING DEPTH						

DATUM Alameda Datum ELEVATION 103.48

DRILL RIG CME 750

ANGLE BEARING

SAMPLE HAMMER TORQUE

SURFACE CONDITIONS: Located at S.W. corner of site. Dry, grassy field.

DRILLING CONTR All Terrain Explorations Bob Enelx

DEPTH IN FEET	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	OTHER TESTS
12.0	2		9								
			13.5 – 15.0 ft: trace bivalve shells.								
14.0	2		10							2.80	
			Total depth – 15.0 ft								
16.0											
18.0											
20.0											
22.0											
24.0											

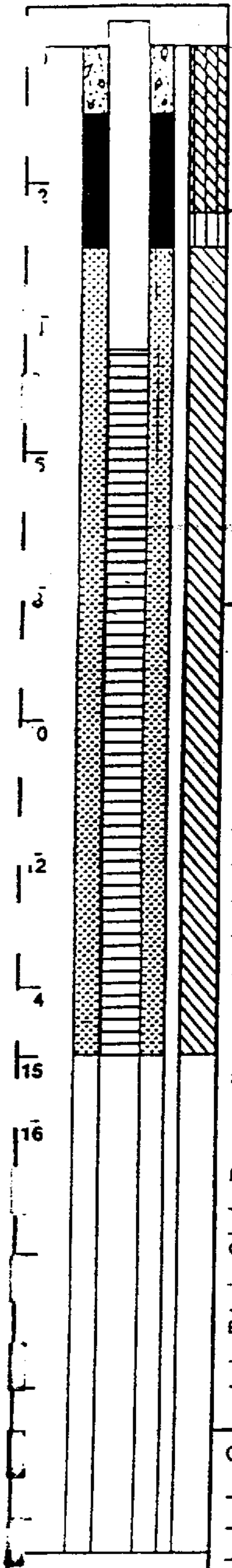
SL 9296 C

LOGGED BY P. E. Bowers CHKD BY KRR

DATE 10/12/89

Well No. MW2

Boring No. X-Ref:



MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N 457976.3938
E 1501153.8848

Elevation Ground Level 100.3 ft MSL

Top of Casing 102.19 ft. MSL

SITE NAME Port of Oakland - SWAT

LOCATION Oakland, CA

WC 03695

Drilling Summary:

Total Depth 15.0 ft

Borehole Diameter 10 inches

Casing Stick-up Height:

Driller Bob Eneix
All Terrain Explorations

Rig CME 750

Bit(s) 10" Hollow Stem Augers

Drilling Fluid None

Protective Casing Steel Monument

Construction Time Log: (1)

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	10-12	1310	10-12	1430
Geophys. Logging:				
Casing:	10-12	1430	10-12	1435
Filter Placement:	10-12	1435	10-12	1445
Cementing:	10-12	1450	10-12	1500
Development:				

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____

Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
0 - 4.5'	C1	95.8' - 100.3'
4.5' - 15.0'	S1	85.3' - 95.8'

Casing: C1 4" Dia. Sch.40, PVC Brainard-Kilman Tri-Loc

C2

Screen: S1 4" Dia. Sch.40, PVC, 0.01" slots, Brainard-Kilman Tri-Loc

Filter Pack: (2.5'-15.0') Lonestar Lapis Lustre 1/20 Sand

Grout Seal: (0'-1.0'): Lonestar Type I-II Cement

Bentonite Seal: (1.0'-2.5') 3/8" Pellets

Well Development:

Surge Block, Bailing

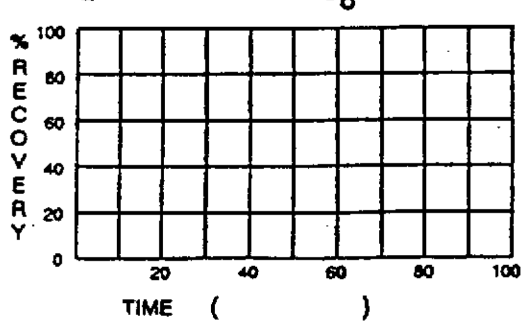
Total Gallons Removed - 93

Stabilization Test Data: 10-19-89

Time	pH	Spec. Cond.	Temp (C)
1000	6.94	8360 MS	22
1043	7.06	2820 MS	22
1110	7.06	2810 MS	22

Recovery Data:

Q= S_o=



Comments: (1) All dates are 1989

SUPERVISED BY Kent R. Reynolds

DATE 10-16-89

SOIL BOREHOLE LOG

Golder Associates Inc.

SITE NAME AND LOCATION: Port of Oakland Disposal Site, Oakland, CA	DRILLING METHOD: Hollow Stem Auger	BORING NO. MW2
	SAMPLING METHOD: Continuous core split spoon and modified california sampler	SHEET 1 OF 2
DATUM Alameda Datum	ELEVATION 102.19	

WATER LEVEL	3.97	4.02		
TIME	1124	0951		
DATE	10/13/89	10/19/89		
CASING DEPTH				

DRILLING	START	FINISH
TIME	1310	1430
DATE	10/12/89	10/12/89

DRILL RIG CME 750

SURFACE CONDITIONS: Located at N.W. corner of site. Parking lot.

ANGLE BEARING

SAMPLE HAMMER TORQUE

DEPTH IN FEET	BLOWS/6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	OTHER TESTS
0.0	15, 32, 12 (100)		1 — Compact, light brown, SILT and CLAY, some fine angular gravel, trace roots, Dry (MH). Gravel subgrade in cuttings (parking lot).	ss							
	2 (50)		2								
2.0	2		Compact, dark brown with reddish brown mottling, SILT and fine angular GRAVEL, little sand, wet (ML).	ss							
	1, 1, 1 (50)		3 — Firm, dark brown, sandy CLAY, some silt, little fine angular gravel, wet (CL).	ss							
4.0	1, 2		4 — Soft, dark brown, silty CLAY, trace organics, wet (CL). Becomes black at 6.0 ft.	mcs							
6.0	2, 3, 18 (70)		5	ss							
	2 (100)		6 — Very soft, light gray, CLAY, wet (CH). Some organics from 7.5 – 9.0 ft.	ss							
8.0	2		7	mcs							
10.0	1 (50)		8	ss							
12.0											

DRILLING CONTR All Terrain Explorations Bob Enelx

LOGGED BY P. E. Bowers CHKD BY KRR

DATE 10/12/89

SOIL BOREHOLE LOG

Golder Associates Inc.

SITE NAME AND LOCATION	DRILLING METHOD:					BORING NO.	
Port of Oakland Disposal Site, Oakland, CA	Hollow Stem Auger					MW2	
	SAMPLING METHOD: Continuous core split spoon and modified california sampler					SHEET 2 OF 2	
						DRILLING	
						START	FINISH
	WATER LEVEL	3.97	4.02			TIME 1310	TIME 1430
	TIME	1124	0951				
	DATE	10/13/89	10/19/89			DATE 10/12/89	DATE 10/12/89
DATUM Alameda Datum ELEVATION 102.19	CASING DEPTH						

DRILL RIG CME 750

SURFACE CONDITIONS: Located at N.W. corner of site. Parking lot.

ANGLE — BEARING

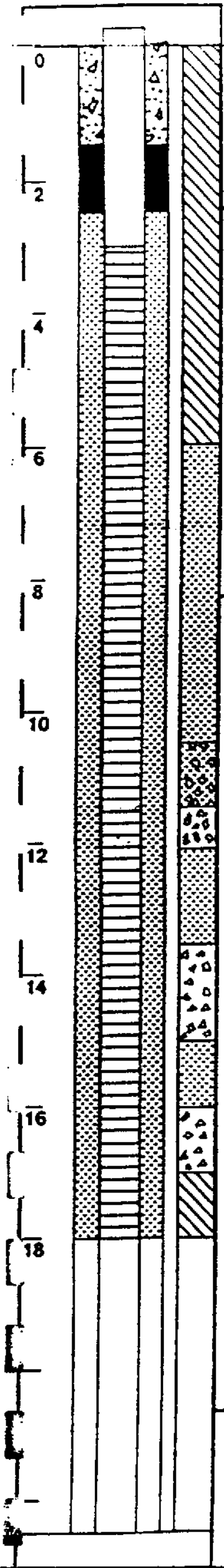
SAMPLE HAMMER TORQUE

DEPTH IN FEET	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	OTHER TESTS
12.0	(0.000) 2		9								
	1 1 1		10								
14.0											
			Total depth – 15.0 ft.								
16.0											
18.0											
20.0											
22.0											
24.0											

DRILLING CONTR All Terrain Explorations Bob Enelx

LOGGED BY P. E. Bowers CHKD BY KBR

DATE 10/12/89



Well No. MW3

Boring No. X-Ref:

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N 457800.2736
E 1502083.2078

Elevation Ground Level 101.6 ft. MSL
Top of Casing 102.48 ft MSL

Drilling Summary:

Total Depth 18.0 ft
Borehole Diameter 12 inches
Casing Stick-up Height:
Driller Bob Eneix
All Terrain Explorations
Rig CME 750
Bit(s) 10" and 12" Hollow Stem Augers
Drilling Fluid None
Protective Casing Steel Monument

Construction Time Log: (1)

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	10-12	1530	10-12	1730
Geophys. Logging:				
Casing:	10-12	1730	10-12	1740
Filter Placement:	10-12	1740	10-12	1810
Cementing:	10-12	1815	10-12	1825
Development:				

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
0' - 3.0'	C1	98.6'-101.6'
3.0' - 18.0'	S1	83.6'-98.6'

Casing: C1 4" Dia. Sch. 40 PVC Brainard-Kilman Tri-Loc
C2

Screen: S1 4" Dia. Sch.40 PVC, 0.01" slots, Brainard-Kilman Tri-Loc

Filter Pack: (2.5'-18.0'): Lonestar Lapis Lustre 1/20 Sand

Grout Seal: (0'-1.5'): Lonestar Type I-II Cement

Bentonite Seal: (1.5'-2.5'): 3/8 " Pellets

Well Development:

Surge Block, Bailing

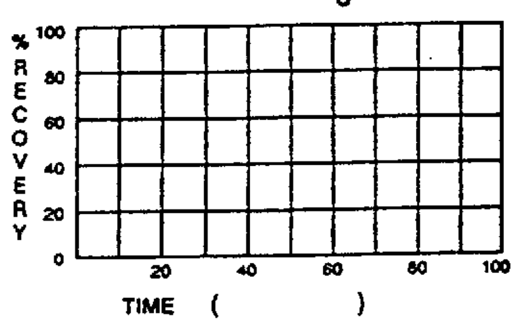
Total Gallons Removed - 135

Stabilization Test Data: 11-1-89

Time	pH	Spec. Cond.	Temp (C)
1456	7.0	17050 MS	21
1540	7.04	17200 MS	21
1623	7.09	17360 MS	21

Recovery Data:

Q= S_o=



Comments: (1) All dates are 1989

SITE NAME Port of Oakland - SWAT

LOCATION Oakland, CA

WC 03693

SUPERVISED BY Kent R. Reynolds

DATE 10-16-89

Golder Associates Inc.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION: Port of Oakland Disposal Site, Oakland, CA	DRILLING METHOD: Hollow Stem Auger					BORING NO. MW3
	SAMPLING METHOD: Continuous core split spoon and modified california sampler					SHEET 1 OF 2
						DRILLING: START / FINISH
	WATER LEVEL	4.81				TIME 1530 / TIME 1730
	TIME	1143				
	DATE	10/13/89				DATE 10/12/89 / DATE 10/12/89
DATUM Alameda Datum ELEVATION 102.48	CASING DEPTH					
DRILL RIG CME 750	SURFACE CONDITIONS: Located at N.E. corner of site. Dry, grassy field.					
ANGLE / BEARING						
SAMPLE HAMMER TORQUE						

DRILLING CONTR All Terrain Explorations, Bob Eneix

DEPTH IN FEET	BLOWS/6 IN. ON SAMPLER (RECOVERY)	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	OTHER TESTS
0.0	15, 25, 30 ([illegible])	1 — Firm, light grayish brown, CLAY, some fine angular gravel, some silt, roots, dry (CL).	[illegible]							
2.0	16, 12, [illegible] ([illegible])	2 — Firm, light brown, silty CLAY, some fine angular gravel, roots, dry (CL).	[illegible]							
	5, [illegible], [illegible] ([illegible])	3	[illegible]							
4.0	5, [illegible], [illegible] ([illegible])	4	MCS							
6.0	7, [illegible], 5 ([illegible])	5 — Loose, dark gray, fine to coarse SAND, little fine subrounded gravel, wet (SW). 7.0–7.4 ft: Fine to coarse subrounded gravel, some sand (GW).	[illegible]							
8.0	12, [illegible], 5 ([illegible])	6	[illegible]							
10.0	[illegible], 5, 5	7	MCS			16.9			2.78	
	2, 2, [illegible] ([illegible])	8 — Loose, light brown, SAND and fine subrounded GRAVEL, trace silt, wet (SW).	[illegible]							
12.0		Loose, light brown, subangular to subrounded, fine to medium GRAVEL, some sand, wet (GW).								

LOGGED BY P. E. Bowers CHKD BY KRR

DATE 10/12/89

SOIL BOREHOLE LOG

Golder Associates Inc.

SITE NAME AND LOCATION: Port of Oakland Disposal Site, Oakland, CA	DRILLING METHOD: Hollow Stem Auger	BORING NO. MW3
	SAMPLING METHOD: Continuous core split spoon and modified california sampler	SHEET 2 OF 2

WATER LEVEL	4.81			
TIME	1143			
DATE	10/13/89			
CASING DEPTH				

DRILLING	START	FINISH
TIME	1530	1730
DATE	10/12/89	10/12/89

DATUM Alameda Datum ELEVATION 102.48

DRILL RIG CME 750

SURFACE CONDITIONS: Located at N.E. corner of site. Dry, grassy field.

ANGLE BEARING

SAMPLE HAMMER TORQUE

DRILLING CONTR All Terrain Explorations Bob Enelx

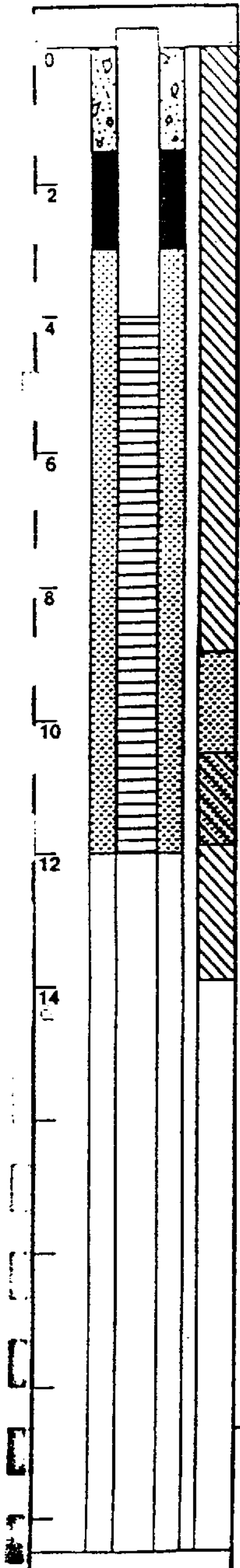
DEPTH IN FEET	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	OTHER TESTS
12.0	8, 10, 10 (600)		9 Loose, light brown, fine to coarse SAND, some fine subrounded gravel, wet (SW).								
14.0	5, 6, 6		10 Loose, light brown, coarse SAND and fine to medium, rounded to subrounded GRAVEL, wet (SW).								
	2, 5, 7 (570)		11 Becomes fine to coarse SAND, little fine, subrounded to subangular gravel (SW).								
16.0	1, 2, 2 (0000)		12 Firm, light brown, sandy CLAY, trace fine gravel, trace silt, trace bivalve shells, wet (CL).								
			Soft, medium dark gray, CLAY, moist (CH).								
18.0			Total depth — 18.0 ft.								
20.0											
22.0											
24.0											

LOGGED BY P. E. Bowers CHKD BY KRR

DATE 10/12/89

Well No. MW4

Boring No. X-Ref:



MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N 457353.6652
E 1502208.4591

Elevation Ground Level 99.3 Ft MSL
Top of Casing 100.41 Ft MSL

Drilling Summary:

Total Depth 15.0 Ft
Borehole Diameter 10 Inches
Casing Stick-up Height:
Driller Bob Eneix
All Terrain Explorations

Rig CME 750
Bit(s) 10" Hollow Stem Auger

Drilling Fluid None

Protective Casing Steel Monument

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling	10-13	0830	10-13	0940
Geophys. Logging:				
Casing:	10-13	1005	10-13	1010
Filter Placement:	10-13	1010	10-13	1020
Cementing:	10-13	1025	10-13	1030
Development:				

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
0 - 4.0'	C1	95.3' - 99.3'
4.0' - 12.0'	S1	87.3' - 95.3'

Casing: C1 4" Dia. Sch 40 PVC
Brainard-Kilman Tri-Loc
C2

Screen: S1 4" Dia. Sch.40, PVC, 0.01" slots
Brainard-Kilman Tri-Loc

Filter Pack: (3.0'-12.0'): Lonestar Lapis Lustre 1/20 Sand

Grout Seal: (0'-1.5'): Lonestar Type I-II Cement

Bentonite Seal: (1.5'-3.0'): 3/8" Pellets

Well Development:

Surge Block, Bailing

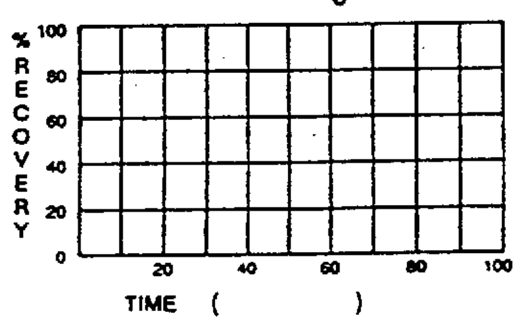
Total Gallons Removed - 55

Stabilization Test Data: 11-2-89

Time	pH	Spec. Cond.	Temp (C)
1015	6.60	4980 MS	21
1055	6.51	4680 MS	21
1140	6.55	4280 MS	21

Recovery Data:

Q= S_o=



Comments: (1) All dates are 1989

SITE NAME Port of Oakland - SWAT
LOCATION Oakland, CA

WC 03694

SUPERVISED BY Kent R. Reynolds
DATE 10-16-89

SOIL BOREHOLE LOG

Golder Associates Inc.

SITE NAME AND LOCATION	Port of Oakland Disposal Site, Oakland, CA
DRILLING METHOD:	Hollow Stem Auger
SAMPLING METHOD:	Continuous core split spoon and modified california sampler
BORING NO.	MW4
SHEET	1 OF 2
DATUM	Alameda Datum
ELEVATION	100.41
DRILL RIG	CME 750
ANGLE	
BEARING	
SAMPLE HAMMER TORQUE	
SURFACE CONDITIONS:	Located at S.E. corner of site. Dry, grassy field.

WATER LEVEL	3.06			
TIME	1039			
DATE	10/13/89			
CASING DEPTH				

DRILLING	START	FINISH
TIME	0830	0940
DATE	10/13/89	10/13/89

DRILLING CONTR: All Terrain Explorations, Bob Engle

LOGGED BY: P. E. Bowers CHKD BY: KRR

DATE: 10/13/89

DEPTH IN FEET	BLOWS/6 IN. ON SAMPLER (RECOVERY)	SAMPLE NUMBER	DESCRIPTION OF MATERIAL
0.0	10 9 5 [illegible]	1	Firm, light brown, silty CLAY, some organics, trace fine subangular gravel, dry (CL).
	3 [illegible]	2	2" black asphalt layer at 2.3'. Granite chips at 5.3'.
2.0			
	50 [illegible]	3	Firm, brown, silty CLAY, some organics, moist (CL). 0.1' burned wood layer at 3.4'. 0.1' granite chips, cement matrix at 3.5' (dry).
4.0		4	Wood chunks, iron spike in cuttings (railroad tie).
6.0	[illegible] 5 7	5	
	[illegible] 2 2 [illegible]	6	
8.0			Soft, dark gray to black, silty CLAY, some organics, trace fine angular gravel, little sand, oily sheen, wet (CL).
	5 3 5	7	Loose, dark gray, fine SAND, little bivalve shells, trace fine subrounded gravel, wet (SP). 0.2' soft, dark gray, CLAY layer (CH) at 10.3'.
10.0			
	2 1 1 [illegible]	8	Loose, dark gray, clayey fine SAND, little bivalve shells, trace organics, wet (SC).
			Very soft, medium gray, CLAY, high plasticity, wet (CH)
12.0			

SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	OTHER TESTS

SOIL BOREHOLE LOG

[illegible] Associates, Inc.

SITE NAME AND LOCATION	Port of Oakland Disposal Site, Oakland, CA
DRILLING METHOD:	Hollow Stem Auger
SAMPLING METHOD:	Continuous core split spoon and modified california sampler
BORING NO.	MW4
SHEET	2 OF 2
DATUM	Alameda Datum
ELEVATION	100.41
DRILL RIG	CME 750
ANGLE	
BEARING	
SAMPLE HAMMER TORQUE	
SURFACE CONDITIONS:	Located at S.E. corner of site. Dry, grassy field.

WATER LEVEL	3.06			
TIME	1039			
DATE	10/13/89			
CASING DEPTH				

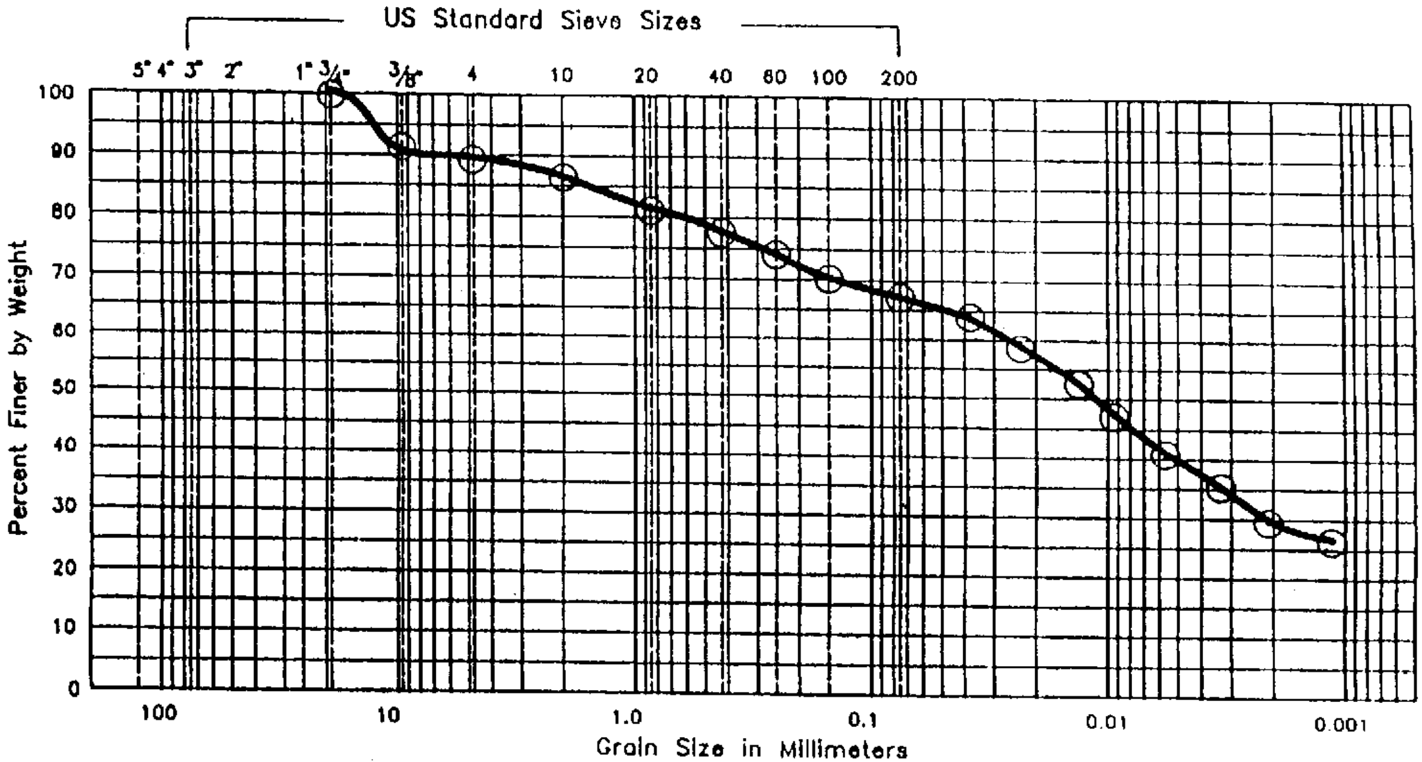
DRILLING	START	FINISH
TIME	0830	0940
DATE	10/13/89	10/13/89

DEPTH IN FEET	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	OTHER TESTS
12.0	2 (67%)										
14.0	1 1 1		2								
			Total depth – 15.0 ft.								
16.0											
18.0											
20.0											
22.0											
24.0											

DRILLING CONTR All Terrain Explorations — Bob Focix

LOGGED BY P. E. Bowers CHKD BY KBR

DATE 10/13/89

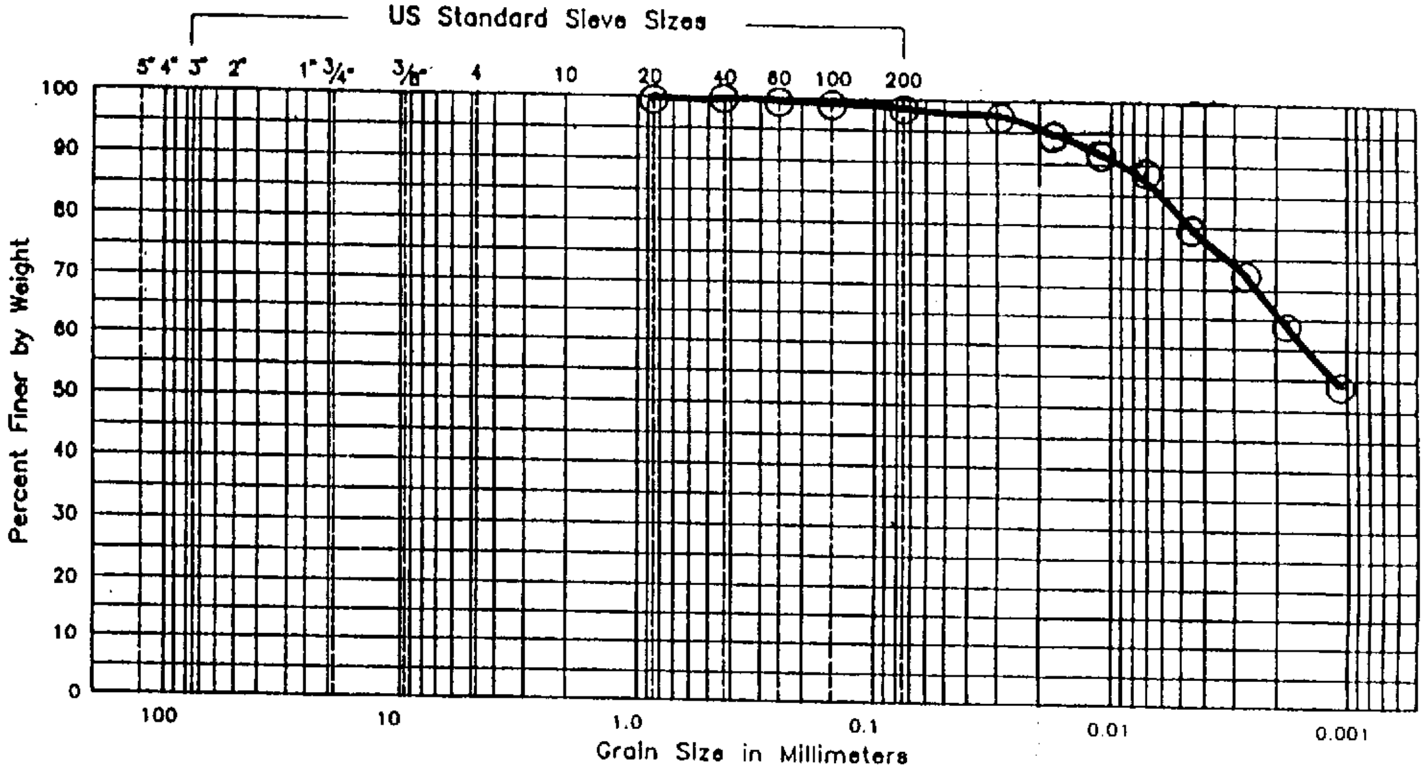


Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
MW 1	5.0 - 5.5	42.1				Olive black, siltyclay, some coarse to fine sand, little fine gravel (CL).

Job No.	893-7039	Scale	------------
Drawn	DVR	Date	June 1990
Checked	KRR	Dwg No.	

GRAIN SIZE DISTRIBUTION
North Port of Oakland Site Disposal



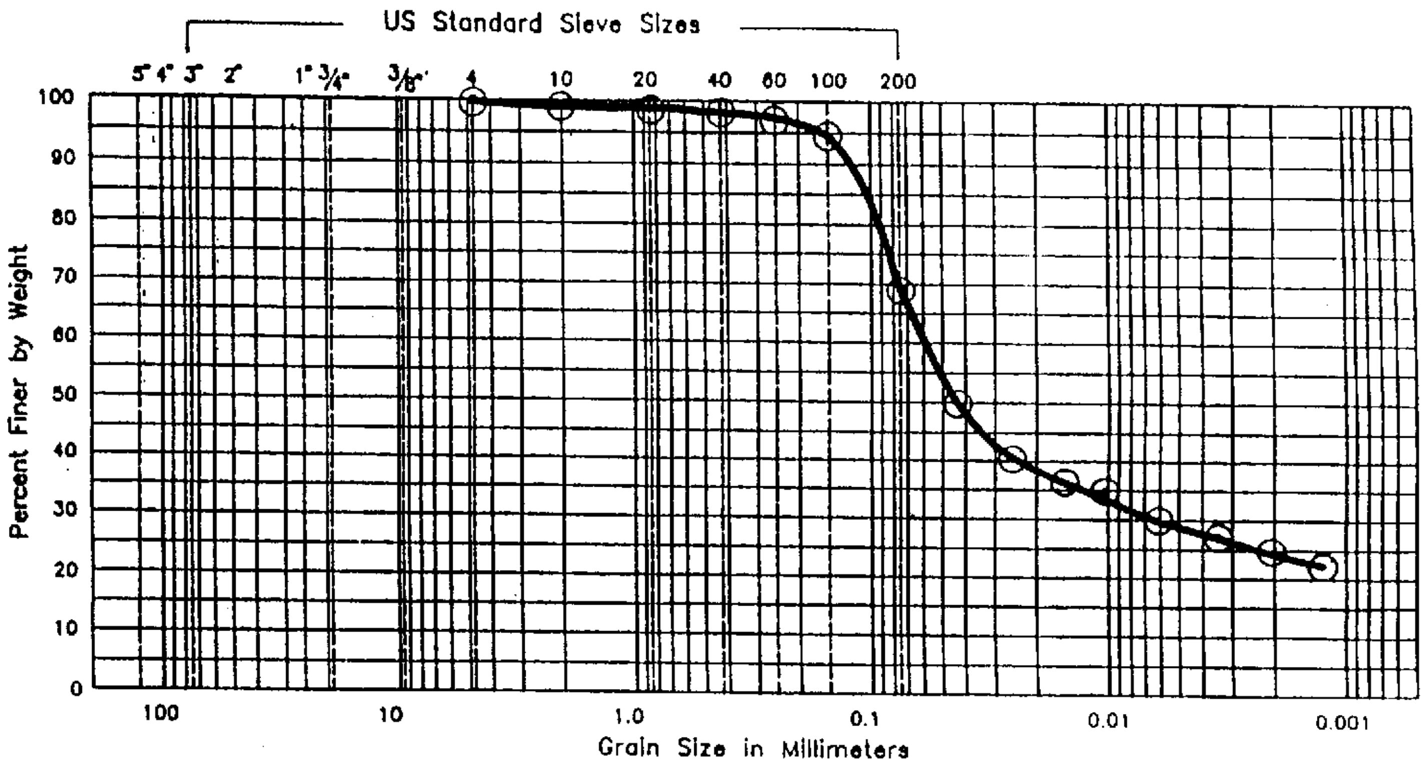
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
MW 1	14.5 - 15.0	101.9				Olive gray, clay trace - fine sand, (CH) organic material present.

Job No. 893-7039	Scale ------------	**GRAIN SIZE DISTRIBUTION** **North Port of Oakland Site Disposal**
Drawn DVR	Date June 1990	
Checked KRR	Dwg No.	

Golder Associates Inc.

Waste Management of North A...

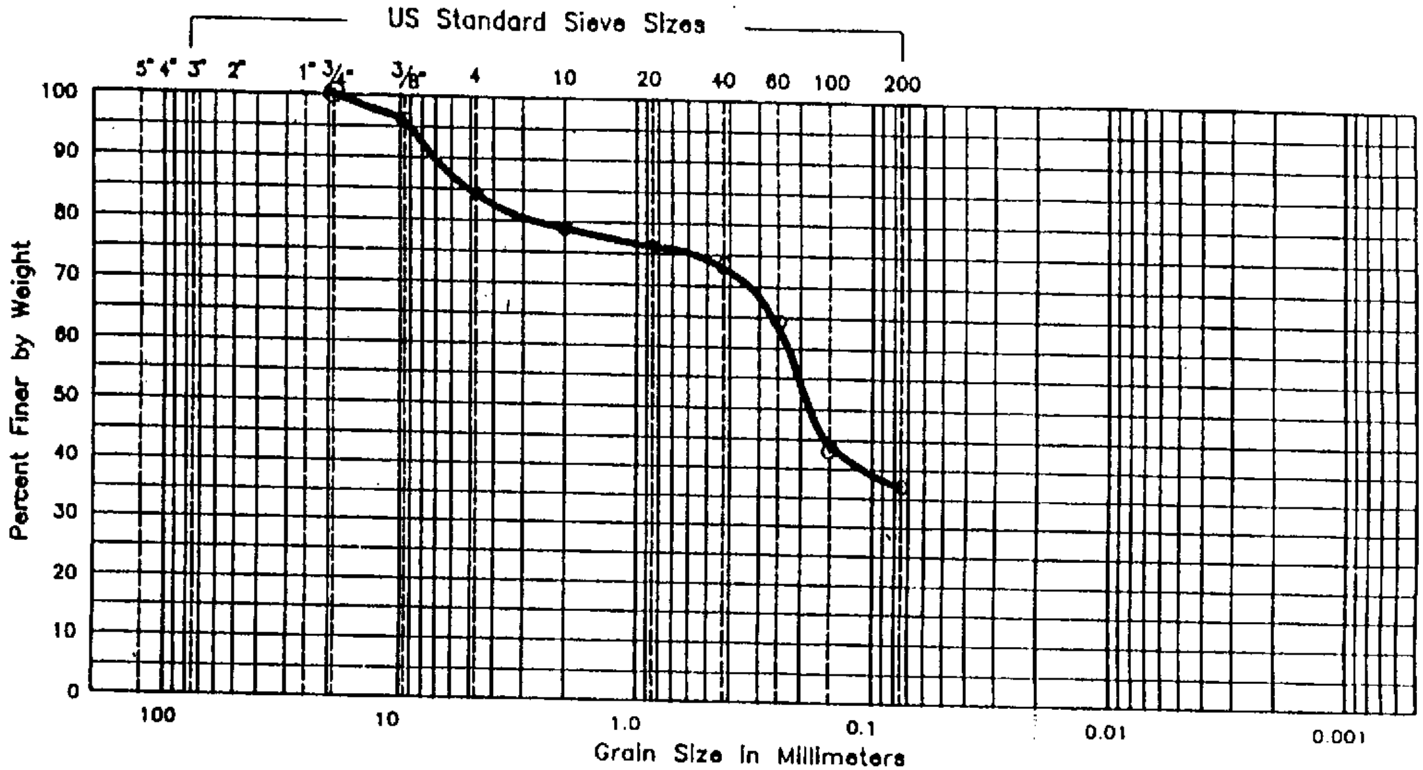


Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
MW 2	14.5 - 15.0	33.1				Olive gray, siltyclay, somefine sand, (CL).

Job No	893-7039	Scale	------------	**GRAIN SIZE DISTRIBUTION** **North Port of Oakland Site Disposal**
Drawn	DVR	Date	June 1990	
Checked	KRR	Dwg No		

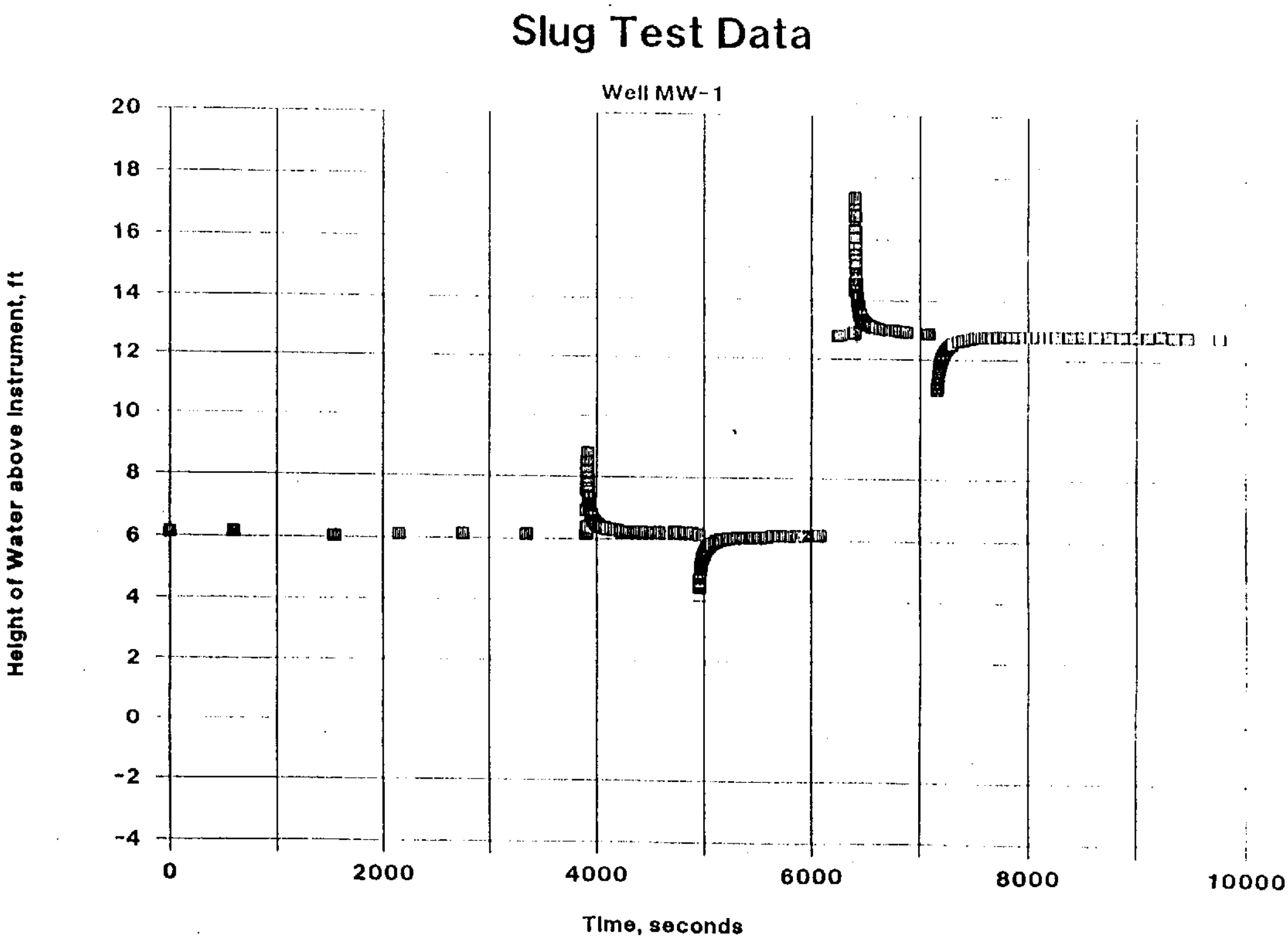
Figure



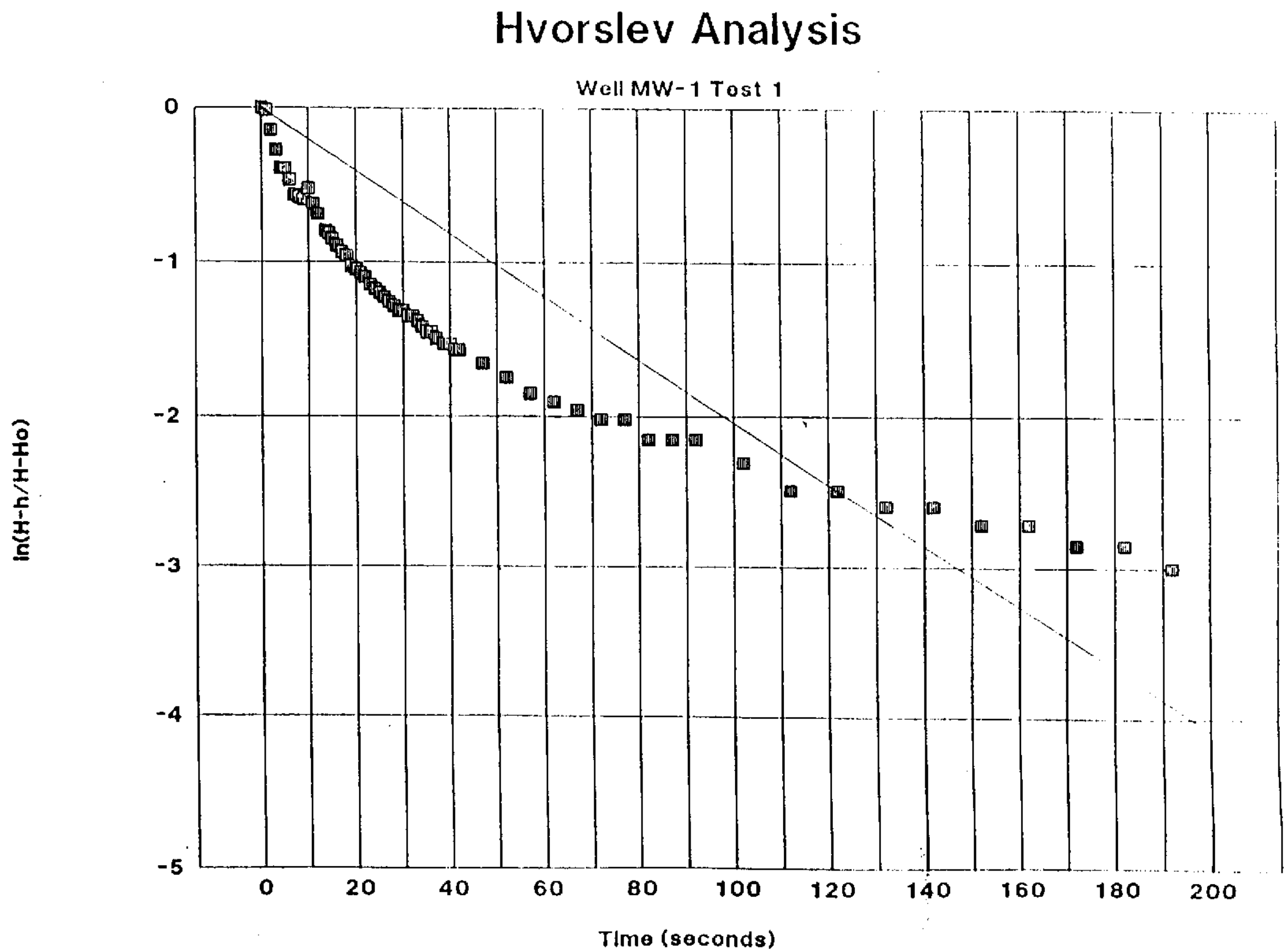
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
MW 3	9.5 - 10.0	16.9				Dark gray fine sand, and silt, some fine gravel.

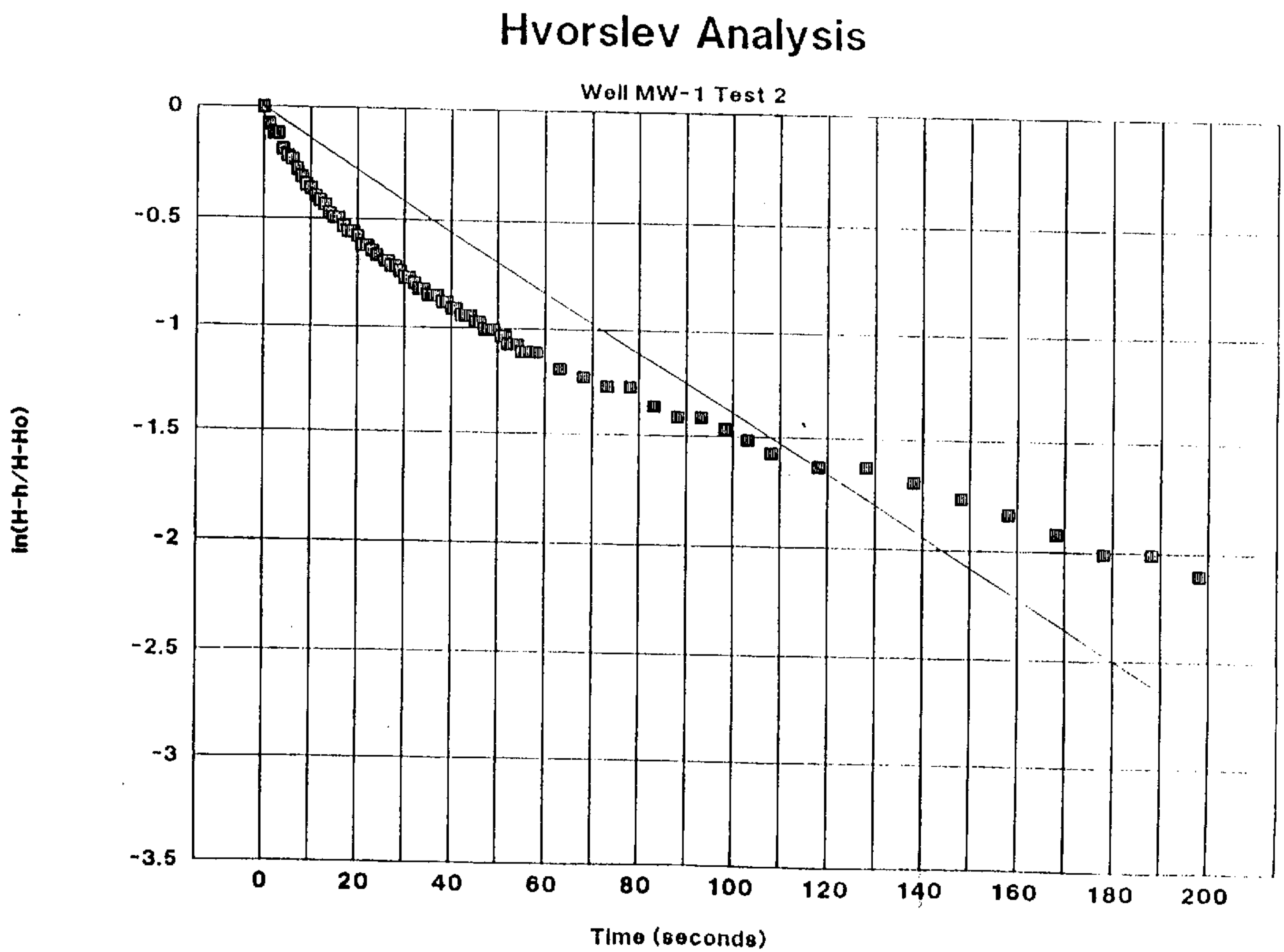
Job No. 893-7039	Scale ------------	**GRAIN SIZE DISTRIBUTION** **North Port of Oakland Site Disposal**
Drawn DVR	Date June 1990	
Checked KRR	Dwg. No.	
Golder Associates Inc.		Waste Management of North America, Inc. — Figure B4



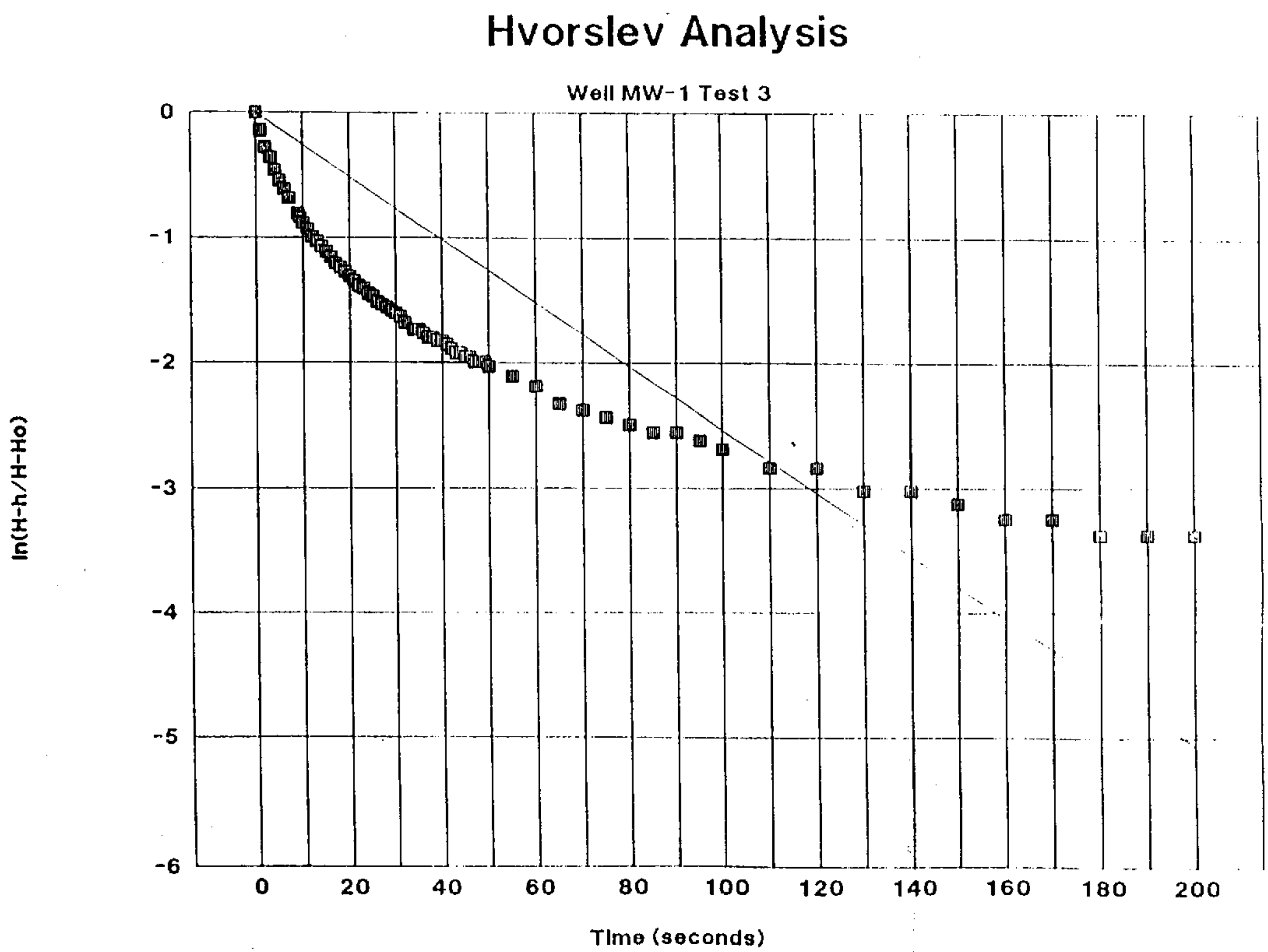
Job No. 893-7039	Scale	SLUG TEST DATA OF WELL MW - 1 North Port of Oakland Site Disposal	
Drawn DVR	Date June 1990		
Checked KRR	Dwg No.		
Golder Associates Inc.		Waste Management of North America, Inc.	C1



Job No 893-7039	Scale ------------	**HVORSLEV ANALYSIS OF WELL MW - 1 TEST 1**		
Drawn DVR	Date June 1990	**North Port of Oakland Site Disposal**		
Checked KRR	Dwg No			
Golder Associates Inc.		Waste Management of North America, Inc.	Figure	C2

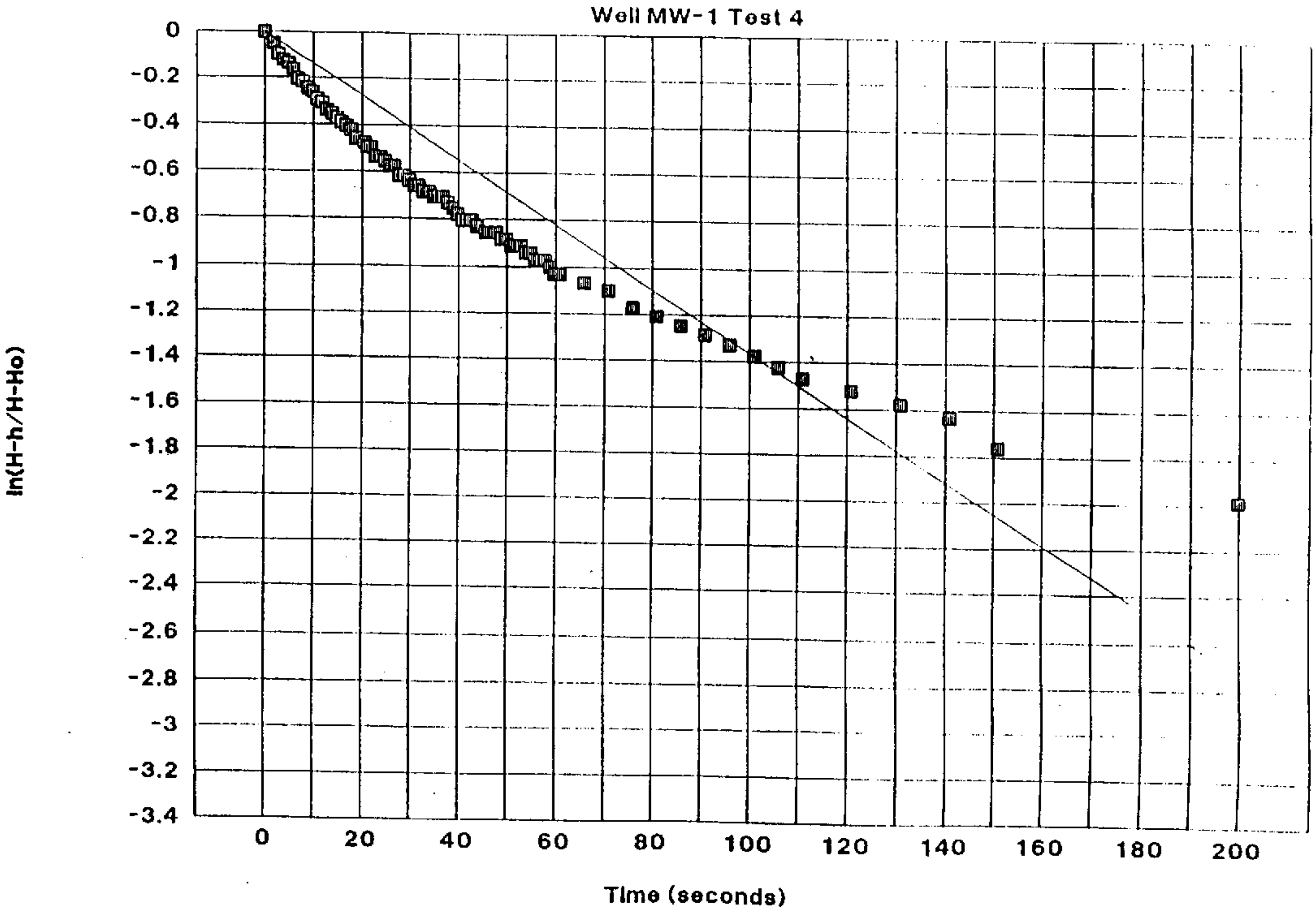


Job No. 893-7039	Scale -------------	HVORSLEV ANALYSIS OF WELL MW - 1 TEST 2 North Port of Oakland Site Disposal
Drawn DVR	Date June 1990	
Checked KRR	Dwg No.	
Golder Associates Inc.		Figure



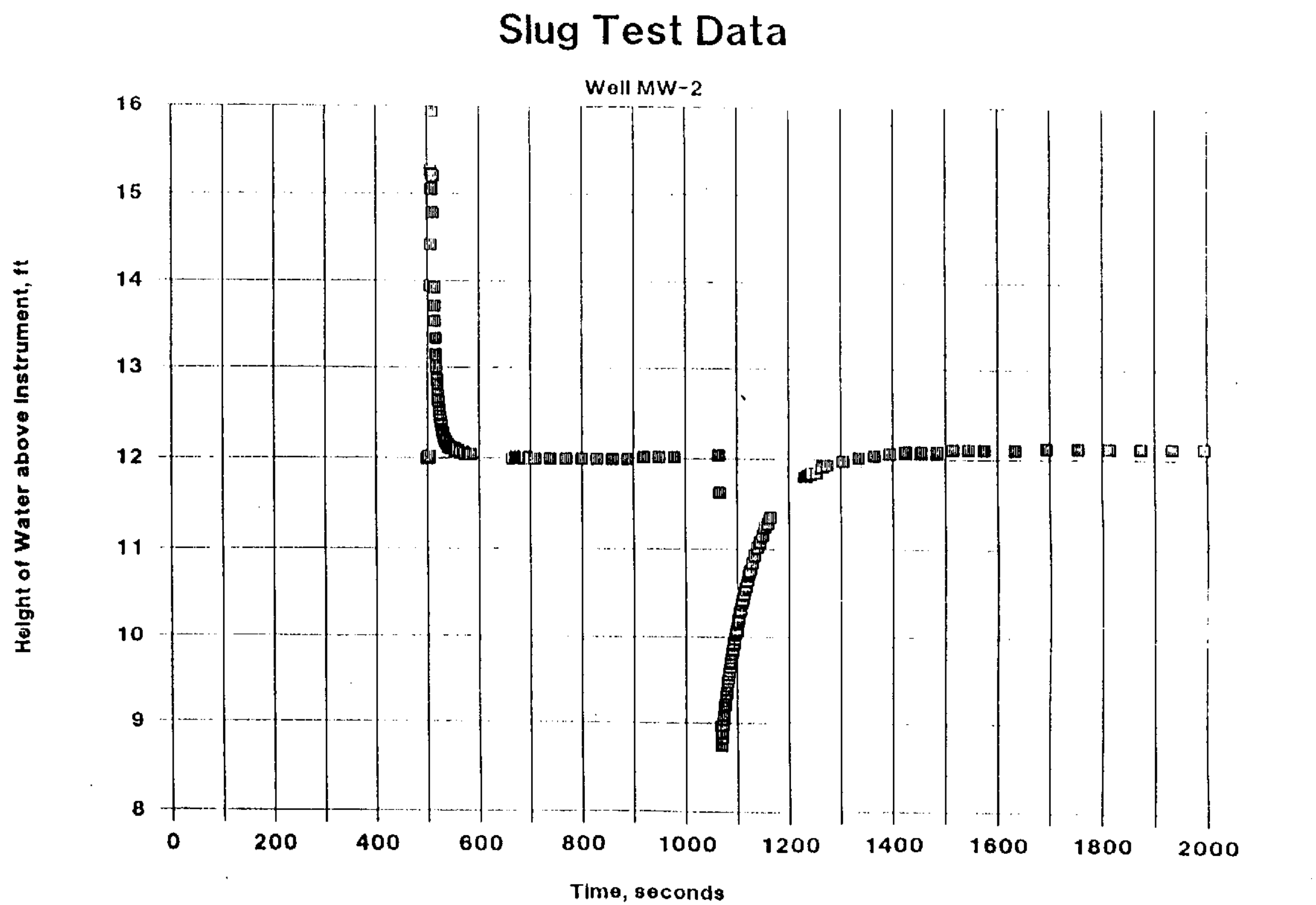
Job No 893-7039	Scale ------------	HVORSLEV ANALYSIS OF WELL MW - 1 TEST 3 North Port of Oakland Site Disposal		
Drawn DVR	Date June 1990			
Checked KRR	Dwg. No.			
Golder Associates Inc.		Waste Management of North America, Inc.	Figure C4	

Hvorslev Analysis



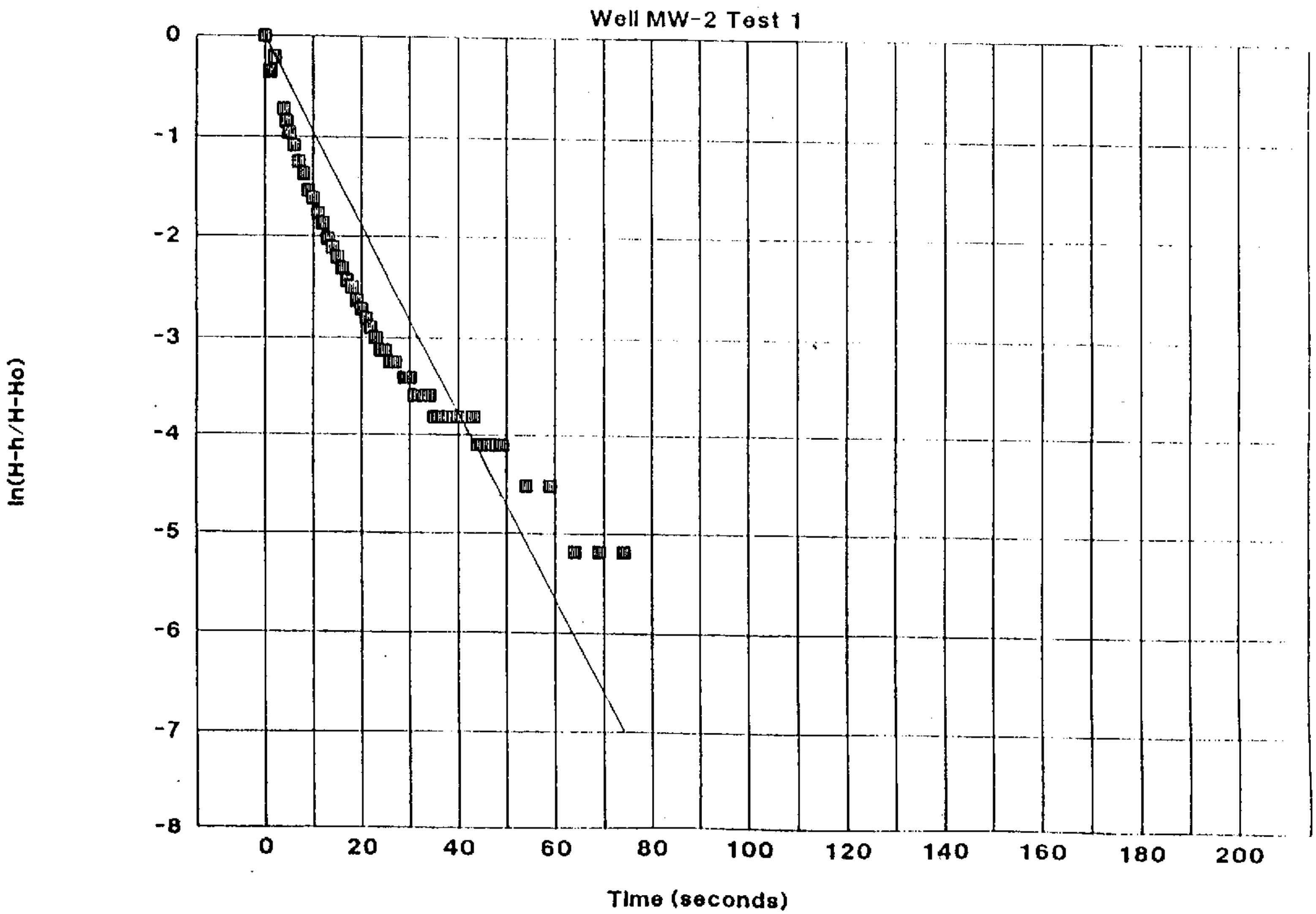
Job No. 893-7039	Scale	**HVORSLEV ANALYSIS OF WELL MW - 1 TEST 4** **North Port of Oakland Site Disposal**
Drawn DVR	Date June 1990	
Checked KRR	Dwg No.	

Golder Associates Inc.

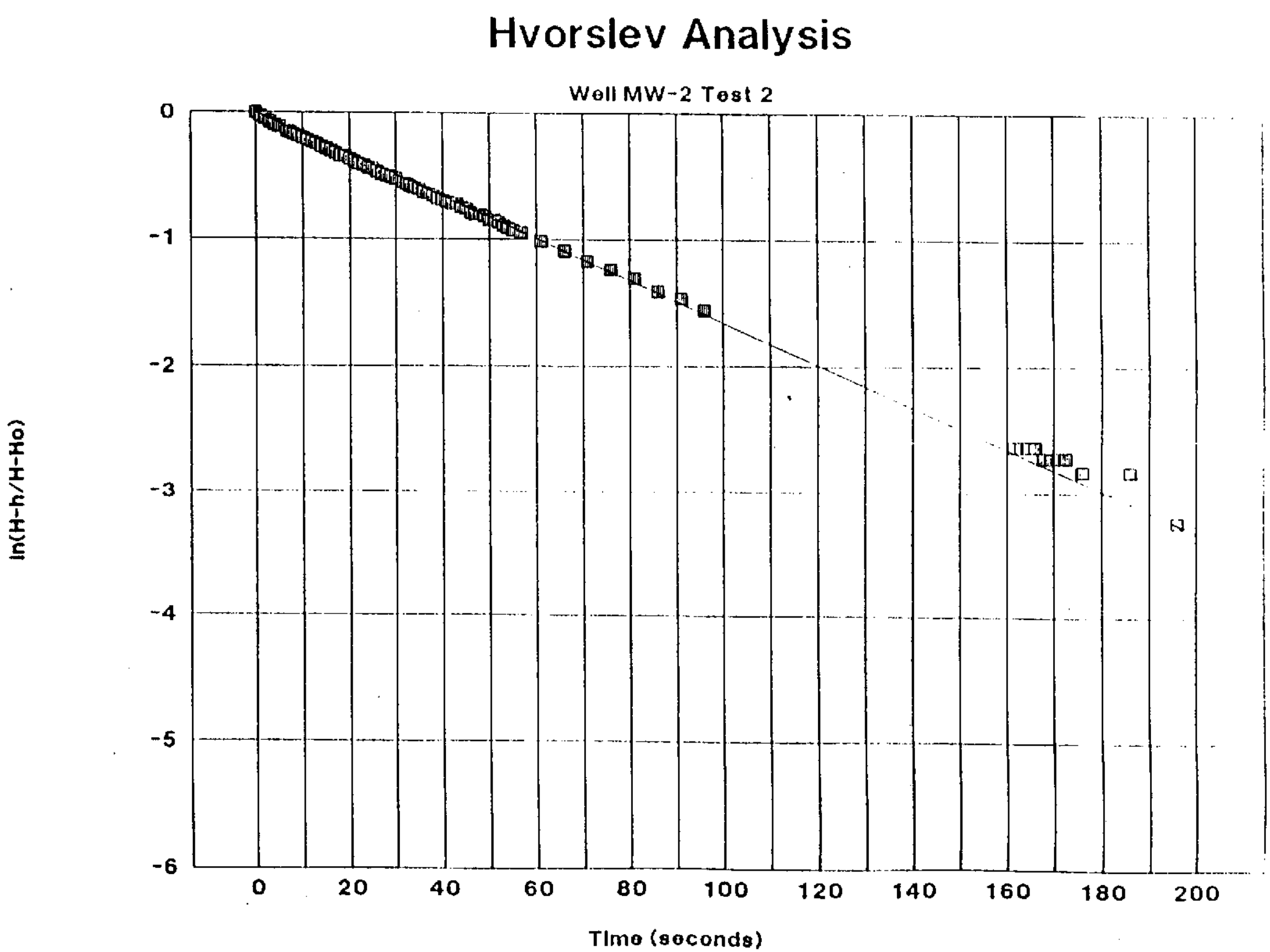


Job No	893-7039	Scale		**SLUG TEST DATA OF WELL MW - 2**
Drawn	DVR	Date	June 1990	**North Port of Oakland Site Disposal**
Checked	KRR	Dwg No		
Golder Associates Inc				Waste Management of North America, Inc. — Figure C6

Hvorslev Analysis



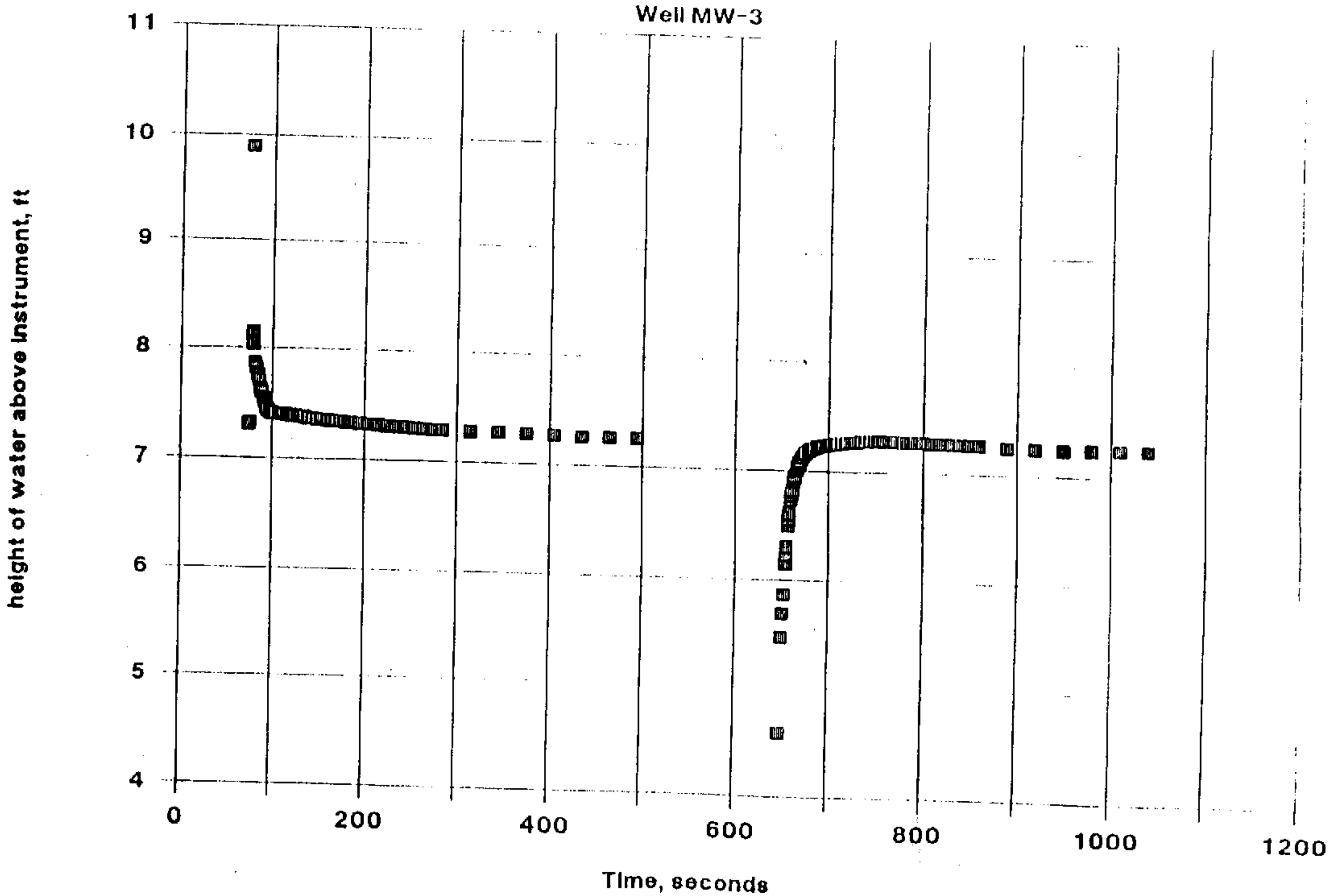
Job No. 893-7039	Scale ------------	**HVORSLEV ANALYSIS OF WELL MW - 2 TEST 1** **North Port of Oakland Site Disposal**	
Drawn DVR	Date June 1990		
Checked KRR	Dwg. No.		
Golder Associates Inc.		Waste Management of North America	Figure



Job No. 893-7039	Scale		
Drawn DVR	Date June 1990		
Checked KRR	Dwg. No.		

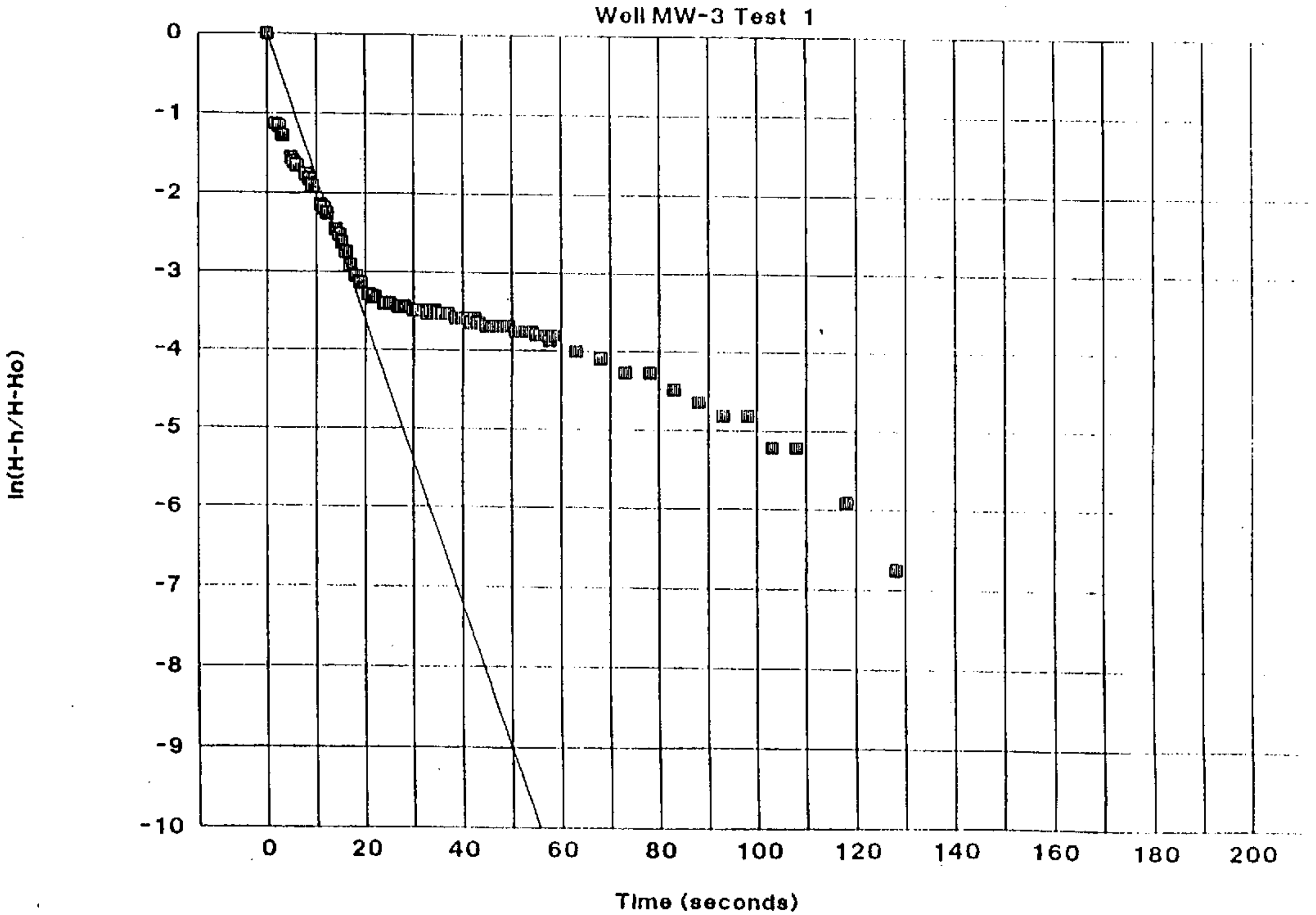
HVORSLEV ANALYSIS OF WELL MW - 2 TEST 2
North Port of Oakland Site Disposal

Slug Test Data

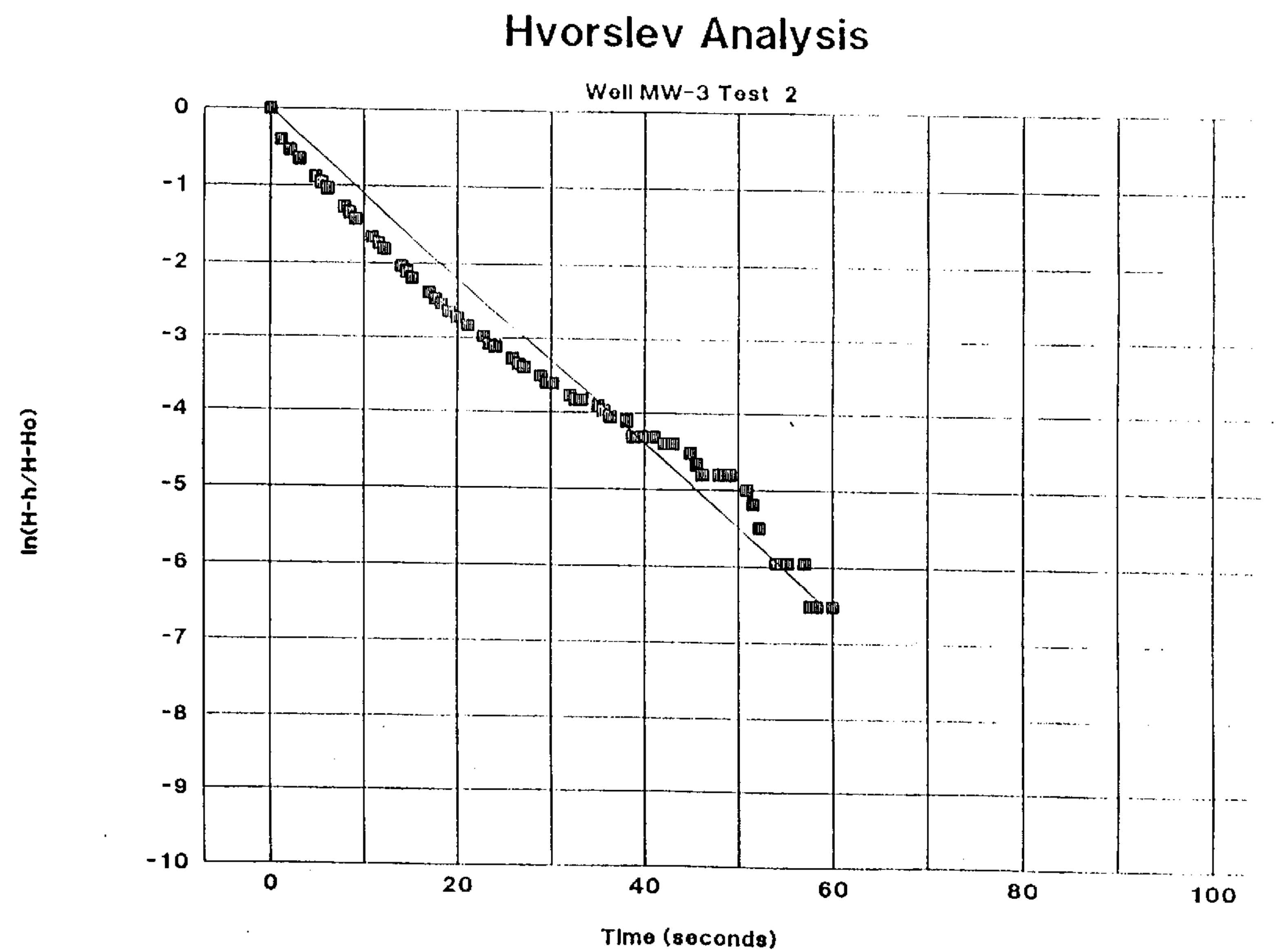


Job No. 893-7039	Scale	SLUG TEST DATA OF WELL MW - 3 North Port of Oakland Site Disposal
Drawn DVR	Date June 1990	
Checked KRR	Dwg. No.	
Golder Associates Inc.		Waste Management of North America, Inc.

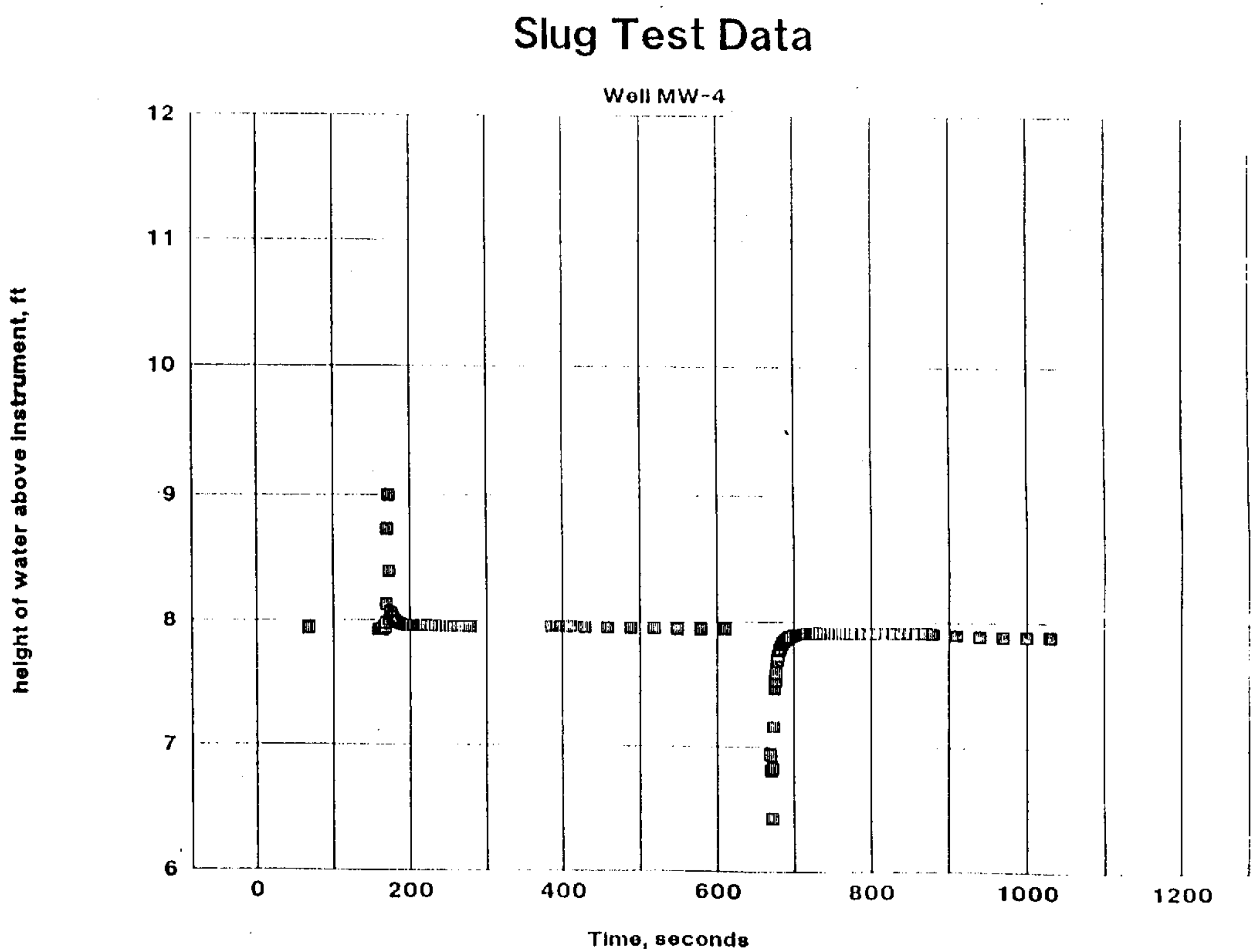
Hvorslev Analysis



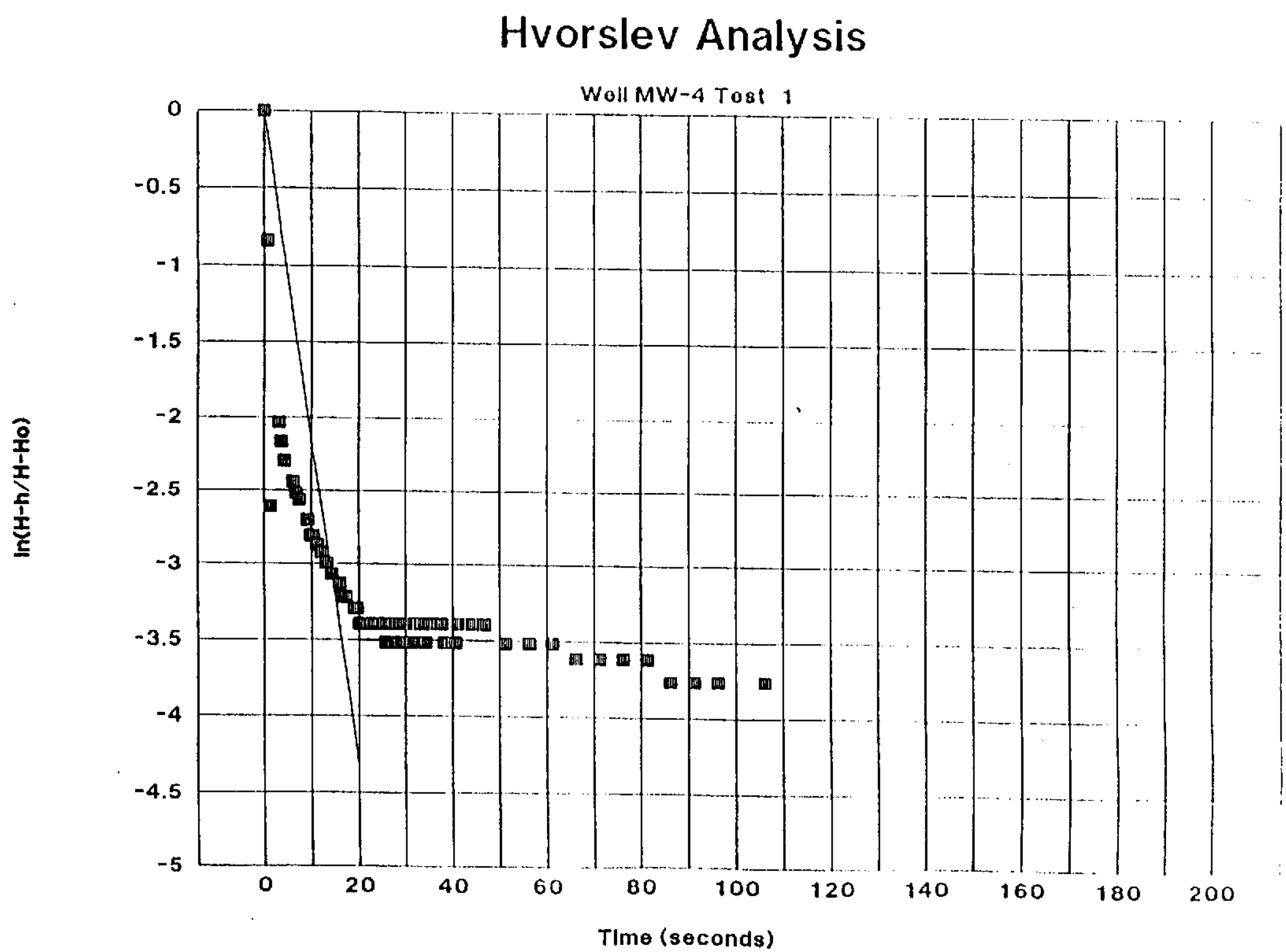
Job No	893-7039	Scale		HVORSLEV ANALYSIS OF WELL MW - 3 TEST 1 North Port of Oakland Site Disposal
Drawn	DVR	Date	June 1990	
Checked	KRR	Dwg No.		



Job No. 893-7039	Scale -------------	HVORSLEV ANALYSIS OF WELL MW - 3 TEST 2 North Port of Oakland Site Disposal
Drawn DVR	Date June 1990	
Checked KRR	Dwg No.	
Golder Associates Inc		Waste Management of North America, Inc. Figure C11

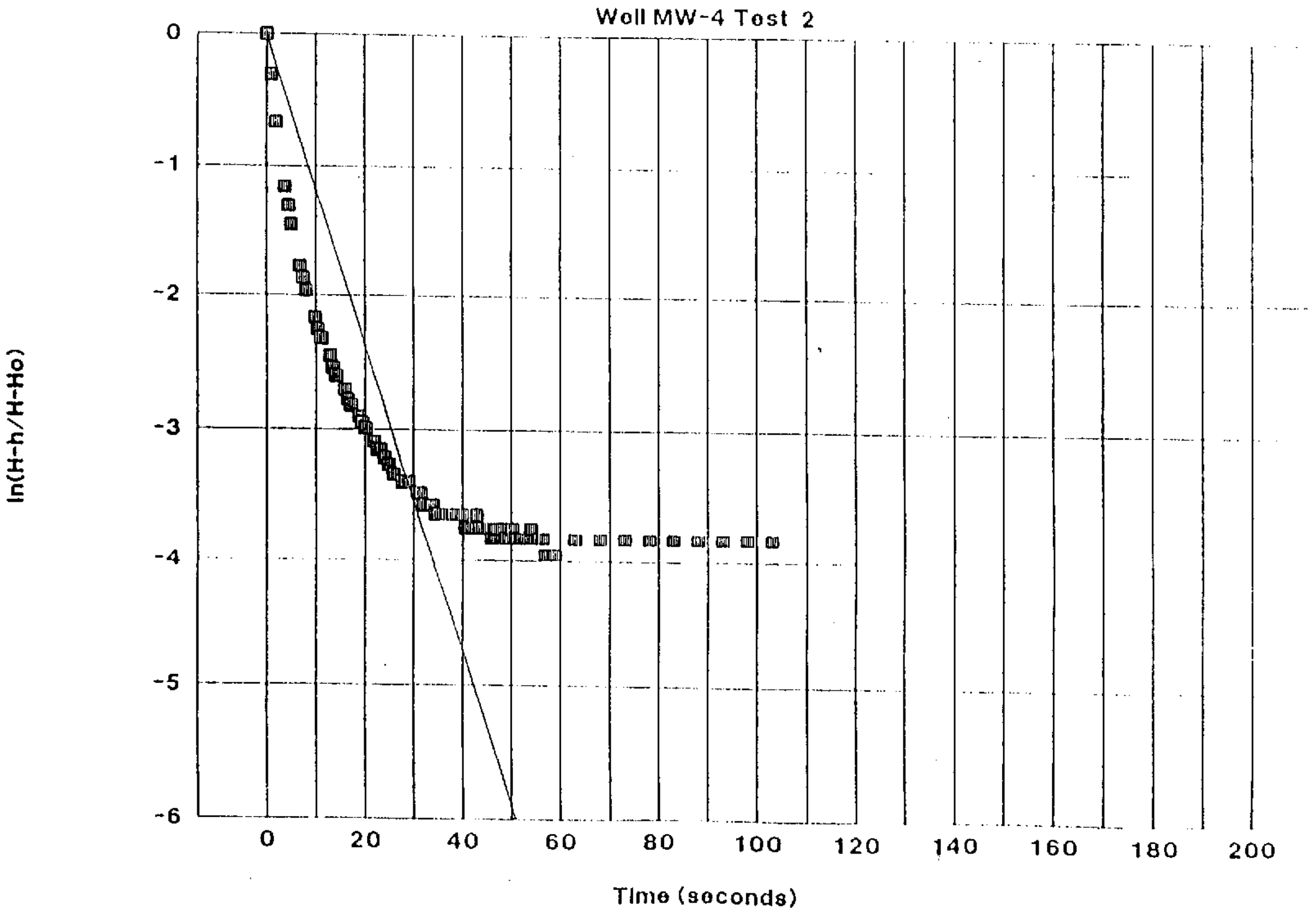


Job No 893-7039	Scale	SLUG TEST DATA OF WELL MW - 4 North Port of Oakland Site Disposal
Drawn DVR	Date June 1990	
Checked KRR	Dwg No.	
Golder Associates Inc.		Waste Management of North America, Inc — Figure C12



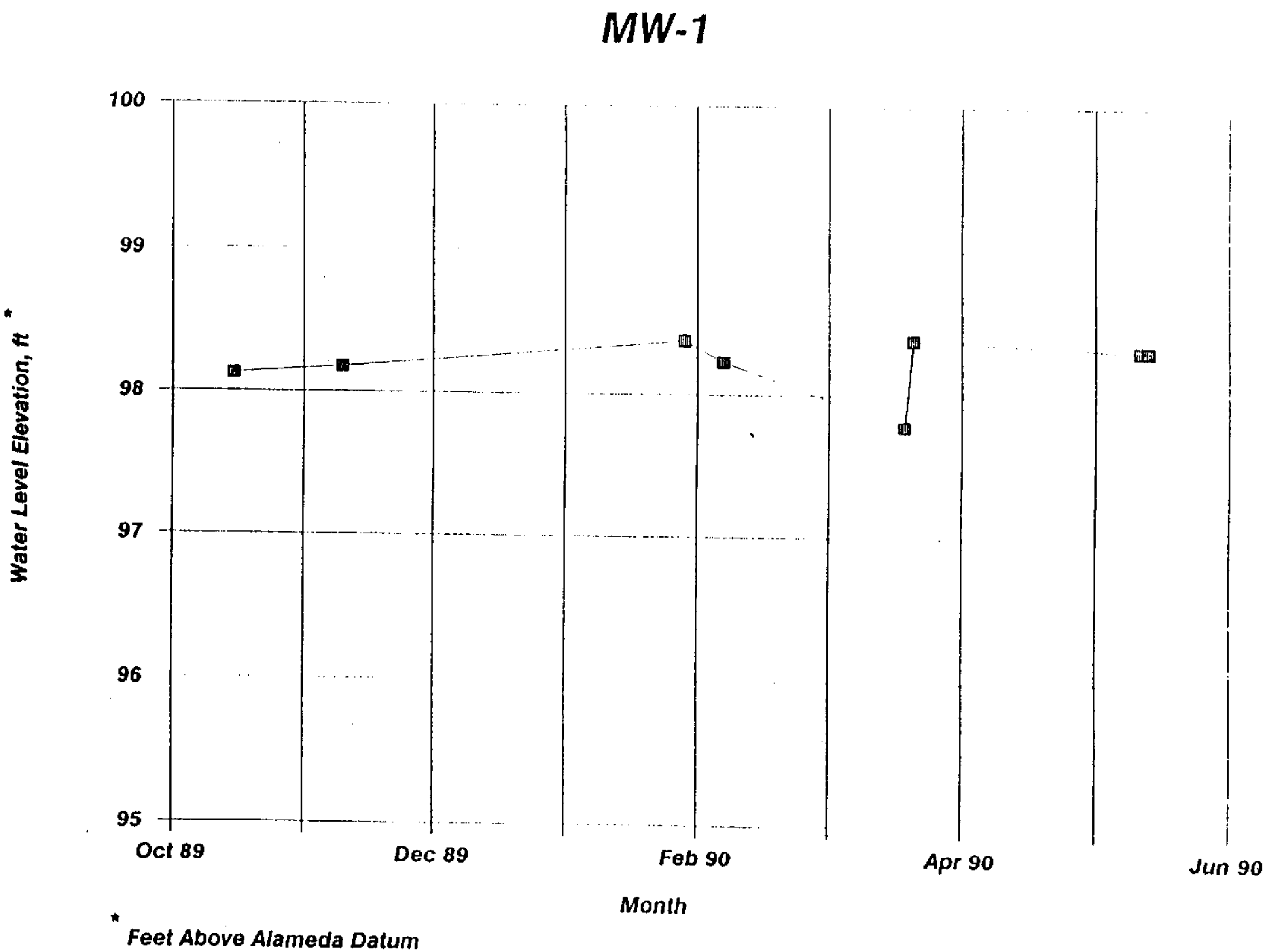
Job No. 893-7039	Scale		
Drawn DVR	Date June 1990		**HVORSLEV ANALYSIS OF WELL MW - 4 TEST 1**
Checked KRR	Dwg. No.		**North Port of Oakland Site Disposal**

Hvorslev Analysis



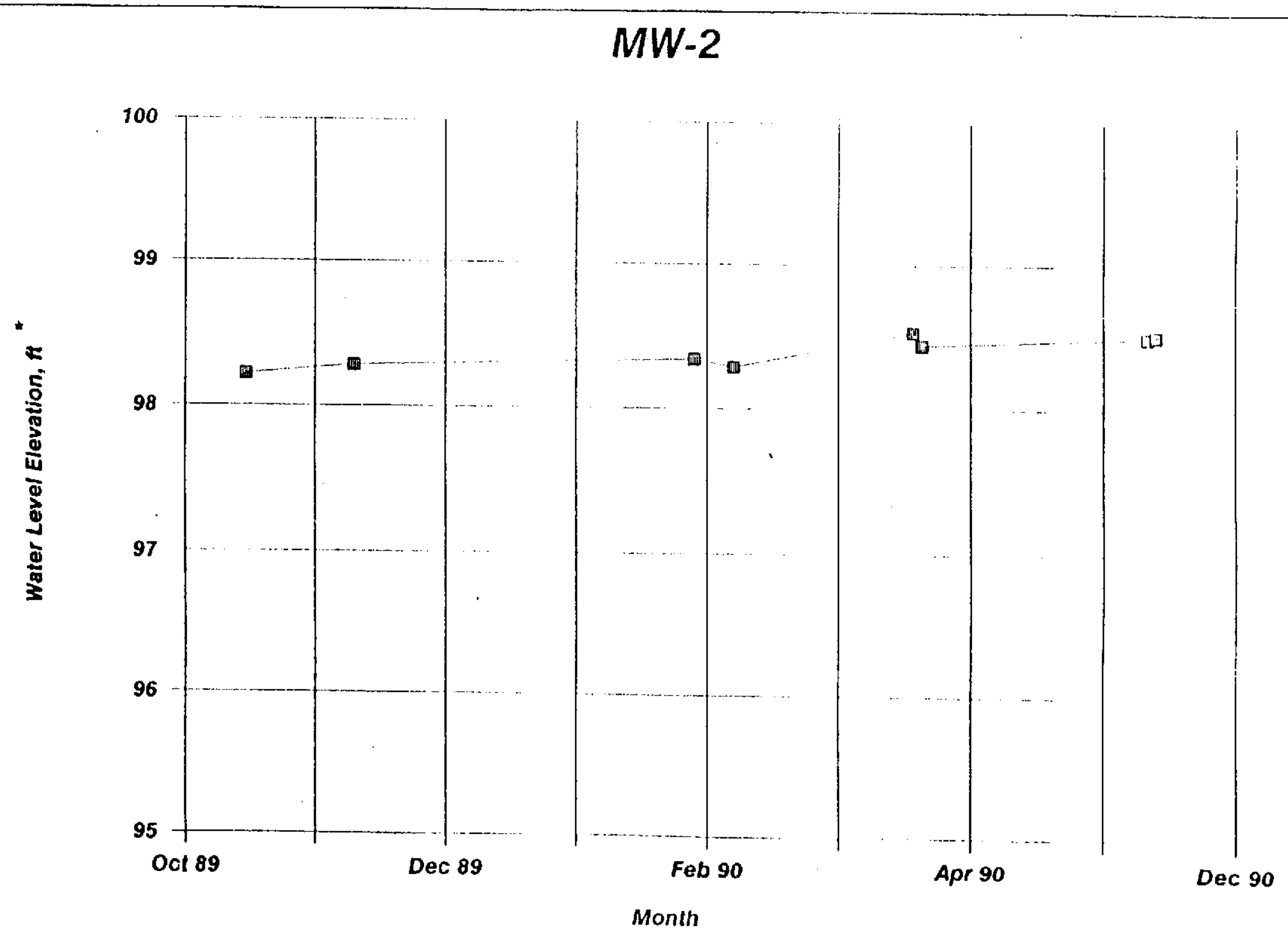
Job No 893-7039	Scale	HVORSLEV ANALYSIS OF WELL MW - 4 TEST 2 North Port of Oakland Site Disposal
Drawn DVR	Date June 1990	
Checked KRR	Dwg No	

Golder Associates Inc



Job No.	893-7039	Scale	------------	**HYDROGRAPH OF MW - 1** **North Port of Oakland Site Disposal**
Drawn	DVR	Date	June 1990	
Checked	KRR	Dwg. No		

Golder Associates Inc.



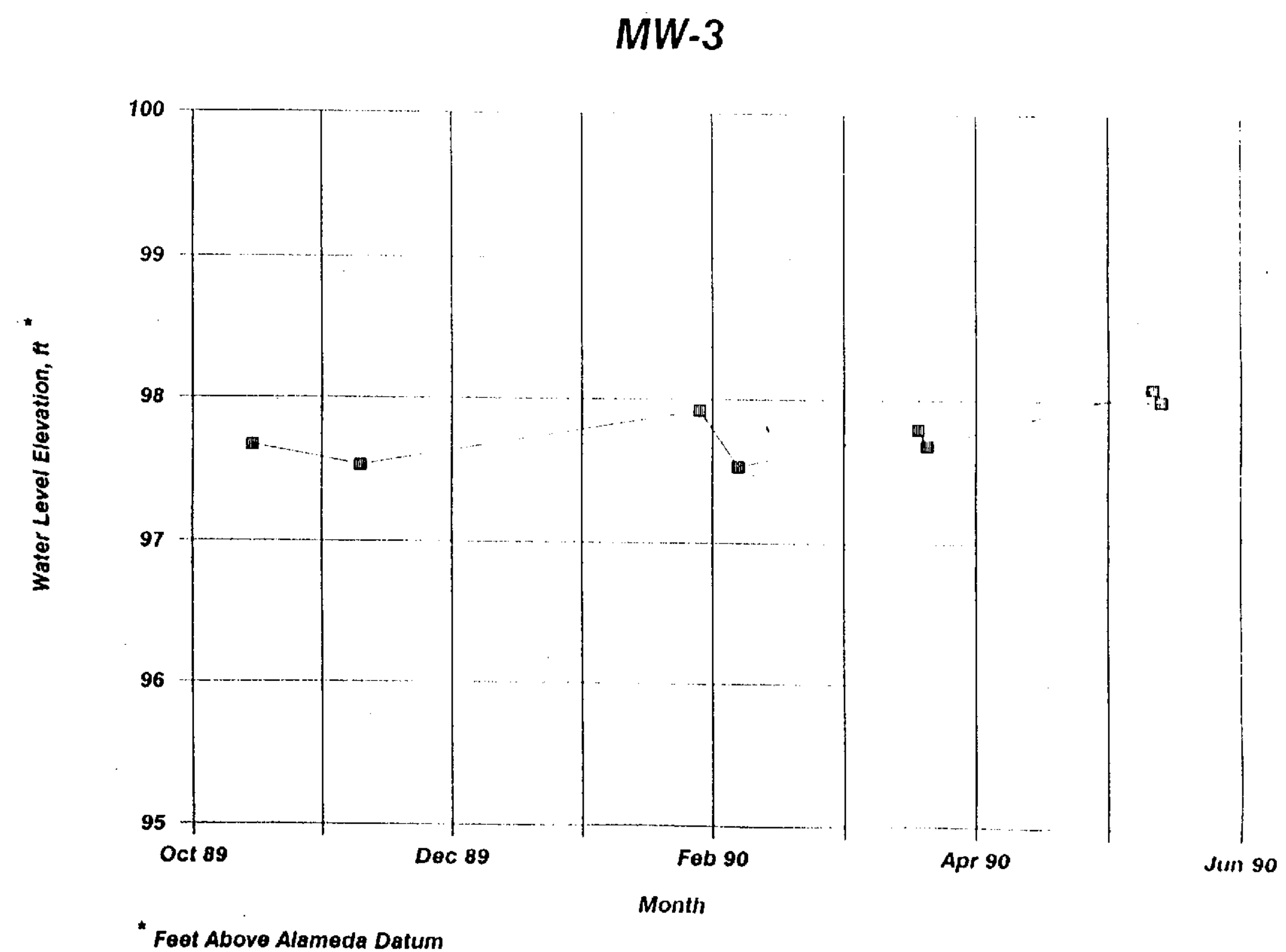
* Feet Above Alameda Datum

Job No	893-7039	Scale	
Drawn	DVR	Date	June 1990
Checked	KRR	Dwg. No.	

HYDROGRAPH OF MW - 2
North Port of Oakland Site Disposal

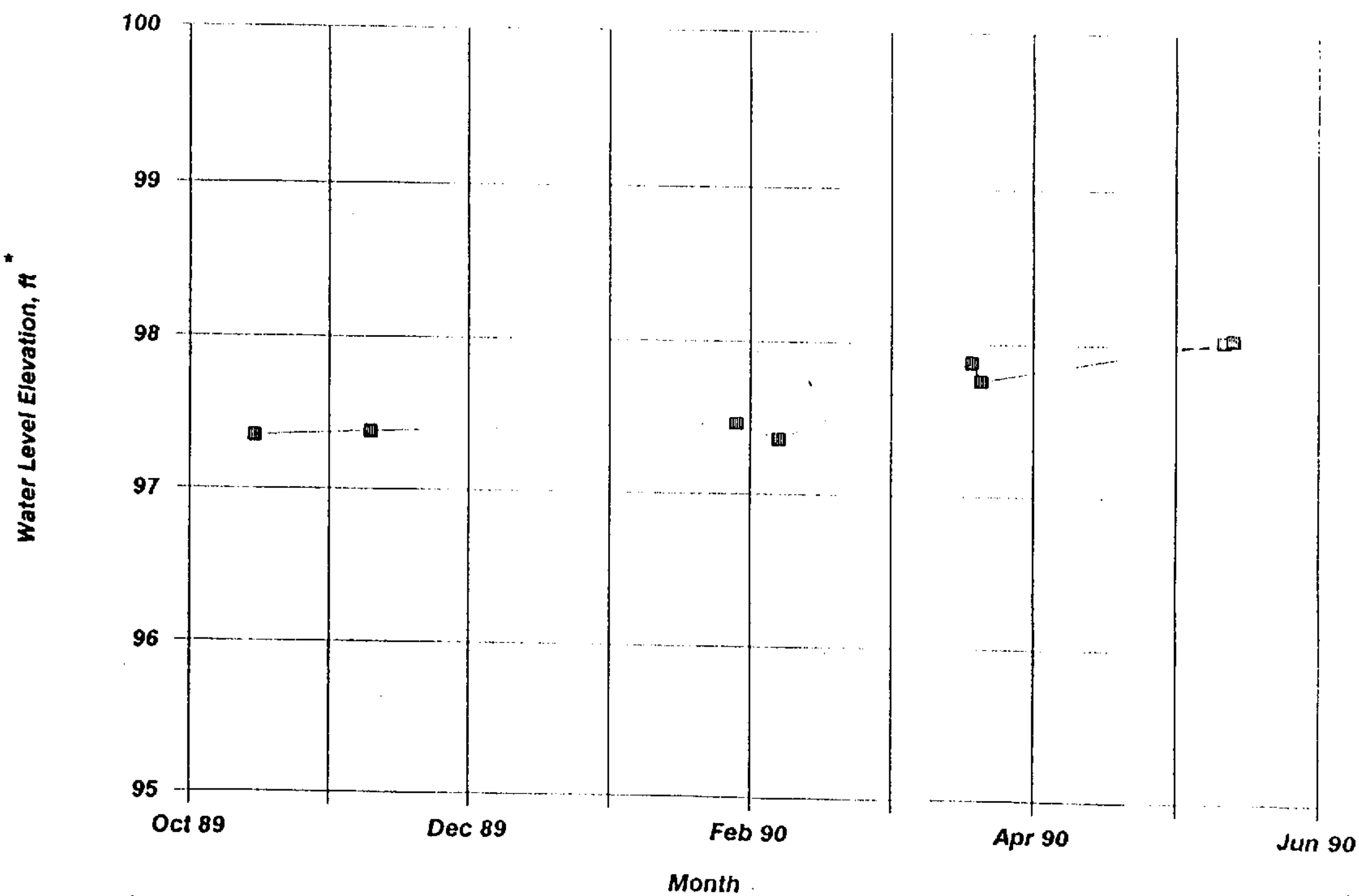
Golder Associates Inc.

Waste Management of North America, Inc. Figure D2



Job No 893-7039	Scale ------------	
Drawn DVR	Date June 1990	**HYDROGRAPH OF MW - 3**
Checked KRR	Dwg No	**North Port of Oakland Site Disposal**

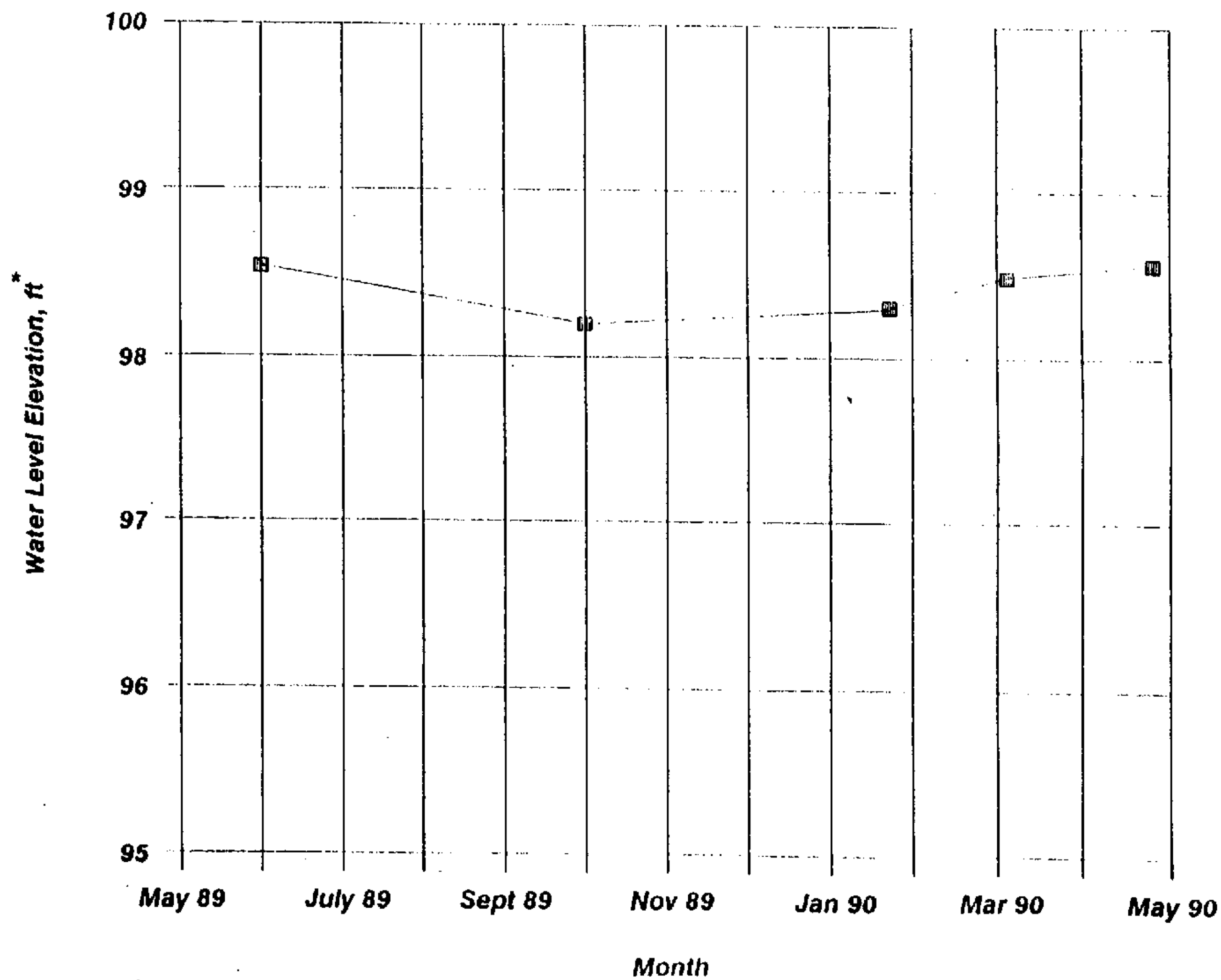
MW-4



* Feet Above Alameda Datum

Job No. 893-7039	Scale ------------	HYDROGRAPH OF MW - 4 North Port of Oakland Site Disposal	
Drawn DVR	Date June 1990		
Checked KRR	Dwg. No.		
Golder Associates Inc.		Waste Management of North America, Inc.	Figure D4

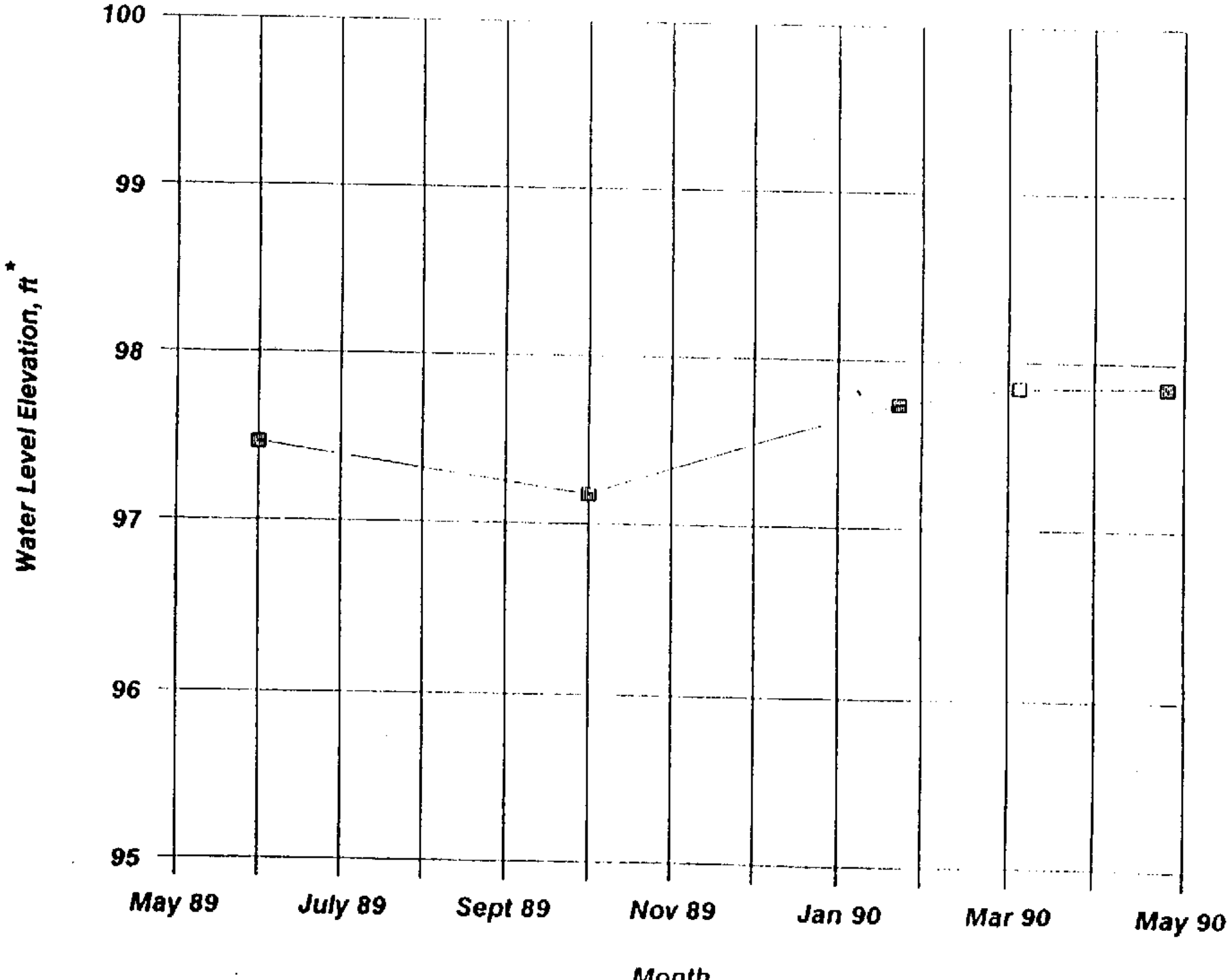
P-6



*Feet Above Alameda Datum

Job No 893-7039	Scale As Shown	**HYDROGRAPH OF P - 6** **North Port of Oakland Disposal Site**
Drawn DVR	Date June 1990	
Checked KRR	Dwg No.	
Golder Associates Inc		Waste Management of North America, Inc. — Figure D5

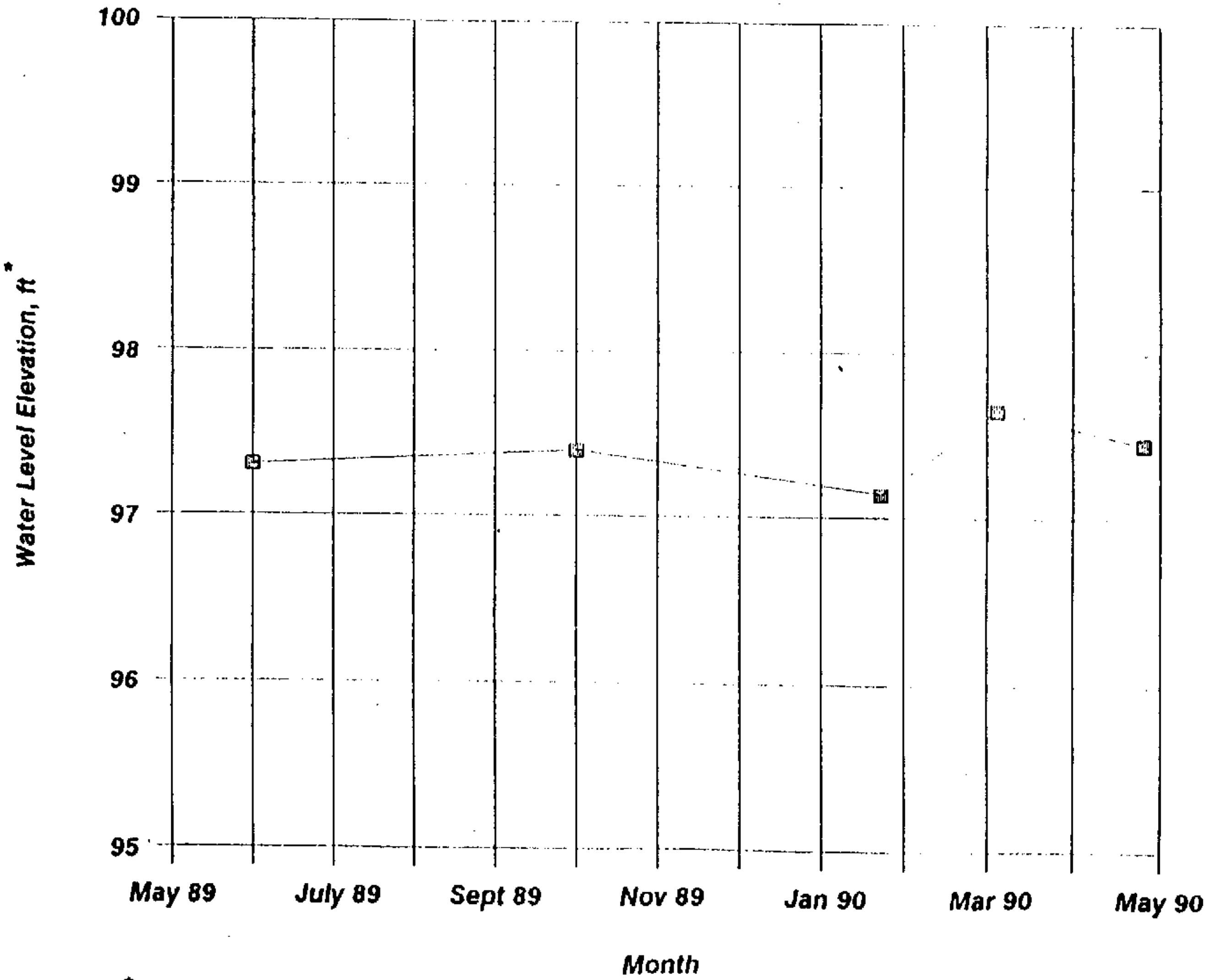
P-6A



*Feet Above Alameda Datum

Job No 893-7039	Scale As Shown	HYDROGRAPH OF P - 6A North Port of Oakland Disposal Site
Drawn DVR	Date June 1990	
Checked KRR	Dwg. No.	

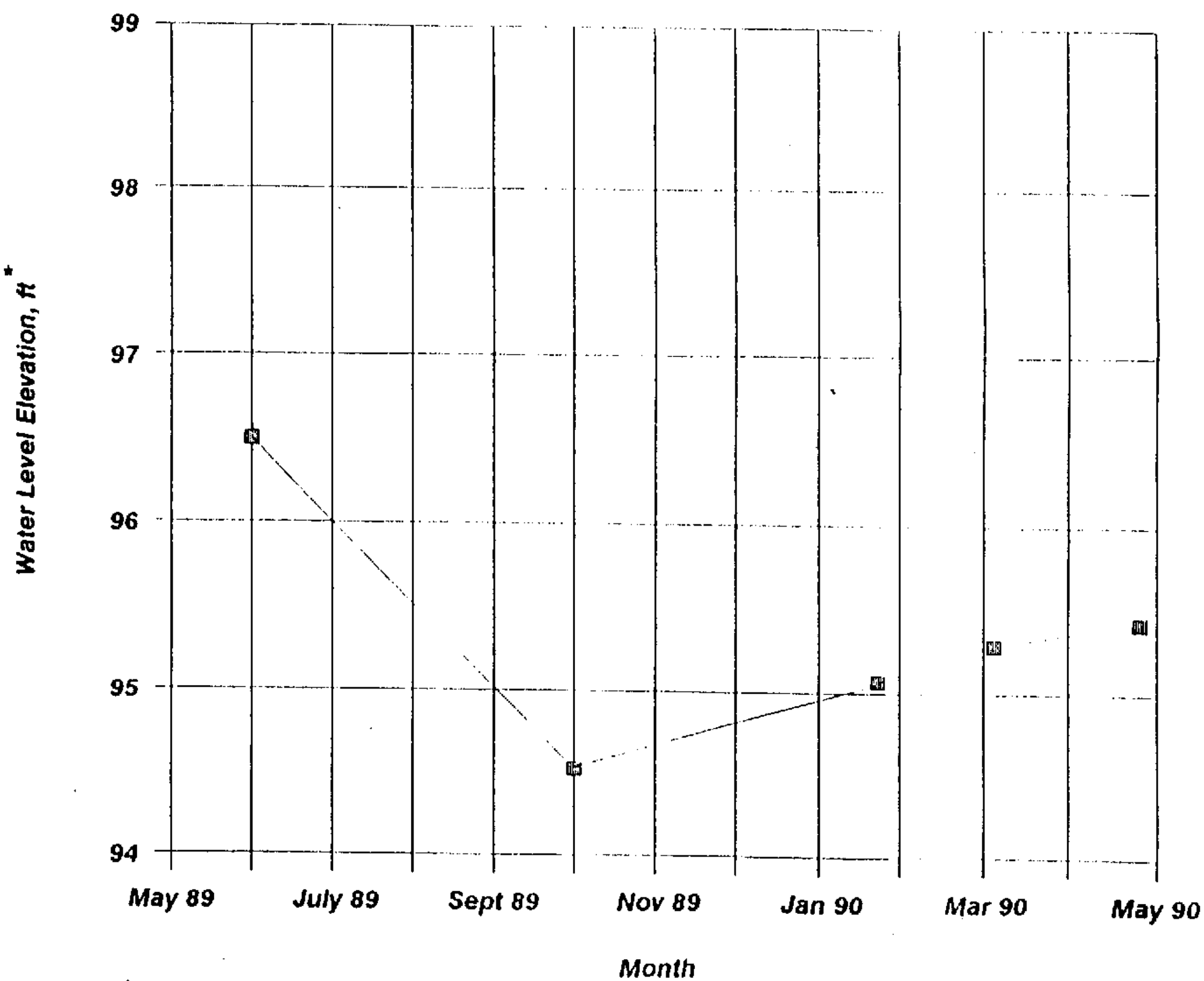
P-7



*Feet Above Alameda Datum

Job No	893-7039	Scale	As Shown	**HYDROGRAPH OF P - 7**
Drawn	DVR	Date	June 1990	**North Port of Oakland Disposal Site**
Checked	KRR	Dwg No		

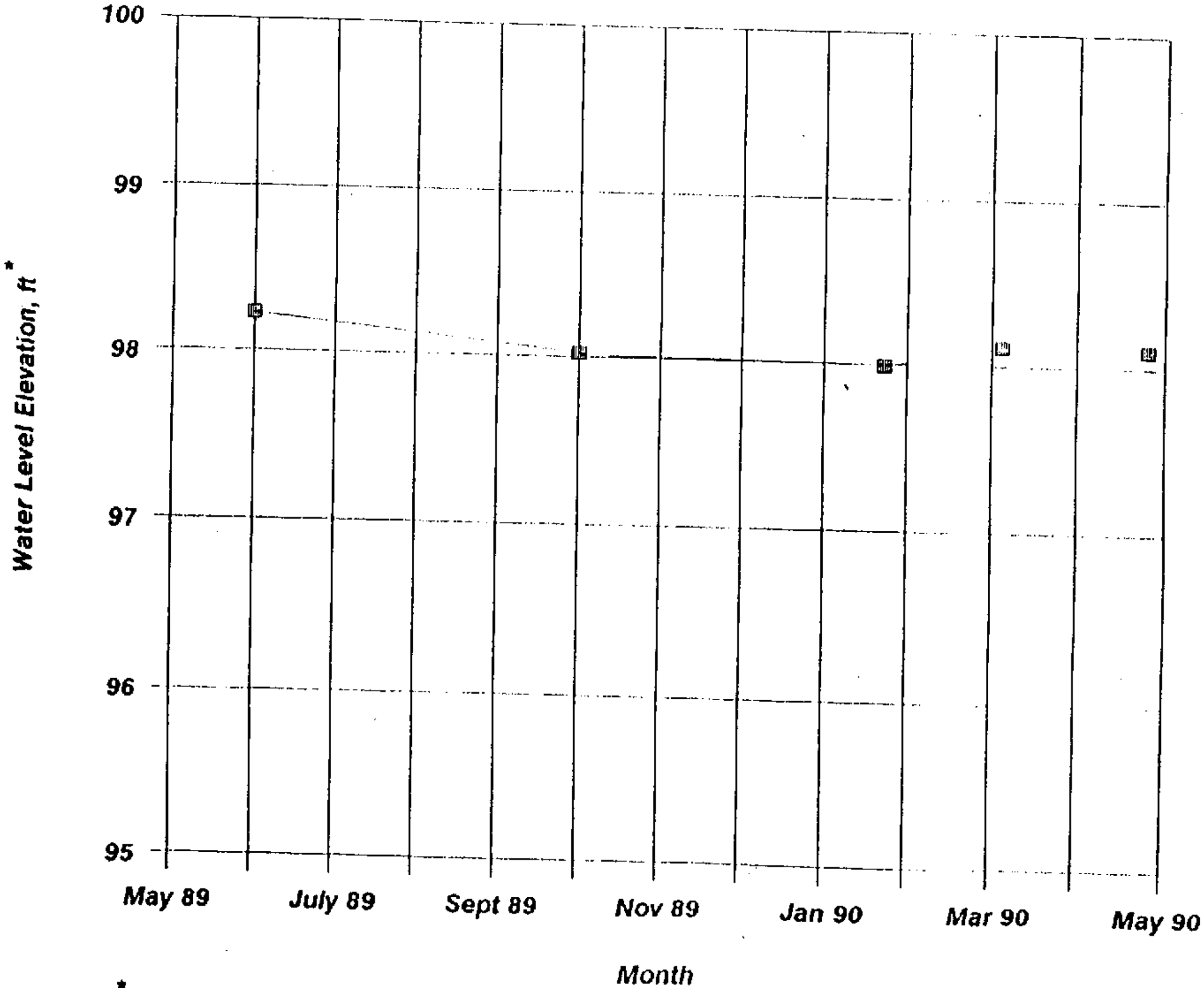
P-7A



*Feet Above Alameda Datum

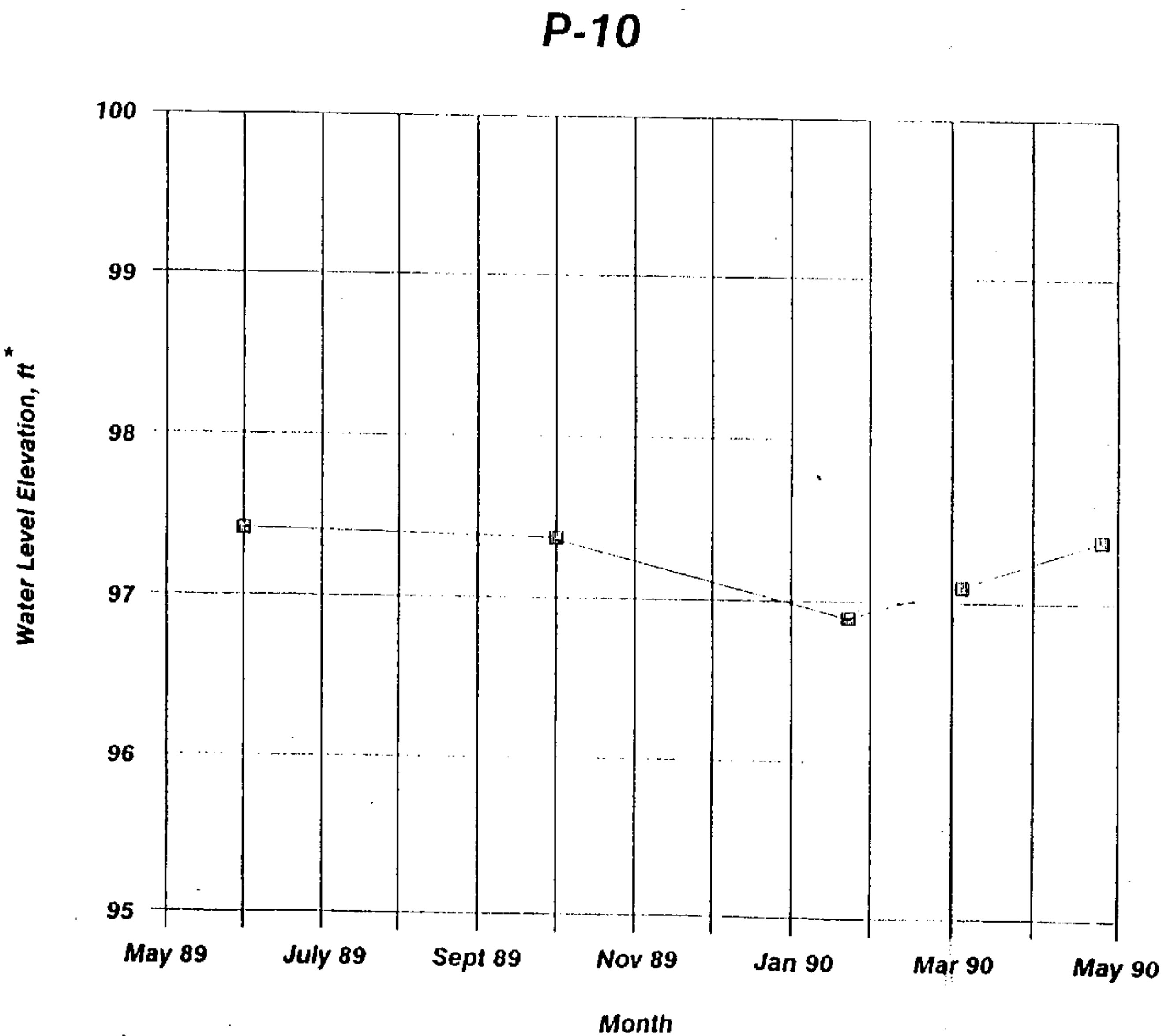
Job No 893-7039	Scale As Shown	**HYDROGRAPH OF P - 7A** North Port of Oakland Disposal Site
Drawn DVR	Date June 1990	
Checked KRR	Dwg. No.	

P-9



*Feet Above Alameda Datum

Job No 893-7039	Scale As Shown	**HYDROGRAPH OF P - 9** **North Port of Oakland Disposal Site**
Drawn DVR	Date June 1990	
Checked KRR	Dwg. No.	



*Feet Above Alameda Datum

Job No. 893-7039	Scale As Shown	HYDROGRAPH OF P - 10 North Port of Oakland Disposal Site
Drawn DVR	Date June 1990	
Checked KRR	Dwg. No.	
Golder Associates Inc.		