TECHNICAL MEMORANDUM

PRELIMINARY EVALUATION OF THE SOURCES, NATURE, EXTENT, AND MOVEMENT OF CONTAMINATION IN SURFACE WATER AND GROUNDWATER

HALACO SITE

OXNARD, CALIFORNIA

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Acronyms and Abbreviations

µmhos/cm	micromhos per centimeter
µg/L	micrograms per liter
AWPF	Advanced Water Purification Facility
bgs	below ground surface
DHS	California Department of Health Services (now California Department of Public Health (DPH)
DPH	California Department of Public Health
CDO	Cease and Desist Order
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
City	City of Oxnard
E&E	Ecology & Environment, Inc.
EC	electrical conductivity
EPA	U.S. Environmental Protection Agency
FCGMA	Fox Canyon Groundwater Management Agency
gpm	gallons per minute
LAS	Lower Aquifer System
mg/L	milligrams per liter
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NCL	Nature Conservancy Land
ND	Not detected
NEIC	EPA National Enforcement and Investigation Center
NGVD 29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List

O&G	oil and grease
OID	Oxnard Industrial Drain
pCi/L	picocuries per liter
PVC	polyvinyl chloride
RASA	Regional Aquifer System Analysis
RI	Remedial Investigation
RWQCB	Regional Water Quality Control Board
SAGE	SAGE Consultants
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TM	Technical Memorandum
TPH	total petroleum hydrocarbons
UAS	Upper Aquifer System
USGS	U.S. Geological Survey
UWCD	United Water Conservation District
VCWPD	Ventura County Watershed Protection District
VOC	volatile organic compound
WA	Work Assignment
WDRs	Waste Discharge Requirements
WDA	waste disposal area
WDP	Wastewater Discharge Permit
WMU	waste management unit
WWTP	Wastewater Treatment Plant

SECTION 1

Introduction

CH2M HILL prepared this surface water and groundwater preliminary evaluation technical memorandum (TM) to support Remedial Investigation (RI) activities on behalf of the U.S. Environmental Protection Agency (EPA) Region 9 for the former Halaco secondary metal smelting facility (Halaco Site, or Site). CH2M HILL prepared this TM as part of Work Assignment (WA) No. 263-RIRI-09X6 with EPA Region 9.

1.1 Objectives

The objectives of this preliminary evaluation are to compile and evaluate information on the sources, nature, and extent of surface water and groundwater contamination at the Halaco site, and the physical processes that affect the movement of the contaminants. This report does not assess risks to human health and the environment posed by the contamination. A separate TM provides a screening-level assessment of potential risks from contamination at the Site (CH2M HILL, 2008).

1.2 Technical Approach

To meet the objectives of the preliminary evaluation, existing information was reviewed, new site-specific data were collected, and a conceptual model of groundwater and surface water flow at the Site was developed. The following types of information were obtained and evaluated:

- Precipitation
- Regional and local geology
- Regional aquifer system and groundwater elevations
- Topographic and surface water features in the vicinity of the Site
- Surface water and groundwater flow in the vicinity of the Site
- Surface water and groundwater chemistry in the vicinity of the Site
- Tidal, seasonal, and other temporal influences on surface water and groundwater flow and chemistry

Sources of existing information include:

- Site-specific studies of environmental conditions at the Halaco Site by Halaco, EPA, and other Federal, State, and local agencies
- Regional studies supporting wetlands restoration efforts for the Ormond Beach area by the California Coastal Conservancy and others
- Regional studies regarding surface water, groundwater, and water resource conditions across the Oxnard Plain by the U.S. Geological Survey (USGS), United Water Conservation District (UWCD), and others

New site-specific data collected by EPA and CH2M HILL include:

- Inventorying and, as necessary, repairing the existing groundwater monitoring well network at the Halaco Site
- Installing new surface water staff gauges at two locations
- Surveying the horizontal coordinates and vertical elevations of the Site's groundwater monitoring well network, two new staff gauges, an existing staff gauge, and a nearby regional, multi-level groundwater monitoring well
- Measuring surface water and groundwater levels monthly using a hand-held meter over a 1-year period from October 2007 through September 2008
- Measuring surface water and groundwater levels every 10 to 15 minutes using a transducer and data logger for selected time periods from October 2007 through September 2008
- Measuring groundwater electrical conductivity (EC) on a one-time basis by lowering a hand-held probe down each of the Site's groundwater monitoring wells

The water level data were collected in accordance with a monitoring plan approved by EPA (CH2M HILL, 2007a).

Numerous agencies and firms were contacted to obtain information on surface water and groundwater conditions in the area, including UWCD, Fox Canyon Groundwater Management Agency (FCGMA), City of Oxnard (or City) Wastewater Division, and Ventura County Watershed Protection District (VCWPD).

1.3 Report Organization

This report is organized into the following sections:

- Section 1: Introduction
- Section 2: Site Description and History
- Section 3: Information Review and Data Collection
- Section 4: Regional Hydrologic Conditions
- Section 5: Local Hydrologic Conditions
- Section 6: Wastewater, Surface Water, and Groundwater Chemistry
- Section 7: Preliminary Conclusions
- Section 8: References

SECTION 2

Site Description and History

This section provides a brief description of the history and layout of the Halaco Site. The Halaco Site is located in western Ventura County at 6200 Perkins Road in Oxnard, California (Figure 2-1).

2.1 Site History

Halaco Engineering Company operated a secondary metal smelter at the approximately 37-acre Site from 1965 to 2004, processing aluminum- and magnesium-bearing materials, including radioactive magnesium-thorium alloy. During its 40 years of operation, Halaco produced a large quantity of solid and liquid waste. From 1965 to about 1970, Halaco discharged much or all of its waste to the Oxnard Industrial Drain (OID). From about 1970 to 2002, Halaco discharged hundreds of millions of gallons of waste slurry made up largely of water, residual metal, and salts to unlined earthen waste ponds in the waste management area east of the smelter. It is estimated that more than 700,000 cubic yards of waste solids remain onsite. Most of the solids are in a waste pile that covers about 15 acres and rises up to 40 feet above grade. A description of Halaco's metal recovery process is provided in Appendix A.

In 2002, Halaco filed for Chapter 11 bankruptcy. Halaco ceased operations in 2004; then, in 2006, the bankruptcy was converted to a Chapter 7 (liquidation) bankruptcy. Future use of the property is uncertain.

In July 2006, EPA reached agreement with some of the Site owners to complete a limited removal action at the Site. The work included the removal of drums and other hazardous substances, as well as installation of fencing, silt curtain, and straw wattles around the waste pile. A second, EPA-funded removal began in February 2007 to stabilize and secure the Site and limit offsite migration of contaminated wastes. That removal work included regrading the waste pile to reduce the steepness of the slopes, placing matting on the slopes to reduce erosion, stabilizing the banks along the lower portion of the OID, removing wastes from the smelter parcel, and removing some Halaco waste materials located in a wetland area adjacent to the Halaco property.

The Halaco Site was added to the National Priorities List (NPL) in September 2007.

2.2 Site Layout

The Site is located on the Pacific Ocean shoreline in the City of Oxnard. The Site is bisected by the OID, a surface water channel that drains upstream agricultural, commercial, and residential areas of the Oxnard Plain (Figure 2-1). Immediately to the north and east of the Site is a wetland area owned by The Nature Conservancy. To the south of the Site are a wetland area, a lagoon, and the Pacific Ocean. The wetlands are part of the larger Ormond

Beach wetland area, which extends from Port Hueneme (to the northwest) to the Mugu Lagoon (to the southeast).

The smelter is located on approximately 11 acres on the west side of the OID. The waste management area, including the waste management unit (WMU) and waste disposal area (WDA), is located on approximately 26 acres on the east side of the OID. The Site has been divided into the following study areas for site investigation purposes (Figure 2-1):

- Smelter parcel—West of the OID, where Halaco operated the smelter and used some of its waste as fill
- WMU—East of the OID, where Halaco deposited most of its waste
- WDA—East of the OID and north of the WMU, where wastes are also located
- OID—Surface water channel bisecting the Site
- The Nature Conservancy land (NCL)—East and north of the WMU and WDA
- Wetlands area—Between the Site and the Pacific Ocean, fed by the OID, J Street Drain, and Hueneme Drain

2.3 Historical Site Development

The historical development of the Halaco site is shown in U.S. Coastal Survey and USGS topographic maps (Figure 2-2), aerial photographs (Appendix B), and EPA photographs and topographic maps taken before and after the 2006 removal action (Figures 2-3 through 2-6). These maps and photographs show the following:

- The 1850s coastal survey map shows the development of the City of Port Hueneme and the undeveloped wetlands at and near the Site. Several coastal water bodies are evident. The large northwest lagoon is associated with the present-day Hueneme Drain and the middle lagoon is part of the present-day OID.
- The 1904 topographic map shows additional development, but the lagoon associated with the present-day OID is still undeveloped.
- The 1929 aerial photograph shows predevelopment conditions.
- The 1949 topographic map (photorevised 1967) shows more development, including improvements at the Site. The lagoon has been filled and the OID channelized.
- The 1945 through 1959 photographs show fill, burial, and burn activities west of the current-day OID. These activities may be associated with the dump operated by the City of Oxnard until about 1962. The fill and dumping activities appear to have taken place within a lagoon visible in the 1850s coastal survey and 1904 topographic map.
- The 1965 through 1991 photographs show Halaco's operations and waste disposal activities.

Appendix B.3 provides an undated oblique aerial photo showing Halaco's operations with waste disposal occurring at the WMU and WDA.

SECTION 3

Information Review and Data Collection

This section provides a description of the existing information that was reviewed and the new site-specific data that were collected as part of the evaluation described in this TM.

3.1 Information Review

The primary information reviewed is summarized below.

3.1.1 Site-Specific Information – Halaco Engineering Co.

Industrial Waste Discharge Permit Applications

Halaco submitted Industrial Wastewater Discharge Permit (WDP) applications in 1979 and 2001 to obtain approval to discharge industrial wastewater to the Oxnard Industrial Drain (1979) and the City of Oxnard Wastewater Treatment Plant (WWTP) (2001). These applications were reviewed to obtain information on the chemical composition of the industrial wastewater discharged from former smelter operations.

Site Investigation, Sampling, and Analysis Activities – 1970s

Halaco performed site investigation, sampling, and analysis activities in the early 1970s in accordance with Waste Discharge Requirements (WDRs) issued by the Los Angeles Regional Water Quality Control Board (RWQCB) in 1970 to assess the suitability of the waste management area for disposal of Halaco's wastes and assess potential impacts on surface water and groundwater from waste disposal that began in about 1970. The earliest known piezometer installation and groundwater sampling activities were performed beginning in 1970. Groundwater, surface water, and wastewater samples were collected and analyzed for a variety of chemistry parameters throughout the 1970s as documented in reports by Buena Engineers and various laboratories. The status of the piezometers installed during the 1970s is not known.

Monitoring and Reporting Program – 1981 to 2003

Halaco performed wastewater, surface water, and groundwater monitoring from 1981 through 2003 to comply with revised WDRs issued by the RWQCB in 1980. Three groundwater monitoring wells were installed at the waste management area in 1981 and a fourth was installed in 1983. Groundwater and plant effluent were sampled twice per year. Surface water was sampled twice per month from the OID south and north of the Site. Well installation and monitoring data are documented in monitoring reports prepared by Buena Engineers, Inc. (monitoring period 1981 through 1991), Earth Systems Consultants (monitoring period 1991 through 2001), and Halaco or Brash Industries (monitoring period 2001 through 2003). The four wells were abandoned in 2003 (Padre, 2003a).

Site Investigation – 1985

A site investigation was performed in 1985 to characterize (1) surface water and groundwater quality and (2) chemical and geotechnical properties of shallow soils and sediments at the Halaco Site. This included drilling 15 soil borings and installing 18 monitoring wells at the smelter parcel and the waste management area. A summary of the investigation is provided in a letter by Levine-Fricke (1987). Appendix C provides a location map and hydrogeologic cross-sections from this investigation.

Monitoring and Reporting Program – 2002 to 2004

Halaco performed surface water and groundwater monitoring activities from 2002 to 2004 to comply with a Cease and Desist Order (CDO) issued by the RWQCB in 2002. Nine new monitoring wells and two shallow groundwater sampling points were installed in 2003. Groundwater was sampled quarterly and surface water was sampled twice per month. Surface water sampling locations included the OID south and north of the Site, and the lagoon, ocean, and ditch south of the WMU. Two reports provide information on well installation, geology, and data on the surface water and groundwater flow and chemistry associated with the installation of the nine wells in 2003 (Padre Associates, 2003a, 2003b). A letter provides information on well installation and data on surface water and groundwater chemistry associated with two shallow groundwater sampling points (Halaco, 2003). The monitoring data are provided in monitoring reports prepared by Halaco or Brash Industries.

3.1.2 Site-Specific Information – State of California

The results of site inspections performed by the State Water Resources Control Board (SWRCB), Los Angeles RWQCB, and California Department of Health Services (DHS) (now the California Department of Public Health [DPH]) were reviewed to obtain information on site conditions and wastewater, surface water, and groundwater chemistry. Several of these inspections included the collection and analysis of wastewater and surface water samples. Inspection reports reviewed included the following:

- SWRCB inspections on February 28, 1972 and May 15, 1973 (SWRCB, 1972, 1973). These inspections were performed to evaluate the suitability of the waste management area for disposal purposes and did not include the collection or analysis of samples.
- DHS inspection on October 4, 1979. This inspection was performed to determine whether Halaco was discharging hazardous waste into the waste pond and included the collection and analysis of wastewater and surface water samples.
- RWQCB inspections on August 14, 1998 and August 19, 1999 (RWQCB, 1998, 2000). These inspections were performed to evaluate compliance with WDRs and included the collection and analysis of wastewater and surface water samples.

3.1.3 Site-Specific Information – EPA

Historical Aerial Photographs

The following historical aerial photographs of the Halaco Site, discussed in Section 2, were reviewed to obtain information about predevelopment conditions and development activities that may affect surface water and groundwater flow.

- 1929
- October 10, 1945
- May 4, 1951
- October 2, 1959
- September 20, 1965
- October 11, 1969
- April 27, 1971
- March 26, 1972
- August 23, 1973
- March 4, 1974
- October 7, 1975
- May 16, 1978
- June 22, 1981
- January 10, 1991

These photos, included in Appendix B, were analyzed for EPA's Environmental Monitoring Systems Laboratory (Lockheed Engineering and Management Services Company, 1982, and Lockheed Engineering and Sciences Company, 1991).

1980 and 1991 Site Inspections

Information from two site investigations performed at the direction of EPA was reviewed to obtain information on site conditions and surface water and groundwater chemistry. These investigations were conducted in 1980 and 1991 as follows:

- National Enforcement Investigations Center (NEIC) (1981) performed a site inspection from December 8 to 11, 1980, to (1) determine whether the waste generated by Halaco was a hazardous waste under the Resource Conservation and Recovery Act and (2) evaluate compliance with the Clean Water Act.
- Ecology & Environment, Inc. (E&E) (1992a and 1992b) performed a site investigation from September 10 to 13, 1991, to determine whether (1) hazardous substances, pollutants, or contaminants were present in wastes within Halaco's waste pond and WDA, and (2) hazardous substances, pollutants, or contaminants had been released to adjacent areas. This inspection was performed under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended.

2006 Integrated Assessment

Information from EPA's Integrated Assessment Report for the Halaco Site was reviewed to obtain information on surface water and groundwater levels and chemistry at the Site (Weston Solutions, 2007). The Integrated Assessment was performed to help determine the Site's eligibility for placement on the NPL and to evaluate the need for short-term response actions to mitigate risks and stabilize the Site. This report documents the sampling of media (waste material, air, surface water, sediment, surface soils, subsurface soils, and groundwater) and assessment of groundwater flow conditions in June 2006. Nine new wells were installed to supplement the nine existing wells installed by Halaco in 2003 and obtain groundwater flow and chemistry data.

2007 Removal Action Photographs and Topographic Maps

Aerial photographs and topographic maps from immediately before (February 2007) and after (April 2007) EPA's 2007 removal action were reviewed to obtain information about recent and current conditions that may affect surface water and groundwater flow. These are included as Figures 2-3 through 2-6.

2007 Southeast Smelter Investigation

Information from EPA's supplemental investigation of the southeast corner of the smelter parcel was reviewed to obtain information on groundwater chemistry at the Halaco Site (Team 9, 2008). This investigation included the analysis of waste material, sediment, surface soils, subsurface soils, and groundwater and a surface gamma radiation survey to assess the wastes used as fill from 1965 through about 1970, before waste disposal began in the waste management area.

3.1.4 Agricultural Well Sample Analysis

Results from the chemical analysis of a groundwater sample collected from an agricultural water supply well approximately 0.5-mile east of the site (well no. 27H02) were evaluated for possible site impacts. The well is located near the intersection of McWane Blvd. and Edison Dr.

3.1.5 Regional Ormond Beach Wetland Restoration Studies

The following regional studies supporting wetlands restoration efforts for the Ormond Beach area were reviewed:

- Biological Assessment of the Ormond Beach Wetland Restoration Area (WRA Environmental Consultants, 2007)
- Hydrologic and Geomorphic Conditions Feasibility Plan for the Ormond Beach Wetland Restoration Area (Philip Williams & Associates, 2007)
- Site-Wide Soil and Surface Water Investigation for the Ormond Beach Wetland Restoration Area (AMEC Earth & Environmental, 2006)

These reports were reviewed to obtain information on surface water and groundwater flow conditions at and near the Halaco Site.

3.1.6 Regional Surface Water, Groundwater, and Water Resource Studies

The following regional studies were reviewed regarding surface water, groundwater, and water resource conditions across the Oxnard Plain:

- *Ventura County Investigation (*California State Water Resources Control Board, 1956)
- *Ventura County Water Resources Management Study – Geologic Formations, Structures and History in the Santa Clara-Calleguas Area* (Mukae and Turner, 1975)
- *Lithologic and Ground-water Data for Monitoring Wells in the Santa Clara-Calleguas Ground-water Basin, Ventura County, California 1989-95, USGS Open-file Report 96-120 (*USGS, 1996a)
- *Seawater Intrusion in a Coastal California Aquifer*. Fact Sheet 125-96 (USGS, 1996b)
- *2003 Coastal Saline Intrusion Report, Oxnard Plain, Ventura County, California* (UWCD, 2004)

- *Simulation of Ground-Water/Surface-Water Flow in the Santa Clara-Calleguas Basin, Ventura County, California.* Water-Resources Investigations Report 02-4136 (USGS, 2003)
- *Groundwater Management Plan* (FCGMA, 2007)

The 1956 and 1975 studies include detailed assessments of the geology and hydrogeology in Ventura County for the purpose of developing water resources. The next three studies (USGS 1996a, USGS 1996b, and UCWD 2004) address saline intrusion in the regional aquifer system underlying Oxnard Plain resulting from historical groundwater pumping that exceeded replenishment. The 2003 USGS study developed a regional numerical groundwater flow model for the aquifer system underlying most of Ventura County to assess historical groundwater conditions and evaluate different water management scenarios. The Groundwater Management Plan prepared by the FCGMA (2007) sets management objectives for use of groundwater resources within FCGMA's boundary, and identifies water management strategies to meet these objectives.

3.1.7 Historical U.S. Coastal Survey and USGS Topographic Maps

The following topographic maps covering the Halaco Site vicinity were reviewed:

- *Map of a Part of the Coast of California from River Santa Clara southward to Hueneme* (U.S. Coastal Survey, 1855)
- *Map of a Part of the Coast of California from Hueneme eastward to Point Mugu* (U.S. Coastal Survey, 1857)
- *Hueneme Quadrangle, California, Ventura County*. 7.5 Minute Series Topographic Map. 15 Minute Series Topographic Map (USGS, 1904, reprinted 1947)
- *Oxnard Quadrangle, California-Ventura County*. 7.5 Minute Series Topographic Map (USGS, 1949, Photorevised 1967)

These topographic maps are included in Figure 2-2 and discussed in Section 2.

3.1.8 Ocean Tide Stage and Precipitation Data

Ocean tide and precipitation data were obtained from existing sources.

Ocean Tide Stage

Ocean tide elevations were obtained from National Oceanographic and Atmospheric Administration (NOAA) tide gauging stations 9411340 (Santa Barbara) and 9410840 (Santa Monica). These are the closest stations north and south of the Halaco Site, respectively. The data were obtained from NOAA's website (http://www.tidesonline.nos.noaa.gov) at 6-minute frequency readings and averaged to obtain the approximate elevation at the Halaco Site. An average of the tidal data between these two stations was found to result in a suitable correlation between the ocean tide levels and the OID surface water levels when the beach berm was breached (see Section 4 for additional discussion of the beach berm). The location and elevation datum information for the two stations is provided on NOAA datum sheets in Appendixes F.1 and F.2.

Precipitation Data

Precipitation data were obtained from the VCWPD, which maintains a network of meteorological observation stations in Ventura County. One of the stations closest to the Halaco Site is Station 32A, Oxnard Civic Center, located less than 5 miles from the Site. This station has current and historical rainfall data since the 2003-04 water year. Station 32A replaced Station 32, Oxnard Water Department, which has historical data from 1902-03 through 2002-03.

The precipitation data were obtained from VCWPD's website (http://www.vcwatershed.org). Annual rainfall data (for the water year, which begins October 1) were obtained for the historical period of record (1902-2003). Daily rainfall was obtained for the water year that began October 1, 2007 for Station 32A. Data for this automated meteorological station are periodically downloaded, verified, and uploaded to the VCWPD website. These data are also provided real-time (as of 8:00 a.m. daily) on the VCWPD website, but are qualified as preliminary until verified.

3.1.9 Oxnard Drainage Districts

Information from the Oxnard Drainage Districts was reviewed to assess the potential effects of subsurface agricultural drains on groundwater flow in the vicinity of the Halaco Site (Oxnard Drainage District No. 3, undated).

3.1.10 Oxnard Wastewater Collection System and Treatment Plants

As-built, groundwater extraction, water level, and geotechnical information associated with the City of Oxnard's sanitary sewer wastewater collection system, secondary WWTP, and planned Advanced Water Purification Facility (AWPF) was reviewed to evaluate whether infiltration of groundwater into leaking sewer pipes or groundwater dewatering associated with operation or construction activities were affecting groundwater levels at the Site.

3.2 Data Collection

From August 2007 to September 2008, CH2M HILL performed the following surface water and groundwater data collection activities in accordance with a monitoring plan approved by EPA (CH2M HILL, 2007a).

3.2.1 Groundwater Monitoring Well Inventory and Repair

CH2M HILL inspected the 18 existing groundwater monitoring wells at the Site on August 15, 2007. Well depths were measured on several dates, including on March 6, 2008. Figure 3-1 shows the locations of the 18 existing wells and the "old" wells abandoned in 2003. Table 3-1 summarizes and updates as-built well construction information from the well logs, elevation survey information, and other sources of information. Appendix C provides the boring and well construction logs. Appendix D.1 provides photographs of the wells taken on August 15, 2007.

Findings from the August 15, 2007 inspection and March 6, 2008 well depth measurements include the following:

- Some wellheads could not be secured and locked because of corrosion or other physical damage. Most of the wells installed in 2003 were in poor condition, making the well covers unusable or unlockable. Some wells may have material in the bottom, indicated by a comparison of as-built and field-measured depths. The discrepancy between as-built and field-measured depths was greater than 1 foot in two wells (MW-11 and MW-13).
- Two wellheads located on the smelter parcel were damaged and could not be secured (MW-11 and MW-12). The flush-mount vault for MW-11 could not be locked and the above-ground monument for MW-12 was no longer present.
- Three wellheads located on the waste pile had been raised (MW-17 and MW-18) or lowered (MW-19) by more than 5 feet, apparently as a result of waste pile grading activities performed during EPA's removal action.

Blaine Tech Services performed the following wellhead repairs on October 9, 2007 (under subcontract to CH2M HILL) (see photographs in Appendix D.2):

- MW-1R – Replaced standpipe lid
- MW-2RA and MW-2RB cluster – Replaced standpipe lids
- MW-3RA and MW-3RB cluster – Replaced standpipe lids and one locking cap for the polyvinyl chloride (PVC) well casing
- MW-4RA and MW-4RB cluster – Replaced one standpipe lid and two locking caps for the PVC well casing
- MW-6 – Replaced locking cap for the PVC well casing
- MW-11 – Replaced flush-mount well vault
- MW-12 – Replaced standpipe
- MW-17 – Replaced locking cap for the PVC well casing
- MW-18 – Replaced locking cap for the PVC well casing

MW-16 was under standing water in the NCL East area at the time these repairs were made. This well has a flush-mount completion and has continued to be inundated since these repairs were made. Consequently, MW-16 has not been used for this study.

3.2.2 New and Existing Surface Water Staff Gauges

Two new staff gauges were installed and one existing staff gauge was used to measure surface water elevations. The new staff gauges were installed in the NCL East and NCL North areas. The existing staff gauge is located at the foot bridge at the end of Perkins Road. The staff gauge locations are shown in Figure 3-1.

SAGE Consultants (SAGE) installed the two new surface water staff gauges (under subcontract to CH2M HILL). The staff gauges are graduated in 0.01-foot increments and set to directly read surface water elevation relative to North American Vertical Datum of 1988 (NAVD 88).

The existing staff gauge is also graduated in 0.01-foot increments. However, it is not set to directly read relative to NAVD 88. The water level at this staff gauge is the same as the water level in the OID between the smelter parcel and waste management area.

3.2.3 Monitoring Well and Staff Gauge Surveying

SAGE surveyed the horizontal coordinates and vertical elevations of the Site's groundwater monitoring well network, the two new staff gauges, and the existing OID staff gauge. In addition, SAGE surveyed the coordinates and elevations of a nearby, multi-level groundwater monitoring well (CM-4) used to monitor regional groundwater conditions. These wells and staff gauges were surveyed to a horizontal datum using the North American Datum of 1983 (NAD 83) and a vertical datum using the NAVD 88. Top-of-casing (north side) and ground surface elevations were surveyed for the monitoring wells. The elevation of the "8-foot" mark was surveyed on the existing OID staff gauge. The vertical survey elevation data are included in Table 3-1. The survey reports by SAGE are provided in Appendixes E.1 and E.2 and include all surveyed coordinates and elevations.

The original survey data for the nine wells installed by Padre Associates in February and November 2003 could not be located. However, a summary of the surveyed wellhead elevations are provided in the report by Padre (2003a) that documents the installation of these wells. From comparison to the new 2007 SAGE survey data to the original 2003 Padre survey data, it appears that these nine wells were originally surveyed using National Geodetic Vertical Datum (NGVD) 29. The differences in the top-of-casing elevations between the 2003 and 2007 surveys are shown in Table 3-1. These differences range from 1.76 to 2.60 feet, which is consistent with the local correction from NGVD 29 to NAVD 88.

The nine wells installed by Weston Solutions in June 2006 were originally surveyed by FJS Land Consulting using NAVD 88 as the vertical datum.

3.2.4 Surface Water and Groundwater Level Measurements

CH2M HILL and Blaine Tech Services performed the following surface water and groundwater level measurement activities.

Discrete Water Level Measurement and Groundwater Elevations

Discrete monthly water level measurements were made with a hand-held water level meter from October 2007 through September 2008. The water level measurements were made to an accuracy of 0.01 foot. Groundwater elevations were calculated by subtracting the depth-to-water measurements from the surveyed measuring point elevation. Surface water elevations for the NCL East and NCL North locations were directly read from the respective staff gauges. The surface water elevation for the OID staff gauge was calculated by subtracting the depth-to-water measurement from the surveyed "8-foot" mark on the gauge.

Continuous Water Level Measurements

Continuous water level measurements were made with a transducer and data logger system to assess tidal effects and allow detailed correlation of surface water and groundwater elevation changes. The equipment used was a Level Troll system from In-Situ. A single data logger and transducer unit was used at each monitoring location. The transducers were vented and rated at 15 pounds per square inch. The transducers were suspended from the

top of the well casings and lowered below the groundwater level in the monitoring wells. The transducers were placed in a 1-inch steel pipe anchored at ground surface at the surface water locations. The 1-inch steel pipe provided ballast to prevent the transducer from moving in surface water. Readings were collected at 10-minute frequencies.

The transducers were installed and removed as follows:

- Transducers were installed in all site groundwater monitoring wells, NCL North, and the OID on October 15, 2007. A transducer was installed in NCL East on November 26.
- The transducers were pulled from MW-5, MW-17, and MW-18 on November 16, 2007, because they were providing redundant information with other locations. The remaining transducers were pulled on December 3, 2007, except for MW-15 and OID. The transducer for MW-15 was pulled on February 26, 2008. The transducer for the OID remained installed and running at the time this TM was prepared.
- The OID water level dropped below the transducer level when the beach berm breached on December 18, 2007. This transducer was reset below the lowest expected OID water level on February 4, 2008.
- A transducer was installed in the shallowest monitoring well (screened from 180 to 200 feet) in the CM-4 well cluster (CM-4-200) from October 19, 2007, through November 16, 2007.

Groundwater elevations were determined by correlating the relative transducer readings to the manual groundwater elevations. The differences between the transducer and manual measurements at the beginning and end of the transducer monitoring periods were minimal, indicating limited drift.

Electrical Conductivity Measurements

Groundwater EC was measured in each well during the March 6, 2008 water level measurement event. These measurements were made with a Solinst TLC Meter by lowering a calibrated EC probe to the mid-point of each well screen.

SECTION 4

Regional Hydrologic Conditions

This section describes regional surface water and groundwater conditions in the vicinity of the Halaco Site. The Site is located on the Oxnard Plain and overlies the Oxnard Plain Groundwater Basin. The regional geology and hydrogeology of the deeper regional groundwater system have been well characterized and documented. The shallow "semiperched" groundwater aquifer is less well understood in the vicinity of the Site.

4.1 Precipitation

Southern California has a Mediterranean climate characterized by hot, dry summers and cool, wet winters. The temperature extremes at the Halaco Site are moderated by its proximity to the Pacific Ocean. Most rainfall occurs from October through April, defining the wet season. Figure 4-1 shows annual water-year precipitation for the Oxnard Plain obtained from VCWPD Stations 32 (Oxnard Water Department) and 32A (Oxnard Civic Center). The long-term average for Station 32 is 14.58 inches, the minimum is 4.66 inches (1989-90), and the maximum is 38.17 inches (1940-41).

4.2 Surface Water

Surface water features at the Halaco Site include regional channels that drain the Oxnard Plain and standing surface water in the lagoon, NCL East, and NCL North areas at or next to the Site.

4.2.1 Drainage Channels, Lagoon, and Pacific Ocean

Figure 4-2 shows the regional drainage channels that occur in the vicinity of the Site. Figure 2-1 shows these channels in more detail closer to the Site. The alignments of these channels were obtained from a report prepared by Tetra Tech (2006) for VCWPD to evaluate potential improvements to industrial drainage channels. Figure 4-3 shows the Pacific Ocean current and sediment transport directions in the vicinity of the Halaco Site. Ocean current and sediment transport affect beach berm conditions, which in turn affect surface water elevations at the Site. Figure 4-3 was taken from the report by Philip Williams & Associates (2007) that evaluates hydrologic and geomorphic conditions for the Ormond Beach Wetland Restoration project.

The OID, J Street Drain, and Hueneme Drain discharge into the wetland area (lagoon) between the Halaco Site and the Pacific Ocean (Figure 2-1). These channels drain urban and agricultural runoff from the Port Hueneme and Oxnard areas. The OID and J Street Drain discharge into the lagoon by gravity. Water from the Hueneme Drain is pumped over a dam structure at its terminus into the J Street Drain and lagoon. This dam is operated by the VCWPD to prevent reverse flow and inundation of the upstream, urbanized area.

Figure 4-4 is a hydrograph of surface water elevation data collected by the VCWPD from 2002 through 2005 for the J Street Gauge 793 ALERT site (VCWPD, 2007). This site was located at the terminus of the J Street Drain, near the dam structure separating it from the Hueneme Drain. The ALERT data were collected to determine how much precipitation is required to breach the beach berm separating the lagoon and the Pacific Ocean.

The surface water elevation in the lagoon is the same as that in the J Street Drain and OID. As shown in Figure 4-4, the J Street Drain (and lagoon and OID) surface water elevation is most often above 6 feet elevation or below 5 feet elevation. Elevations are typically above 6 feet when the beach berm is intact. Elevations are usually below 5 feet when the beach berm is breached. The beach berm breaches in response to rainfall events and increased flows in the three drains (OID, J Street, and Hueneme).

As shown in Figure 4-4, once the berm is breached, the lagoon, OID, and J Street Drain elevations rise and fall with the ocean tide. The sediment transport processes shown in Figure 4-3 act to restore the beach berm. Site-specific surface water elevation monitoring data obtained from October 2007 through September 2008 for this study show the detailed interaction between lagoon and OID surface water levels, ocean tide levels, and daily rainfall. These data are analyzed in Section 5.

4.2.2 Historical Lagoon and Coastal Drainage Canal

The current configuration of the lagoon appears to date back to the 1990s from review of aerial photographs. Historically, a coastal drainage canal parallel to the shoreline carried surface water from the OID, J Street Drain, and Hueneme Drain southward to Mugu Lagoon. This canal first appears in the 1945 aerial photo, appears to still be operational in the 1951 photo, and appears to have become dilapidated and non-operational by the 1959 photo (Appendix B). This canal is shown on the portion of the Oxnard Drainage District No. 3 map included in Appendix G. A notation on this map indicates that it was prepared in 1937, indicating that the canal was present at that time.

The former coastal drainage canal reportedly helped prevent surface water from backing up into the drains and upstream developed areas. A side effect was that the canal prevented the berm from being breached in the vicinity of the Halaco Site. After the coastal canal became non-operational, VCWPD at some time began to manually breach the berm at the mouth of the J Street drain to prevent water from backing up and affecting developed areas during winter stormwater runoff. Reportedly, VCWPD manually breached the berm at the mouth of the J Street drain in the fall before the winter rains commenced and also at other times of the year (VCWPD, 2008). The October 11, 1969 photo apparently shows a manual breach of the beach berm at the J Street drain.

The VCWPD reportedly stopped breaching the beach berm in 1992 in response to a CDO from the U.S. Fish and Wildlife Service (VCWPD, 2008). The modern extent of the lagoon (Figure 2-1), appears to have formed after this time based on review of the historical aerial photos. Recent berm breaches have occurred farther to the south in the lagoon area, as apparent in the April 2007 aerial photo (Figure 2-4).

Remnants of the former coastal drainage canal are present to the south of the smelter parcel and the WMU.

- The remnant to the south of the smelter parcel extends from the main lagoon area at the mouth of the OID westward to a dike containing the J Street Drain. The former channel appears to resemble its original configuration without significant sedimentation, windblown materials (e.g., beach sand), or other fill. There does not appear to be significant flow in this remnant except for water moving in and out with the rise and fall of the OID and lagoon.
- The remnant to the south of the WMU extends from the main lagoon area at the mouth of the OID eastward toward NCL East. The former channel is mostly filled with sediment and windblown material. The source of fill materials includes beach sands and waste from the WMU. The amount and elevation of fill is greater toward the eastern portion of the "ditch." As described below, surface water from the lagoon enters and rises into this ditch during high water levels and, when high enough, flows across a topographic divide at the southern tip of the WMU into NCL East.

4.2.3 Nature Conservancy Lands

Surface water accumulates in the NCL East and NCL North pond areas in response to rainfall and high water levels in the lagoon and OID. Figure 2-1 shows the NCL East area without water, and Figure 2-4 shows this area with water. Figure 2-3 shows the NCL North area with more water in the ponds to the north of the WDA, and Figure 2-4 shows these ponds with less water. Site-specific surface water elevation monitoring data obtained from October 2007 through September 2008 show the detailed interaction between the lagoon and OID surface water levels, the NCL East and NCL North surface water levels, and daily rainfall. These data are analyzed in Section 5.

4.3 Hydrogeology

The surface geology and groundwater basins of southern Ventura County are shown in Figure 4-5. A geologic cross-section through the Oxnard Plain is shown in Figure 4-6. The regional geology, aquifer units, groundwater quality, and groundwater beneficial use designations are described below.

4.3.1 Geology

Regionally, the Oxnard Plain is located within the southwest portion of the Ventura Basin, south of the Santa Ynez Mountains in the western Transverse Ranges Geomorphic Province of Southern California. The Transverse Ranges Geomorphic Province is an east-west-trending geomorphic province bounded on the north by the Santa Ynez fault, on the east by the San Bernardino Mountains, on the south by the Transverse Ranges frontal fault zone, and on the west by the Pacific Ocean. The province contains igneous, volcanic, metamorphic, and sedimentary rocks ranging in age from Cretaceous to Holocene (recent). Major east-west-trending folds and reverse faults reflect regional north-south compression.

Locally, the Oxnard Plain is bounded by the Oak Ridge and San Cayatano Faults. The basin fill includes Plio-Pleistocene to Recent sediments infilling an actively growing syncline with

sediment from the uplifting Buena Ventura and Santa Monica Mountains, as well as sediments carried from the Santa Clara River (Figure 4-5).

4.3.2 Aquifer System

The Oxnard Plain is part of the Santa Clara-Calleguas Basin, located within the Santa Clara River and Calleguas Creek surface water drainages. The drainage encompasses an area of approximately 2,000 square miles. The main water-bearing units of the Santa Clara-Calleguas Basin are unconsolidated alluvial deposits of Holocene age, unconsolidated to partially consolidated alluvial and marine deposits, and continental and marine deposits of Pleistocene age. Tertiary age consolidated sedimentary rocks underlie the groundwater-bearing zones throughout most of the basin and form the base of fresh water (Figure 4-6).

The Oxnard Plain Groundwater Basin is one of several groundwater sub-basins located within the coastal valleys and plains of the Santa Clara-Calleguas Basin. The Oxnard Plain sub-basin is bounded to the north by the Mound and Oxnard Forebay sub-basins, to the east by the Pleasant Valley sub-basin, and to the south and west by the Pacific Ocean (Figure 4-5).

Groundwater in the Oxnard Plain Groundwater Basin is present in three major aquifer systems, including (from shallowest to deepest) the Semiperched Aquifer, Upper Aquifer System (UAS), and Lower Aquifer System (LAS) (Figure 4-6). The UAS and LAS form the regional aquifer system that is used for water supply. These aquifer systems are intermittently separated by silts and clays of low permeability.

Semiperched Aquifer

The Semiperched Aquifer consists of localized discontinuous units of low-permeability materials (silts and sands), generally to a depth of between 50 to 100 feet below ground surface (bgs). The Semiperched Aquifer is regionally of low yield and poor water quality across the Oxnard Plain and little used, if at all, as a source of water supply. The Semiperched Aquifer is underlain by an extensive clay deposit that separates it from the underlying regional aquifer system.

Regional Aquifer System

The UAS and LAS comprise the major aquifer units underlying the Oxnard Plain. These units consist of highly permeable materials (sands and gravels) generally to a depth of more than 1,000 feet bgs. From shallowest to deepest, the UAS consists of the Oxnard and Mugu Aquifers, and the LAS consists of the Hueneme and Fox Canyon Aquifers. Except where locally affected by saline intrusion from historical overdraft, these regional aquifers yield significant amounts of good quality water across the Oxnard Plain.

Historically, groundwater extraction from the regional aquifer units exceeded replenishment. This overdraft lowered groundwater levels significantly below sea level in the UAS and LAS, causing coastal saline water intrusion. In response to the overdraft and other concerns, the FCGMA was established in 1983 to regulate groundwater use in several groundwater basins underlying the southern portion of Ventura County. UWCD implements water projects to provide local and imported water to agricultural, municipal, and industrial customers. The boundaries of FCGMA and UWCD are shown in Figure 4-7.

Artificial recharge in the Oxnard Forebay implemented by UWCD (Santa Clara River water diverted into spreading basins), cutbacks in groundwater pumping mandated by FCGMA, and other projects that these and other agencies implemented have replenished groundwater levels in the UAS to where they are currently above sea level. However, groundwater levels within the LAS system on the Southern Oxnard Plain remain significantly below sea level because that part of the plain is isolated hydraulically by overlying clay materials that separate it from the UAS, along with a low-permeability structure that separates it from the Northern Oxnard Plain. Figure 4-8 shows the regional groundwater elevations for the UAS and LAS in fall 2006. Figure 4-9 shows the approximate extent of saline intrusion into the UAS and LAS in 2005 and 2006. The saline intrusion is focused in the areas of the Hueneme and Mugu submarine canyons. Figure 4-10 shows hydrographs of groundwater elevations for selected wells in the UAS and LAS.

As part of its Regional Aquifer System Analysis (RASA) program, the USGS installed a regional groundwater monitoring well system in the UAS and LAS to monitor groundwater levels and quality of the Santa Clara-Calleguas Basin. The wells are focused along the Pacific Ocean to help assess saline intrusion resulting from the overdraft conditions. Each well consists of a nested well cluster completed in the discrete aquifers making up the UAS and LAS. Figure 4-10 shows the RASA monitoring well network and the extent of saline water intrusion into the Oxnard Aquifer as interpreted by data from these wells.

USGS RASA Well CM-4 is immediately northwest of the Halaco Site, located on the property of the City of Oxnard WWTP. The well log is provided in Appendix C.4. Time-series groundwater level and salinity data for this well are shown in Figure 4-11. These data show that historically the UAS and LAS water levels were significantly below sea level in all levels monitored (UAS and LAS) and the salinity was elevated in the upper levels being monitored (UAS only). Figure 4-11 shows a significant increase in groundwater levels in all aquifer zones and a decrease in salinity in the shallowest aquifer zone beginning in the early 1990s. The increase in groundwater levels and decrease in salinity occurred in response to increased artificial recharge in the Oxnard Plain Forebay that resulted from additional diversions from the newly completed Freeman Diversion on the Santa Clara River. The additional Santa Clara River water that recharged the spreading basins in the Oxnard Forebay has increased the groundwater levels to above sea level across the Oxnard Plain in the UAS. However, the levels remain below sea level in the LAS on the southern Oxnard Plain because this area is hydraulically isolated, as noted above.

4.3.3 Beneficial Use Designation

The RWQCB has assigned beneficial uses to all groundwater of the Oxnard Groundwater Basins, including the Semiperched Aquifer, UAS, and LAS.

RWQCB Basin Plan Beneficial Uses of Groundwater for the Oxnard Plain

	Beneficial Uses			
	MUN	**IND**	**PROC**	**AGR**
Unconfined perched aquifers (Semiperched Aquifer)	E	P	--	E
Confined aquifers (UAS and LAS)	E	E	E	E

AGR = Agricultural supply
IND = Industrial service supply
MUN = Municipal and domestic supply
PROC = Industrial process supply

E = Existing beneficial use
P = Potential beneficial use

These aquifers have been assigned as having beneficial use for municipal and domestic water supply, industrial service supply, and agricultural supply. All of the aquifers have been assigned as having beneficial use for industrial process supply, except for the Semiperched Aquifer zone. However, Finding No. 145 of RWQCB Order 80-58 provided:

> *Because of its very poor mineral quality waters from the semi-perched aquifer are not used for domestic, agricultural, or industrial water supply in any significant quantity.*

As noted above, the Semiperched Aquifer is little used, if at all, for water supply because it is generally high in dissolved solids. It is not protected from overlying agricultural irrigation runoff and other runoff from industrial and municipal areas that can impair water quality.

SECTION 5

Local Hydrologic Conditions

This section describes local surface water and groundwater hydrologic conditions at the Halaco Site. This includes a description of the topography, hydrogeologic units and groundwater monitoring wells, surface water and groundwater elevations, and groundwater hydraulic gradients.

5.1 Topography

Surface water and shallow groundwater flow are influenced by topography in the vicinity of the Halaco Site. Figure 5-1 shows the topography in the Ormond Beach area at 2-foot intervals in 2006, before EPA regraded the waste pile in the WMU. Figure 2-6 shows the topography in May 2007, after EPA re-graded the waste pile.

5.2 Hydrogeologic Units and Monitoring Wells

The hydrogeologic units underlying the Site consist of the regional units of the Semiperched Aquifer, the UAS (Oxnard Aquifer and Mugu Aquifer), and the LAS (Hueneme Aquifer and Fox Canyon Aquifer) (Figure 4-6). The aquifer units and monitoring wells installed to collect hydrogeologic information about these units are described below.

5.2.1 Semiperched Aquifer

Historical and recent site-specific investigations have encountered Pleistocene to Quaternary beach and fluvial deposits composed of sands and silts with low-to-moderate permeability within the Semiperched Aquifer beneath the Halaco Site. In addition, local fill materials occur on top of these native materials. Some of Halaco's wastes (and wastes from the former Oxnard dump) lie, at times, beneath the water table.

Historical Groundwater Monitoring Wells – 1970s

Halaco installed and sampled several sets of groundwater monitoring wells in the 1970s. These included the following that were generally located around the waste pond area:

- Four borings and piezometers installed on September 8, 1970 (Buena Engineers, 1970)
- Six piezometers installed on May 15, 1973 (Buena Engineers, 1973)
- Three piezometers installed on November 26, 1974 (Dames & Moore, 1974)

The status of these piezometers is not known. They may be covered by the waste pile.

Historical Groundwater Monitoring Well Network – 1981 through 2003

Halaco installed and monitored a network of four monitoring wells from 1981 through 2003: three wells installed in 1981 (MW1, MW2, and MW3) and a fourth installed in 1983 (MW-4). The locations of these "old" wells are shown in Figure 3-1, according to survey coordinates in a November 7, 1994 letter from Halaco (1994). The wells were located along the eastern and

southeastern edge of the waste management area. The wells were constructed to total depths between 16 and 25 feet bgs as described in routine monitoring reports by Buena Engineers, Inc. The wells were renumbered in 2000 as described in routine monitoring reports by Earth Systems Consultants:

Well	Through March 2000	Beginning October 2000
MW-1	Near the southeast corner of pond	Outside northeast corner of pond
MW-2	North of southeast corner of the pond	Outside central portion of pond
MW-3	Outside central portion of pond	Outside southeast corner of pond
MW-4	Outside northeast corner of pond	No longer monitored

The four wells were abandoned in 2003 by removing each well casing to total depth and backfilling with bentonite grout (Padre, 2003a).

Site Investigation – 1985

A site investigation was performed in 1985 that included 15 soil borings and the installation of 18 monitoring wells into the Semiperched Aquifer at the smelter parcel and waste management area. The location map and two cross-sections through the borings and wells are provided in Appendix C.1. Cross-section A-A′ runs northwest-to-southeast along the southern portion of the smelter parcel and waste management area. Cross-section B-B′ runs south-to-north from the former waste pond to NCL N.

Current Groundwater Monitoring Well Network

The existing groundwater monitoring well network at the Site consists of 18 groundwater monitoring wells: nine installed in 2003 by Halaco and its contractor Padre Associates and nine installed in 2006 by EPA and its contractor Weston Solutions. The locations of these wells are shown in Figure 3-1 and the construction of the wells is summarized in Table 3-1. Boring and well construction logs are provided in Appendix C.2 for the Padre Associates (2003a and 2003b) wells and Appendix C.3 for the Weston Solutions (2007) wells.

Padre Associates installed the following nine wells at six locations in 2003:

- MW-1R
- MW-2RA/MW-2RB (cluster of two wells constructed in separate boreholes)
- MW-3RA/MW-3RB (cluster of two wells constructed in separate boreholes)
- MW-4RA/MW-4RB (cluster of two wells constructed in separate boreholes)
- MW-5
- MW-6

These wells were installed around the perimeter of the waste management area and encountered native materials of the Semiperched Aquifer during installation. Clusters of two wells were installed at the MW-2, MW-3, and MW-4 locations to screen two distinct intervals at each location. The shallow wells are generally screened across or just below the water table, and the deeper wells are screened 10 to 15 feet deeper than the shallow wells.

Weston Solutions installed the following nine wells in 2006:

- MW-11
- MW-12
- MW-13
- MW-14
- MW-15
- MW-16
- MW-17
- MW-18
- MW-19

These wells were installed around the perimeter and within the smelter parcel and waste management area. These wells encountered both fill and native materials of the Semiperched Aquifer during installation. Fill materials consisted of City dump materials on the smelter parcel and Halaco waste material on the smelter parcel and in the waste management area.

5.2.2 Upper and Lower Aquifer System

Regional investigations, including the RASA study by the USGS, have defined the deeper aquifer units and groundwater quality underlying the Semiperched Aquifer in the vicinity of the Halaco Site. The nearest RASA well, CM-4, is located west of the Site across Perkins Road, at the Oxnard WWTP. The location of CM-4 is shown in Figure 4-10.

CM-4 has five wells, each completed with a separate casing and 20-foot-long screen, at depths of 200, 275, 760, 1,095, and 1,395 feet bgs. The shallowest well (CM-4-200, screened from 180 to 200 feet) is completed in the Oxnard Aquifer, beneath the aquitard separating it from the overlying Semiperched Aquifer. The four deeper wells are screened in the deeper Mugu, Hueneme, and Fox Canyon Aquifers that underlie the Oxnard Aquifer (Figure 4-6).

5.3 Recent Surface Water and Semiperched Aquifer Groundwater Levels (2003-2008)

The following surface water and groundwater elevation data were reviewed to assess recent surface water flow and groundwater flow conditions within the Semiperched Aquifer, after disposal to the waste pond stopped in September 2002:

- November 24, 2003 groundwater elevation data obtained after installation of wells MW-1R through MW-6 (Padre Associates, 2003a and 2003b)
- February 6, April 30, August 6, and November 24, 2004 quarterly groundwater elevation data for wells MW-1R through MW-6 (Halaco or Brash Industries)
- June 2006 groundwater elevation data obtained after installation of wells MW-11 through MW-19 (Weston Solutions, 2007)
- Surface water and groundwater level data from October 2007 through September 2008 (“new data” collected for this study)
- Information related to the historical Oxnard Drainage District No. 3 features that potentially could affect groundwater flow at the Site
- Information related to the City of Oxnard sanitary sewer collection system in the vicinity of the Site and at the WWTP that could potentially affect groundwater flow at the Site

Historical groundwater elevation contours prepared by Padre Associates (2003b) and Weston Solutions (2007) are shown in Figures 5-2 and 5-3, respectively. Historical groundwater contours were not available for the 2004 quarterly data collected by Halaco. The depth-to-water data and calculated surface water and groundwater elevations for the new monthly water level data (October 2007 to September 2008) are provided in Table 5-1. Groundwater elevation contours for the new monthly data are shown in the following figures:

- Figure 5-4 – October 15, 2007,
- Figure 5-5 – December 3, 2007
- Figure 5-6 – January 3, 2008
- Figure 5-7 – January 31, 2008
- Figure 5-8 – March 6, 2008
- Figure 5-9 – April 1, 2008

Groundwater contour maps are not provided for the May through September 2008 period. The range of water levels and surface water and groundwater flow directions during this period was repetitive with the preceding October 2007 through April 2008 period.

Figures 5-10 and 5-11 are hydrologic transects prepared using the new monthly data (October 2007 through April 2008) through the shallow wells and deeper wells, respectively. These transects were prepared to show the relationship between surface water, groundwater, and screened interval elevations. These transects indicate the following regarding the use of the groundwater elevation data to prepare contour maps:

- Except for MW-1R, the shallow wells (MW-2RA, MW-3RA, MW-4RA, MW-5, MW-6, and MW-11 through MW-19) are screened at or slightly below the water table (Figure 5-10).The water level data from these wells are used to represent the water table.
- MW-1R is screened deeper, similar to MW-2RB, MW-3RB, and MW-4RB (Figure 5-11). Therefore, water level data from MW-1R are not used to interpret the water table. Water level data from MW-1R, MW-2RB, MW-3RB, and MW-4RB are used to represent the deeper groundwater conditions.

Figures 5-12 through 5-19 are hydrographs for the October 2007 through September 2008 data that show surface water and groundwater elevation changes over time.

5.3.1 Recent Surface Water Elevations

Shallow groundwater elevations and flow within the Semiperched Aquifer at the Halaco Site are influenced by rainfall and surface water elevations in the lagoon between the Site and the Pacific Ocean, the OID, the ditch to the south of the WMU, the ponds in the NCL North area to the north of the WDA, and the NCL East area to the east of the waste management area. Figure 5-12 shows daily precipitation and surface water elevations for the OID, NCL East, and ocean tide from October 2007 through September 2008. Figure 5-13 shows these same data from December 2007 through April 2008 to provide a more detailed view of the interaction of the OID and lagoon levels with tidal fluctuations when the beach berm is breached, as further described below. The daily precipitation data are summarized in Table 5-2. The recent October 2007 through September 2008 data in Figures 5-12 and 5-13 are consistent with the historical data from 2002 through 2005 for the J Street Gauge (Figure 4-4).

Ocean Tide

During the October 2007 through September 2008 monitoring period, tidal elevations ranged as follows (approximate):

- 4 to 7 feet – Higher high water
- 3 to 5 feet – Lower high water
- 3 feet – Average
- 1 to 3 feet – Higher low water
- -1 to 2 feet – Lower low water

Lagoon, OID, and Ditch to the South of WMU

When the beach berm is intact, the surface water elevations in the OID (at the Halaco Site) are relatively stable and the same as in the lagoon, the ditch to the south of the WMU, and the ponds in the NCL North area. The transducer monitoring data for the OID and NCL North (October 15 through December 3, 2007) were similar (therefore, only the OID data are shown in Figures 5-12 and 5-13). The NCL North ponds appear to (1) fill from the OID when the OID rises as indicated by their slower rate of water level rise compared to the OID and (2) empty into the OID when the OID level decreases (Figure 5-14). The lagoon, OID, and NCL North levels are unaffected by tidal fluctuations when the beach berm is intact and surface water levels are high.

During the October 2007 through September 2008 monitoring period, the beach berm was first breached on December 18, 2007, during the rainy season's first significant storm event of 1.62 inches. The early season rains were not significant enough to provide sufficient flow to breach the berm. After the breach, the lagoon and OID levels rose and fell with the tide whenever the tide elevation was above approximately 3 feet. For most of the time between December 18, 2007, and mid-March 2008, the berm is partially or fully breached, allowing water to move relatively freely between the OID, lagoon, and ocean.

Although surface water elevations in the ditch to the south of the WMU were not measured or monitored with any instrumentation, surface water in the ditch was observed to be lower and less extensive when the beach berm was breached. The extent of water would have been similar to that shown in Figure 2-3 when the berm was intact (water levels higher) and Figure 2-4 when the berm was breached (water levels lower).

NCL North

After being relatively stable along with the OID when the beach berm was intact, the NCL North water level dropped with the OID (and lagoon) after the December 18, 2007 berm breach. Water levels at the NCL North staff gauge subsequently dropped below the bottom of the gauge (Table 5-1). The areal extent of the NCL North ponds during breach and non-breach conditions is shown in Figures 2-3 and 2-4, respectively. In Figure 2-3, the OID water level is high, and a smaller pond to the west and larger pond to the east are visible (non-breach condition). In Figure 2-4, the OID water level is low, the smaller pond is "dry," and the larger pond is much smaller (breach conditions). The staff gauge is located in the smaller pond to the west (Figure 3-1). This relationship between the NCL North pond levels and the OID level indicates that these ponds are in direct communication with the OID.

NCL East

Surface water levels in the NCL East area are controlled by topography. Surface water accumulates from local precipitation and overflow when the lagoon and OID levels are high during non-breach conditions. As shown in Figure 5-1, the surface topography in the NCL East area is sloped from northeast to southwest. Water from the lagoon and OID can enter NCL East through the drainage ditch to the south of the WMU (via a remnant of the former coastal drainage canal, as described in Section 4) and potentially the NCL North pond area when the lagoon and OID levels are greater than the respective watershed divides that separate the NCL East area from each of these two areas.

As shown in Figure 5-12, the NCL East surface water level was increasing to match the high (greater than 8-foot elevation) OID water level before the beach berm break on December 18, 2008. The NCL East surface water level then dropped slowly after the berm breach because the watershed divides prevented the NCL East from draining back into the lagoon and OID. The NCL East surface water level appears to decline when the lagoon and OID are low through direct percolation and evaporation. After decreasing following the December 18, 2008 berm break, the NCL East water levels again began increasing to match the higher OID water levels after the beach berm was reestablished in April 2008.

5.3.2 Recent Groundwater Elevations

Shallow groundwater elevations and flow within the Semiperched Aquifer and fill materials below the Halaco Site are strongly influenced by surface water elevations and an inferred groundwater depression to the north of the Halaco Site. Figures 5-2 through 5-18 depict surface and groundwater elevation data in various formats: groundwater elevation contours (Figures 5-2 through 5-9), hydrologic transects (Figures 5-10 and 5-11), and hydrographs (Figures 5-13 through 5-18). The cause of the groundwater depression is not known, but is suspected to be groundwater removal from within the Semiperched Aquifer. It does not appear to be caused by groundwater pumping from the underlying UAS because, as described below, the UAS water level elevations recently have been, or currently are, at or above shallow water levels in the Semiperched Aquifer at the Halaco Site.

Groundwater Elevations

Figures 5-15 and 5-16 show the transducer data collected from October 15, 2007, through December 3, 2007. These data were taken before the berm breach on December 18, 2007, and indicate the following:

- For this period, most groundwater elevations are relatively stable and maintained between 6- and 9-foot elevation by the high water levels in the lagoon, OID, NCL East, and NCL North areas. MW-3RA and MW-5 water level elevations and trends are almost identical to the lagoon and OID levels. Except for those wells discussed in the following bullets, groundwater elevations for the other wells similarly follow surface water elevation trends for the lagoon, OID, NCL North, and NCL East areas.
- MW-15 water level is maintained at approximately zero elevation, far below the other water levels, which are mostly between 6- and 9-foot elevations. MW-4RB, MW-18, and MW-19 water level elevations are maintained between the MW-15 water level and the other water levels. MW-4RA and MW-4RB show a temporary lowering of water level elevation in November 2007. The MW-4RA water level appears to be elevated above

MW-4RB in response to surface recharge from the NCL North ponds. The lower water levels in MW-15, MW-18, MW-19, and the MW-4 cluster appear to be related to the groundwater depression to the north of the Halaco Site.

- Shallow groundwater elevations are not influenced by tidal fluctuations when the beach berm is intact. The berm maintains the lagoon, OID, and NCL North surface water levels above the ocean tide levels.
- Small diurnal cycles are present in the water level elevation data. These may be related in part to diurnal barometric pressure changes.

Figures 5-17 and 5-18 show the manual data collected from October 15, 2007, through September 2, 2008. The transducer data for MW-15 and OID are also shown. These data indicate the following general trends.

- The groundwater elevations were relatively stable, consistent with the relatively stable OID surface water elevations before the first major storm of the season and breaching of the berm on December 18, 2007.
- Groundwater levels dropped after breaching of the berm on December 18, 2007, consistent with the drop in the OID levels. Groundwater levels remained low through the end of March 2008 as the berm was partially or fully breached and OID levels were relatively low during this time. A notable exception is a temporary water level increase on January 3, 2008, for wells MW-11, MW-12, and MW-17 that appears to be a short-term surface recharge effect from the 1.99-inch storm event.
- Groundwater levels increased to their pre-breach elevations in April 2008 as the berm reestablished itself and remained relatively stable for the rest of the monitoring period through September 2008, consistent with the increased and relatively stable OID levels over this time.
- As further described in the description of groundwater gradients below, groundwater elevations are primarily controlled by surface water elevations in the OID, lagoon, NCL North, and NCL East areas. However, elevations in the wells located at the north end of the smelter parcel (MW-15), at the north end of the waste pile parcel (MW-4RA and MW-4RB cluster), and center of the waste pile parcel (MW-18 and MW-19), are typically lower than the elevations in the other wells. These lower water levels provide evidence of a groundwater depression to the north of the Halaco Site. The water level in MW-4RA is similar to that of MW-4RB when the beach berm is breached (when OID, lagoon, and NCL North surface water levels are low), but is notably higher than that of MW-4RB when the beach berm is not breached (OID, lagoon, and NCL North surface water levels are high) because the higher surface water recharges the shallower-screened interval of MW-4RA, counteracting the effects of the groundwater depression in the deeper-screened interval of MW-4RB.

It is not known how ocean tides affect shallow groundwater elevations when the berm is breached because transducer groundwater level data were not collected during this time (except for MW-15) after December 18, 2007.

MW-11 became dry on March 6, 2008. This may be because there is material in the bottom of the well (Table 3-1) as documented during the August 15, 2007 well inventory.

Groundwater Gradients – November 24, 2003 (Figure 5-2)

The November 24, 2003 data are from a period when the beach berm was breached as indicated by the J Street Gauge data (Figure 4-4). The November 24, 2003 data show an east-to-northeast gradient across the WMU and WDA for the shallow wells (MW-1R, MW-2RA, MW-3RA, MW-4RA, MW-5, and MW-6) and a northern gradient for the deeper wells (MW-2RB, MW-3RB, and MW-4RB) (Figure 5-2). The east-to-northeast gradient for the shallow wells is probably influenced by the absence of surface water in NCL East (indicated by the low groundwater elevation in MW-2RA of 1.49 feet NGVD 29, or approximately 4.08 feet NAVD 88), and recharge from the OID (indicated by the groundwater elevation in MW-5 of 2.62 feet NGVD 29, or approximately 5.02 feet NAVD 88). The conversion from NGVD 29 to NAVD 88 was made by adding the survey differences for the respective wells in Table 3-1.

Groundwater Gradients – June 2006 (Figure 5-3)

The June 2006 data are from a period when the beach berm was intact and the NCL East area had little, if any, surface water. These conditions are indicated by the relatively high groundwater elevations at MW-5 near the OID (8.71 feet) and low groundwater elevation at MW-2RA near NCL East (4.80 feet). The data for the shallow wells show a northwest gradient at the smelter parcel and a northeast gradient under the waste management area. Data are not available for the deeper wells (MW-2RB, MW-3RB, and MW-4RB). The northwest gradient at the smelter parcel is influenced by the high lagoon and OID levels to the south and east and the groundwater depression to the north. The northeast gradient at the waste management area is influenced by the high lagoon and OID levels to the south and west, the groundwater depression to the north, and the lack of surface water in the NCL East area.

Groundwater Gradients – October 15, 2007 and December 3, 2007 (Figures 5-4 and 5-5)

The October 15, 2007 and December 3, 2007 data are from before the berm breached on December 18, 2007, and when surface water was present in the NCL East area. Similar to June 2006, the data for the shallow wells show a northwest gradient at the smelter parcel, influenced by the high lagoon and OID levels to the south and east, and the groundwater depression to the north. Unlike June 2006, however, the data for the shallow wells show an inward gradient toward the center of the waste management area. This is influenced by surface water recharge on all sides of the waste pile (OID to west, lagoon to south, NCL East, and NCL North). There is a downward gradient from shallow to deep wells, suggesting that groundwater moves downward from the center of the WMU.

Groundwater Gradients – January 3, 2008; January 31, 2008; March 6, 2008; and April 1, 2008 (Figures 5-6 through 5-9)

The January 3, 2008; January 31, 2008; March 6, 2008; and April 1, 2008 data are from after the berm breach on December 18, 2007, and when surface water was present in the NCL East area. The data for the shallow wells show a northwest gradient at the smelter parcel, influenced by the groundwater depression to the north, similar to earlier data (June 2006; October 15, 2007; and December 3, 2007). Surface recharge from the NCL North ponds had decreased and, consequently, the MW-2RB water level was lower and the shallow groundwater gradient at the waste management area was toward the north. The deeper wells continue to show a northern gradient.

Groundwater Gradients – May 2, 2008; June 2, 2008; July 3, 2008; August 4, 2008; and September 2, 2008

The May 2, 2008; June 2, 2008; July 3, 2008; August 4, 2008; and September 2, 2008 data are from after the beach berm reestablished itself during April 2008. The water level elevations and interpreted groundwater gradients for these data are similar to the October 15, 2007 and December 3, 2007 data from the time before the berm breached on December 18, 2007. The similarity in the water level elevations before the beach berm breached and after the beach berm reestablished itself is shown in the groundwater elevation hydrographs.

Oxnard Drainage District No. 3

Information from Oxnard Drainage District No. 3 was reviewed to assess the effects of the District's drain system on groundwater flow at the Site. Early in the 20th century, the District installed clay or tile pipe to lower groundwater levels near the Site. The pipes are typically 7 to 10 feet bgs.

A portion of the map of Oxnard Drainage District No. 3 is included in Appendix G. According to this map, there is a 14-inch east-west drainage line approximately 175 feet north of McWane Blvd and a sump where the drain crosses the OID. An EPA inspection in June 2008 noted standing water in the sump but the absence of any pumping or active removal of water from the sump or drain. Based on these observations, the drains are not believed to have a significant impact on groundwater flow at the Site.

Oxnard Wastewater Collection System and Treatment Plants

Information from the City of Oxnard was reviewed to assess the effects of the City's sanitary wastewater collection facilities on groundwater flow at the Site. The City's WWTP is shown in Figure 2-1. The information reviewed includes:

- As-built diagram of the sewer collection pipelines in the vicinity of the Halaco site that lead into the wastewater collection headworks at the treatment plant
- As-built diagram of the recently improved headworks facility and groundwater dewatering data from 2005 through 2007 associated with the headworks improvement project

In addition, groundwater elevation data from 2006 through 2008 associated with the design of the City' planned AWPF were reviewed to assess potential impacts on groundwater flow. The planned AWPF, shown on Figure 2-1, will treat secondary effluent from the WWTP to produce high-quality water that will be used for irrigation and groundwater recharge.

Sanitary Wastewater Collection System. The City collects sanitary wastewater throughout its service area for treatment. The collection system terminates in "northwest" and "southeast" trunk lines that feed into the headworks facility. The headworks facility was recently improved to maintain capacity.

Raw influent from the sanitary sewer collection system is delivered to an inlet junction structure at the headworks, where the trunk line "invert" (bottom of pipe) elevation is 75.4 feet (local plant datum) or approximately -17 feet (1988 NAVD). After primary treatment, the raw influent then passes into the influent pump station wet well where the influent is pumped to the WWTP for secondary treatment. The pump station maintains the

raw influent level at approximately the trunk line invert elevation entering the headworks facility.

The "northwest" trunk line runs south along Perkins Road and then into the headworks. The "southeast" trunk line runs west along McWane Blvd., north along Perkins Road, and then into the headworks. These are large-diameter drainage lines that would have an invert elevation along McWane Blvd. slightly higher than at the headworks inlet. Investigations are under way to determine whether groundwater leakage into the trunk line (or gravel backfill) along McWane Blvd. could explain the depressed groundwater elevation at the north part of the Site as shown by the water level at MW-15, which is several feet below the other wells on the smelter parcel (Figure 5-17).

Headworks Construction Dewatering. The City performed construction dewatering activities associated with the headworks improvements over a 3-year period from May 2005 through March 2007 according to 2005, 2006, and 2007 annual National Pollutant Discharge Elimination System (NPDES) self-monitoring compliance reports submitted to the RWQCB (City of Oxnard, 2006, 2007, and 2008). The locations and construction of the groundwater dewatering wells are documented in a contractor's construction submittal (ABA, 2005). Monthly dewatering discharge rates ranged from approximately 500 gallons per minute (gpm) to 4,000 gpm based on the annual reports. This dewatering had the potential to affect the June 2006 water level data but not the November 2003 or October 2007 through September 2008 water level data, which continue to show water levels at MW-15 several feet below other wells on the smelter parcel (Figure 5-17).

AWPF Groundwater Elevations. Groundwater elevation data collected by the City as part of a geotechnical study for construction of the City's planned AWPF were also reviewed (CH2M HILL, 2007b). These data are presented below, together with an additional set of water level measurements obtained by EPA on May 2, 2008.

Piezometer Number	Approximate Ground Surface Elevation	Piezometer Construction (feet, bgs)		Groundwater Depth (feet, bgs)			Groundwater Elevation (feet, NAVD 88)		
		Screen Depth	Total Depth	6/26/06	6/14/07	5/2/08	6/26/06	6/14/07	5/2/08
P-1	9.5	15–45	45	18.5	11.5	7.2	-9.0	-2.0	2.3
P-2	8.8	15–45	45	14.8	12.5	8.0	-6.0	-3.7	0.8
P-3	8.7	15–45	45	14.5	10	6.6	-5.8	-1.3	2.1
P-4	10	15–45	45	19.8	10	6.4	-9.8	0.0	3.3

The June 26, 2006 elevations range from approximately -5 to -10 feet and may be affected by the City's construction dewatering activities from May 2005 through March 2007. The June 14, 2007 elevations range from approximately zero to -4 feet and may be indicative of (1) residual drawdown from the historical construction dewatering activities (i.e., groundwater elevations are still recovering) and/or (2) another, unidentified groundwater depression to the north of the Site. The May 2, 2008 elevations range from approximately 1 to 3 feet and suggest an unidentified groundwater depression exists to the north of the Site.

The depressed groundwater elevations at the planned AWPF could be the result of groundwater leakage into the sanitary sewer collection system. The trunk lines from the northwest and southeast that run along Perkins Road meet and run into the headworks facility in this area, west of Perkins Road.

5.4 Historical Wastewater Discharge Rates and Surface Water and Semiperched Aquifer Groundwater Levels (1965-2002)

This section describes wastewater discharge rates and surface water and groundwater elevations up to the time the discharge to the waste pond ceased in September 2002. The following additional information was reviewed:

- Aerial photographs (Appendix B)
- Groundwater elevation data from 1981 through 2003 (MW-1 through MW-4)
- Wastewater discharge rates to the waste pond from 1981 through 2002
- Historical regulatory site inspection observations (SWRCB, RWQCB, DHS, and EPA)

5.4.1 Historical Wastewater Discharge

Halaco discharged hundreds of millions of gallons of wastewater to the WMU from about 1970 to 2002 based on the following monthly discharge rates reported to the RWQCB by Halaco and its consultants:

- 1981 to 1993 – 480,000 gallons (35 gpm x 60 min/hr x 20 hr/day x 20 day/month)
- 1993 to 1995 – 840,000 gallons (20 gpm x 60 min/hr x 20hr/day x 20 day/month)
- 1995 to 2001 – 472,500 gallons (35 gpm x 60 min/hr x 15 hr/day x 15 day/month)
- 2001 to 2002 – Variable (approximately 500,000 gallons per month)

Rates were not available for the period 1970 to 1980. Based on the above values, from 1981 to 2002, an average of approximately 6 million gallons of wastewater was discharged per year, approximately 1.5 times the annual average volume of rain that would fall over the 10-acre area, assuming an average of 15 inches of rain per year. Most of the wastewater discharged to the pond would have evaporated or percolated into the subsurface.

5.4.2 Historical Surface Water Conditions

As noted in Section 2, aerial photographs suggest that waste disposal associated with Halaco's operations pushed the OID farther eastward between 1965 and 1971 (Appendix B). Waste disposal to the OID is apparent in an October 11, 1969 aerial photo.

Waste disposal to the WMU is apparent in the 1971 through 1978 aerial photographs, and to the WDA (north half of waste management area) in the 1981 and 1991 aerial photographs. The photos also suggest that OID surface water periodically inundated the west half of the present-day waste management area before development of the WMU began in about 1970, and the northwest portion of the waste management area after waste disposal began. Historical breaches in the beach berm (either artificial or natural as described in Section 4) may have controlled the elevations of the OID and lagoon area developing to the south of the waste management area, as they do today.

The pond elevation at the WMU gradually increased from the initial elevation of less than 10 feet to more than 20 to 30 feet in elevation at the time waste disposal stopped in September 2002.

5.4.3 Historical Groundwater Conditions

Waste disposal affected groundwater conditions. Percolation to the subsurface from the small waste pond at the smelter parcel (October 11, 1969 photo) and the larger waste pond at the WMU would have caused water table mounding. The increased head from this mounding would have resulted in radial flow away from the pond areas, both laterally outward and vertically downward within the Semiperched Aquifer.

Visual observations performed during the 1973 SWRCB, 1980 NEIC, 1991 E&E, and 1999 RWQCB site inspections identified seeps through the dike materials surrounding the waste pond. These seeps were mostly observed at the eastern berm, but were also observed at the northern and southern berms. These seeps would have formed where the mounded water table intersected the base of the berm materials. The mounded water table elevation underneath the waste pond at the WMU is shown in the two cross-sections (A-A′, B-B′) from the 1985 site investigation (Appendix C.1).

Groundwater levels from 1981 through 2003 in MW-1 through MW-4 were relatively shallow. These wells were not surveyed and groundwater levels were recorded relative to depth from ground surface. The depths to groundwater generally ranged from ground surface to approximately 2 to 3 feet below ground surface. The shallow depths to groundwater could have resulted from mounding of the water table from the waste pond and/or inundation of surface water from the OID or ocean.

5.5 Upper Aquifer System Groundwater Levels

5.5.1 Recent Groundwater Elevations

Figure 5-19 is a hydrograph that shows the groundwater elevation data collected from the shallowest monitoring well (screened from 180 to 200 feet in the Oxnard Aquifer) at the CM-4 well cluster (CM-4-200). These data were collected with a transducer between October 19, 2007, and November 16, 2007. The hydrograph also provides OID surface water and ocean tide elevations for reference.

The CM-4-200 groundwater elevation is confined and fluctuates daily between approximately 7 and 10 feet, apparently as a pressure response to tide elevation fluctuations. The average CM-4-200 groundwater elevation is approximately equivalent to the OID surface water elevation. Water levels in the OID are at an elevation of approximately 8 to 9 feet, a relatively high level consistent with the non-breach condition of the beach berm. The CM-4-200 groundwater level would be higher than the OID elevation under breach conditions, during which the OID elevation would fall by several feet to equilibrate with the tide elevation (Figure 5-12). The neutral-to-upward gradient indicates that there is currently little or no movement of shallow groundwater underlying the Halaco Site downward from the Semiperched Aquifer, through the underlying aquitard, and into the Oxnard Aquifer of the UAS.

5.5.2 Historical Groundwater Elevations

As described in Section 4, the historical groundwater elevations in the UAS and LAS were significantly below sea level in the vicinity of the Halaco Site (Figure 4-11). This condition, which lasted until the early 1990s, would have resulted in a downward gradient and the potential for shallow groundwater underlying the Halaco Site to move downward from the Semiperched Aquifer, through the underlying aquitard, and into the Oxnard Aquifer. The intervening aquitard would, however, have impeded downward contaminant movement. It is not known whether contamination from the Halaco Site has affected this deeper groundwater.

SECTION 6

Wastewater, Surface Water, and Groundwater Chemistry

This section describes the chemistry of Halaco's wastewater, local surface water, and groundwater underlying the Halaco Site to help assess the sources, nature, and extent of surface water and groundwater contamination.

6.1 Data Sources

Site-related wastewater, surface water, and groundwater chemistry data were obtained from the following existing sources:

- Halaco Industrial WDP application data (Halaco, 1979, 2001)
- Halaco wastewater, surface water and groundwater monitoring data
  - Monitoring period 1981 through 1991 (Buena Engineers, Inc.)
  - Monitoring period 1991 through 2001 (Earth Systems Consultants)
  - Monitoring period 2001 through 2004 (Halaco or Brash Systems Consultants)
- DHS site inspection conducted on October 4, 1979 (DHS, 1979)
- EPA site inspection conducted during December 8-11, 1980 by NEIC (1981)
- EPA site inspection, conducted during September 10-13, 1991 by E&E (1992a and 1992b)
- RWQCB site inspections on August 14, 1998 and August 19, 1999 (RWQCB, 1998, 2000)
- EPA Integrated Assessment data from June 2006 (Weston Solutions, 2007)
- EPA Southeast Smelter Investigation data from June 2007 (Team 9, 2008)

In addition, groundwater EC measurements were collected on March 6, 2008.

The data and original sample location maps from the existing sources are provided in Appendix H. Original data tables are provided where practical. Data are summarized in new tables where the original data are not concisely tabulated. These data are briefly summarized below.

Halaco Industrial WDP Application Data

Wastewater samples were collected by Halaco for the 1979 and 2001 Industrial WDP applications and analyzed for selected metals and general chemistry parameters. The 1979 data also include results for ammonia and oil and grease. These data in their original form are provided in Appendix H.1.

Halaco Monitoring Data – 1981 to 2003

Liquid samples were collected and analyzed by Halaco periodically from 1981 to 2003. Surface water samples were analyzed every 2 months, wastewater discharged to the waste pond was analyzed twice per year, and groundwater samples were analyzed twice per year. Surface water samples were collected from the OID, north and south of the waste management areas. Surface water samples were also collected from the ditch south of the WMU beginning in 2001. Groundwater samples were collected from the "old" well network that was installed in 1981 and 1984 that is described in Section 5. The wastewater, surface water, and groundwater samples were analyzed for a limited set of parameters, including EC, pH, oil and grease (O&G), magnesium, and selected metals (aluminum, copper, zinc). New tables summarizing the original data for the OID surface water, old well (MW-1 through MW-4) groundwater, and wastewater samples are provided in Appendix H.2.

Halaco Monitoring Data – 2002 to 2004

Liquid samples were collected by Halaco from 2002 to 2004 from an expanded set of surface water sampling locations, and a new and expanded groundwater monitoring well network for the waste management area. Surface water samples were collected every 2 months from the OID north (SWS-4) and south (SWS-1) of the waste management area, the lagoon (SWS-2), the ditch south and southeast of the WMU (SWS-5 through SWS-7), and the ocean at the surf line (SWS-3). Groundwater samples were collected quarterly from the new well network installed in 2003 that is described in Section 5.

The surface water and groundwater samples were analyzed for an expanded set of parameters, including the following:

- General parameters: EC, pH, and total dissolved solids (TDS)
- Major anions: Sulfate and chloride
- Hardness (combined measure of calcium and magnesium)
- Metals: Aluminum, barium, chromium, copper, lead, magnesium, nickel, and zinc
- Nitrogen species: Ammonia, nitrate, and nitrite
- Radionuclides: Gross alpha and beta, thorium (228, 230, 232) and radium (226, 228)
- Organics: Volatile organic compounds (VOCs), O&G, and total petroleum hydrocarbons (TPH)

These data and sample location maps in their original form are provided in Appendix H.3. Several ocean surf line samples from 2003 have a TDS of less than 20,000 milligrams per liter (mg/L), indicating that not only seawater was collected or there was an analytical error. Surf line samples with TDS less than 20,000 from 2003 are not used in this analysis to assess seawater concentrations. Seawater should have a TDS of approximately 35,000 mg/L, consistent with the 2004 seawater sample results.

DHS Site Inspection – October 4, 1979

Liquid samples collected and analyzed by DHS in October 1979 included scrubber wastewater and wash water discharges to the WMU. Sample analysis reportedly included metals, pH, ammonia, chloride, and thorium; however, only the ammonia results were available. Except for ammonia, these data are not included in this TM.

EPA Site Inspection – December 8-11, 1980 (NEIC, 1981)

Liquid samples collected and analyzed by NEIC in December 1980 included surface water samples from the OID, scrubber wastewater and wash water discharges to the WMU, seepage and runoff from the WMU, and surface water in the NCL East area. Sample analysis included field measurements (EC, pH, and temperature), a comprehensive list of metals, and ammonia. VOCs were not analyzed. These data and a sample location map in their original form are provided in Appendix H.4.

EPA Site Inspection – September 10-13, 1991 (E&E, 1992a and 1992b)

Liquid samples collected and analyzed by E&E in September 1991 included surface samples from the OID, lagoon and NCL E area. The OID samples were collected 0.5-mile north of the site, north of the site, and south of the site. Sample analysis included a limited set of metals and ammonia. These data and a sample location map in their original form are provided in Appendix H.5.

RWQCB Site Inspections – August 14, 1998, and August 19, 1999

Liquid samples collected and analyzed by the RWQCB on August 14, 1998, and August 19, 1999, included wastewater samples, OID surface water samples, and seepage samples from the waste management area. These samples were analyzed for parameters similar to the expanded set of parameters analyzed during the routine monitoring program conducted from 2002 to 2004. The samples are unique because they were analyzed for a full set of cations and anions that allow a comprehensive characterization of the general chemistry of these samples. Samples from other investigations were not analyzed for this full set of ions. A new table summarizing the original data and the original sample location maps are provided in Appendix H.6.

EPA Integrated Assessment – June 2006

Liquid samples collected and analyzed by Weston in June 2006 for EPA included surface water and groundwater samples. Ten surface water samples were collected from the OID, approximately 0.5-mile north of the site to the lagoon south of the site. Groundwater was sampled from six of the nine monitoring wells (the shallow wells) installed in 2003 in the waste management area and the additional nine wells installed in 2006 as part of the Integrated Assessment. These samples were analyzed for an extensive suite of metals, radionuclides (cesium [137], potassium [40], and thorium [228, 230, 232]), and VOCs. These data and sample location maps in their original form are provided in Appendix H.7.

EPA Southeast Smelter Investigation – June 2007

Liquid samples collected and analyzed by Team 9 in June 2007 for EPA included nine grab borehole groundwater samples. These samples were analyzed for thorium (228, 230, and 232) and radium (226 and 228) radionuclides. The results may reflect a large amount of particle-bound thorium and radium in the samples. These data and sample location map in their original form are provided in Appendix H.8.

Groundwater Electrical Conductivity, March 6, 2008

EC was measured in each well during the March 6, 2008 water level measurement event by lowering a calibrated EC probe and taking in situ measurements at the top, mid-point, and

bottom of each well screen. The data are provided in Table 6-1, together with an indication of the beach berm condition (breached or not breached) and 2003 and 2004 EC monitoring data for surface water and groundwater.

6.2 Wastewater

This section discusses the chemistry of Halaco's wastewater discharge to the OID and waste management area, seepage from the waste management area during the period of wastewater discharge, and runoff from the smelter and waste management areas. As discussed below, Halaco's wastewater had a high pH and contained:

- High levels of salts and residual metals
- Ammonia generated as a byproduct of the metal smelting operation
- Radionuclides from magnesium-thorium alloy scrap that Halaco reports it processed for a limited period, from 1965 to about 1977
- Organic constituents as a result of waste oil and solvent that was reportedly disposed in Halaco's furnaces or rotary washers

6.2.1 Waste Discharge to the OID and Waste Management Area

Data on the chemical composition of Halaco's wastewater discharge are available from the routine monitoring performed from 1981 through 2002, the 1979 and 2001 Industrial WDP Application data, and the historical regulatory site inspection data. As discussed in Section 5, Halaco discharged wastewater to the OID from about 1965 to 1970, and to the WMU from about 1970 to 2002. Detailed information on the chemical composition of Halaco's wastewater between 1965 and 1979 is not available.

Physical Characteristics

NEIC's observations made during the 1980 site inspection indicate that much of the waste material deposited in the waste management area was "reactive, producing heat, flammable gases, and strong ammonia odors." NEIC classified the waste solids as white to gray to dark gray and observed that freshly deposited waste solids from the washer produced heat, emitted crackling sounds, and produced gases. Waste pile material felt hot to the touch (40-50° Celsius) and produced strong ammonia odors. Similarly warm, large (1- to 2-foot diameter) bubble-like formations were observed on some waste materials. Gas bubbles were observed to rise to the surface of the waste pond. Some of the solid and liquid waste samples produced flammable gas.

RWQCB observations made during the 1998 and 1999 site inspections are consistent with those made in 1980 by NEIC. RWQCB representatives noted that the wastes were grey or sometimes blue-green, observed bubbles rising through settled effluent, and smelled ammonia while on the waste pile.

General Chemistry

Halaco's wastewater had high levels of salinity (as indicated by elevated EC), high pH, and elevated levels of magnesium. Figure 6-1 summarizes the EC, pH, and magnesium data from 1981 to 2002, EC ranged up to 311,400 micromhos per centimeter (µmhos/cm),

magnesium ranged up to 62,500 mg/L, and pH ranged between approximately 8 and 10. These levels are consistent with the 1980 NEIC and 1998/99 RWQCB data. The EC and magnesium values are greater than seawater, which has a typical EC of 50,000 µmhos/cm and magnesium of 1,290 mg/L (Drever, 1988).

The wastewater chemistry reflects the flux salts used in the smelting process (potassium chloride, magnesium chloride, and sodium chloride) and may also be influenced by the source of Halaco's process water (the OID). The general chemistry is shown in Figure 6-3 for the 1998/99 RWQCB and 2001 Halaco wastewater samples and in Figure 6-4 for the 1980 NEIC, 1998/99 RWQCB, and 2001 Halaco wastewater samples, together with typical seawater general chemistry from Drever (1988). The 2001 sample is from Halaco's Industrial WDP application. The figures were prepared using the available chemistry (not all major ions were available for all samples). The samples compared in Figures 6-3 and 6-4 all have elevated levels of chloride, as does seawater. Of note, and potentially of importance in distinguishing Halaco's wastewater from seawater, are the concentrations of potassium and sulfate. Potassium was much higher and sulfate was much lower in the 1980 NEIC, 1999 RWQCB, and 2001 Halaco wastewater samples compared to seawater, on a percentage basis. The 1998 RWQCB sample was more similar to seawater. As described below, the 2004 Halaco groundwater samples nearest the waste pond have relatively high potassium and low sulfate concentrations, indicating that the 1980, 1999, and 2001 samples may be more representative of long-term conditions than the 1998 sample.

Nitrogen

Halaco's wastewater contained high levels of ammonia. The main source of ammonia is believed to be the reaction of aluminum and magnesium with atmospheric nitrogen to produce metal nitrides, which react with water to form ammonia. Wastewater and waste pond samples collected during the 1979 DHS, 1980 NEIC, 1991 E&E, and 1998/99 RWQCB inspections consistently had ammonia levels ranging from 100 to several 100 mg/L and occasionally up to near 1,000 mg/L. The high levels of ammonia are consistent with the ammonia odors noted during the site inspections.

Halaco's wastewater contained low levels of nitrate. Wastewater and waste pond samples collected during the 1979 DHS, 1980 NEIC, 1991 E&E, and 1998/99 RWQCB inspections measured nitrate levels generally at less than 5 mg/L. One exception is a nitrate concentration of 16 mg/L for the 1998 RWQCB sample. This higher nitrate concentration may reflect the unusually high nitrate concentrations that were present in the OID at the time (105 to 110 mg/L).

Metals

Halaco's wastewater contained high levels of metals. Figure 6-2 summarizes the aluminum, copper, and zinc monitoring data from 1981 to 2002. Aluminum ranged up to 20,000 mg/L, copper up to 590 mg/L, and zinc up to 426 mg/L. These values are several orders of magnitude greater than seawater, which has typical aluminum, copper, and zinc concentrations of 0.002, 0.0005, and 0.002 mg/L, respectively (Drever, 1988). Barium, beryllium, cadmium, chromium, lead, nickel, and zinc were also elevated in Halaco's wastewater, as documented by the 1980 NEIC and 1998/99 RWQCB site inspection data.

Organics

Halaco's wastewater contained measurable levels of O&G and other organic constituents. Figure 6-1 summarizes the levels of O&G from 1981 to 2002. The maximum concentration measured was 320 mg/L. When detected, O&G was typically ranged from 1 to 100 mg/L. Halaco stored and used large quantities of diesel fuel and oil in its vehicles and equipment, and used petroleum-based solvents for cleaning. Oil and solvent wastes were reportedly poured on metal before placement in the furnaces, and mixed with air pollution control equipment waste and put in Halaco's washers. Slurry from the washers was discharged to the onsite settling ponds.

Radionuclides

Halaco's wastewater may have contained elevated levels of radionuclides from magnesium-thorium alloy scrap that Halaco reports it processed from 1965 to about 1977. Radionuclide data for Halaco's wastewater are not available from this time period. The 1999 RWQCB wastewater sample was analyzed for potassium, uranium, and thorium isotopes. Uranium and thorium appear to be at background levels for this sample. The potassium-40 activity is consistent with the elevated total potassium concentration measured in the sample.

6.2.2 Wastewater Seeps from Waste Management Area

As discussed in Section 5, liquids were observed seeping from the waste management area on several occasions. The general chemistry of the seeps and levels of salts, metals, and ammonia in the seeps are similar to the wastewater discharged to the waste pond, suggesting that the seepage originated as wastewater. The general chemistry of these seeps is documented in samples collected during the 1980 NEIC and 1999 RWQCB site inspections along the eastern pond dike.

Figure 6-5 shows the similarity in the general chemistry of the 1999 RWQCB wastewater and three seep samples collected along the eastern perimeter of the waste management area. The ammonia ranged from 80.8 to 268 mg/L in the seep samples, compared to 460 mg/L in the wastewater sample. TDS ranged from 20,200 to 40,000 mg/L in the seep samples compared to 60,700 mg/L in the wastewater sample.

Wastewater seeps were also observed but apparently not sampled during the 1991 E&E and 1998 RWQCB site inspections. Most of the seeps were documented to occur along the eastern dike, but NEIC also observed seeps along the north pond dike. Seeps could have occurred along any of the dikes to the north, south, east, and west of the pond.

6.2.3 Runoff from Smelter and Waste Management Area

Historical runoff and erosion of solid waste materials from the waste management area into adjoining offsite areas was documented by observations made during the 1980 NEIC and 1998/99 RWQCB site inspections. Sampling of waste solids, soils, and sediments by EPA (Weston Solutions, 2007) and others confirm offsite solid waste materials in certain areas of NCL East, the ditch south of the WMU, and the OID.

6.3 Surface Water

This section evaluates historical data to determine whether the Site has had, or is having, an impact on surface water quality in the OID, lagoon, ditch south of the WMU, or NCL. As discussed in Section 5, the surface water in these areas is interconnected. Water levels in the OID and lagoon are high when the beach berm is intact and water spills into the NCL East area through the ditch south of the WMU. Water levels in the OID and lagoon are low when the beach berm is breached, leaving the ditches dry (or with less water) and stranding water in the NCL East. Stranded water in NCL east slowly dissipates through evaporation and percolation until the area becomes dry or is re-inundated from high water levels in the OID and lagoon. Figures 2-3 and 3-4 show the extent of surface water at the higher (berm intact) and lower (berm breached) water conditions, respectively.

Regardless of water levels, Site-related impacts on surface water quality in the OID and lagoon are difficult to identify, based on historical data. As discussed below, Site-related impacts may be masked by other sources of the same chemicals found in Halaco's wastes (e.g., seawater), variability in surface water flow rates and direction (e.g., tidal influences when the berm is breached), and variable amounts of water available for dilution of Site contaminants (more dilution when the beach berm is intact).

6.3.1 OID and Lagoon

To determine whether Halaco's operations have had an impact on surface water quality in the OID or lagoon, comparisons were made between water quality in the OID upstream (north) of the site, water quality adjacent to the site, and water quality downstream (south) of the site. Comparisons were also made between the composition of surface waters in the OID, Halaco's wastewater, and seawater. Water quality was regularly monitored at one location north of the site and one location south of the site from 1981 through 2004. Occasionally, other OID locations were sampled along the Site in between these two locations and up to 0.5 miles north of the Site.

As discussed below, the comparisons suggest but do not provide consistent evidence of a Site impact on surface water quality. The strongest evidence of a Site impact is in the O&G data. It is unclear if the impact of the Site on surface water is limited, or if a lack of ancillary information (e.g., surface water flow direction and speed) makes it difficult to distinguish between site-related and other sources of the chemical constituents found in Halaco's waste. Possible mechanisms for Site impacts on water quality in the OID and lagoon are erosion and suspension of contaminated bank or bottom sediments, and groundwater to surface water discharge.

Chemical and radiological analysis of sediments (rather than surface water) in the OID and at NCL East provide stronger evidence of a Site impact on the environment. Comparison of metals concentrations in OID and NCL East sediments to concentrations in waste materials by CH2M HILL (2008) clearly show Site impacts on sediments in these areas. These impacts are shown in the box plots for soils, sediments, and solid waste included in Appendix C of CH2M HILL (2008).

General Chemistry

Evaluation of more than 20 years of general chemistry data from 1981 through 2006 does not reveal clear or consistent evidence of a Site-related impact on surface water general chemistry. Figure 6-6 summarizes the EC levels of wastewater and the OID sample locations at the north and south boundaries of the Site from 1981 through 2004. The figure shows that the variability over time is greater than the difference in EC between the north and south locations. At times, EC is higher at the northern monitoring location. At other times, EC is higher south of the site. As discussed in Section 5, surface water in the OID flows north to south when the beach berm is intact, but may reverse direction when the berm is breached and tides are high.

Bigger influences on general chemistry in the OID and lagoon may be surface runoff from the Oxnard Industrial Drain watershed and seawater when the beach berm is breached. As shown in Figure 6-6, EC in the OID (south and north of the Site) periodically rises toward the EC of seawater, suggesting that seawater may dominate surface water chemistry when the beach berm is breached (typical seawater EC is 50,000 μg/L). Figure 6-8 shows the EC and magnesium data from 2003 and 2004 in more detail in relation to when the beach berm was breached and when seawater would have mixed with surface water in the lagoon and OID.

The pattern of EC and magnesium indicating breaching and seawater mixing for the data from 2003 and 2004 is supported by the general chemistry data over this period. Figure 6-12 shows the similarity of the lagoon and OID water to ocean water for November 24, 2004, when the berm was breached and the dissimilarity between the lagoon and OID water to ocean water for August 6, 2004, when the berm would not have been breached. Figure 6-13 shows a similar pattern for other data from 2003 and 2004.

When the beach berm is intact, EC values in the OID are lower and likely representative of surface water runoff from the Oxnard Plain. Figure 6-9 shows multiple snapshots of EC in the OID, from 0.5-mile north of the site to the mouth of the OID. The 1980 NEIC data (blue) show increasing north-to-south EC levels that begin 0.5-mile north of the Site, making the Site contribution, if any, unclear. The 1998 RWQCB data (red) show little or no north-to-south increase along the Site, and the 1999 RWQCB data (pink) show no increase.

Nitrogen

Fewer surface water samples have been analyzed for ammonia, nitrate, and other nitrogen-containing compounds. In data from three of four sampling events in which nitrogen-containing compounds were analyzed, ammonia levels in OID surface water increase as the OID flows past the site. As shown in Figure 6-9, the 1980 NEIC and 1998 RWQCB ammonia data show increasing north-to-south concentrations at three locations adjacent to the site. Both samples appear to have been collected when the beach berm was intact. The Site does not appear to be the sole cause of the increase, however, because the increase in ammonia concentration begins well upstream of the site. (A similar pattern occurs in EC, as noted above.) The 1999 RWQCB data are less clear, showing a decrease in ammonia concentration between the north site boundary and the monitoring location midway between the north and south boundary, and then a slight increase between the midway location and the monitoring location at the southern site boundary.

The ranges of ammonia and nitrate concentration in the 1980 NEIC, 1991 E&E, 1998/99 RWQCB, and 2003-04 Halaco samples are as follows:

Data Set	Ammonia	Nitrate
• 1980 NEIC	0.6 to 4 mg/L	Not analyzed
• 1991 E&E	0.037 to 0.058 mg/L	Not analyzed
• 1998 RWQCB	0.2 to 1 mg/L	105 to 110 mg/L
• 1999 RWQCB	1.1 to 1.7 mg/L	4.1 to 4.4 mg/L
• 2003-2004 Halaco	Not Detected to 0.8 mg/L	Not Detected to 16.4 mg/L

The 2003 and 2004 Halaco monitoring data were collected during conditions when the beach berm was breached and not breached. When the beach berm was breached, ammonia and nitrate were not detected or detected at relatively low concentrations. This is likely because seawater does not have significant ammonia or nitrate and would dilute the ammonia and nitrate in the lagoon and OID.

Metals

Evaluation of the more than 20 years of metals data from 1981 through 2006 suggests a possible Site impact on surface water quality in the OID; however, the data are inconsistent, and metals concentrations were frequently below reporting limits in the older data. Appendix I.1 includes figures summarizing magnesium, aluminum, copper, and zinc concentrations in wastewater and the OID sample locations at the north and south boundaries of the Site from 1981 through 2006. Detection limits were apparently lowered in 2003 and 2004, making these data more useful.

Most useful are the metals data collected during some of the non-routine sampling events. Figure 6-10 summarizes results from sampling events in 1980, 1998, 1999, 2004, and 2006, in the same format as Figure 6-9 described above. The berm appears to have been intact in all five sampling events. The data show increases in aluminum (red), copper (green), and zinc (pink) concentrations between the north site boundary and the location of the former bridge (midway between the north and south site boundaries). In most sampling events, concentrations of aluminum, copper, and zinc decreased between the former bridge and the south site boundary.

Figure 6-11 summarizes the 2006 results for arsenic and 16 metals. These data also show north-to-south increases in many of the metal concentrations in the OID between the northern boundary of the site (WS-7) and the mouth of the OID (WS-6). An increase is seen in the concentrations of aluminum, beryllium, copper, iron, and zinc. Antimony, cadmium, chromium, cobalt, lead, and silver were analyzed for but not detected, or were detected infrequently and at estimated concentrations. The concentration of manganese decreased and arsenic, barium, nickel, and vanadium did not increase significantly.

Metals concentrations in the OID and lagoon may either increase or decrease when the beach berm is breached and seawater moves inland, depending on their concentrations in seawater. Seawater concentrations of some metals were measured in 2003 and 2004, but reported concentrations varied significantly over time, raising concerns about their accuracy. Typical concentrations from the 2004 data thought to be representative of the

seawater concentrations are posted in the figures in Appendix I.1. Typical seawater concentrations for aluminum, copper, and zinc are estimated to be 0.05, 0.003, and 0.02 mg/L based on the 2004 data. These concentrations are higher than the typical concentrations for seawater by Drever (1988), which are reported to be 0.002, 0.0005, and 0.002 mg/L, respectively.

Organics

Evaluation of the more than 20 years of O&G data from 1981 through 2004 shows an apparent correlation of O&G measured in the wastewater effluent and O&G measured in OID samples collected north and south of the site from 1981 through 2002, when waste discharge to the waste management area stopped (Figure 6-7). O&G in the north and south samples were measured at concentrations similar to those in the wastewater effluent for both the north and south samples. Similar to the general chemistry data, the fluctuations in O&G concentrations in the north and south samples (and wastewater) are greater than the differences in O&G concentrations between the two samples. O&G was only detected sporadically after 2002 and at similar concentrations in the north and south samples when it was detected. The similarity of O&G concentrations of the north and south OID samples to the wastewater effluent samples and the diminished O&G detections after wastewater discharge to the waste management area ceased strongly suggest that the O&G in the OID was a Site impact.

O&G, TPH, and VOC concentrations in the OID and lagoon were mostly below reporting limits when monitored in 2003 and 2004. O&G was only detected during the January 31, 2003, and October 27, 2003, monitoring events at concentrations up to 20 mg/L. TPH and VOCs were not detected during any of the 2003 and 2004 monitoring events.

VOCs were not detected in the 2006 EPA Integrated Assessment data, except for minor detections of acetone and MTBE. Acetone was consistently detected at less than 10 µg/L in the samples north of the Site and along the Site. Acetone is a common laboratory contaminant and may be an artifact of laboratory analysis. MTBE was detected in one sample, which was located ½ mile north of the Site.

Radionuclides

Thorium was analyzed for OID surface water and/or Halaco wastewater in 1999, 2003, and 2006. In 1999, thorium activities in the OID were similar to those measured in the wastewater effluent. Th 232 and Th 228 were not detected except for Th 232 in the sample at the south boundary of the Site detected at 0.012 pCi/L. Th 230 was detected at up to 0.091 pCi/L. The 2003 monitoring data detected Th 228, Th 230, and Th 232 at up to 0.8, 2.4, and 1.1 pCi/L, respectively (except for one outlier of 121 pCi/L). In 2006, thorium was not detected in the surface water samples north of the Site or along the Site. Cesium-137 was also analyzed for but not detected. The data do not provide evidence of an impact on surface water quality.

6.3.2 Ditch South of WMU

There is strong evidence that surface water in the ditch south and southeast of the WMU has been affected by the Site.

General Chemistry

The general chemistry of the surface water in the ditch south of the WMU is intermediate between that of the OID/lagoon and Halaco's wastewater (Figure 6-12). It appears that the OID/lagoon water becomes contaminated from the solid waste materials (or contaminated groundwater rising from these materials in response to rising surface water) in the relatively small-volume ditch during times when the beach berm is not breached and water from the OID/lagoon rises into the ditch. The EC levels for the 2003 and 2004 ditch samples during the times that the beach berm was intact ranged from 13,600 to 50,000 µmhos/cm.

Nitrogen

Similar to general chemistry, the ammonia and nitrate concentrations in the surface water in the ditch are intermediate between that of the OID/lagoon and Halaco's wastewater. The detected ammonia levels for the 2003 and 2004 ditch samples ranged from 5.6 to 150 mg/L (except for one outlier of 0.3 mg/L). The detected nitrate levels ranged from 0.06 mg/L to 17 mg/L.

Metals

Similar to general chemistry, the metals concentrations in the surface water in the ditch are intermediate between that of the OID/lagoon and Halaco's wastewater. The concentrations of aluminum, barium, copper, and zinc in surface water in the ditch were higher than the concentrations in the OID/lagoon for the 2003 and 2004 monitoring data but less than the wastewater concentrations. This is consistent with the 2006 data (Figure 6-11).

Organics

O&G, TPH, and VOC concentrations in the in the surface water in the ditch were mostly not detected for the 2003 and 2004 monitoring data. O&G was only detected in one sample from the January 31, 2003 event (3.2 mg/L) and one sample from the August 5, 2003 event (7 mg/L). TPH was detected in one sample from the August 5, 2003 event (1.4 mg/L). VOCs were not detected during any of the 2003 and 2004 monitoring events, or in any of the 2006 samples.

Radionuclides

The 2003 monitoring data showed that Th 228, Th 230, and Th 232 were detected at up to 0.7, 4.5, and 0.7 pCi/L, respectively, similar to the OID/lagoon surface water samples. Cesium and thorium isotopes (Th 228, Th 230, and Th 232) were not detected in the 2006 samples, similar to the OID/lagoon surface water samples.

6.3.3 NCL North

Surface water chemistry data are not available for the NCL North area. The surface water chemistry in the small ponds north of the waste management area is expected to be similar to the surface water chemistry in the adjacent portion of the OID because of the apparent direct communication between the OID and these ponds as discussed in Section 5.

6.3.4 NCL East

NCL East surface water samples were collected during the 1980 NEIC and 1991 E&E site inspections. The ammonia and metals concentrations in the samples were elevated, suggesting that their source was wastewater seepage through the WMU berm. The areal extent of surface water appears to have been limited when the samples were collected as indicated by the historical aerial photos (1978, 1981, and 1991) and sample collection descriptions. E&E (1992a and 1992b) described most of the wetland area as dry and the collection of two water samples from seeps emanating from the eastern dike that were flowing into two pools of water within 50 feet of the eastern dike. The NEIC sample location map indicates that the single wetland sample collected in 1980 is at a location similar to the southern of the two 1991 E&E samples.

The elevated ammonia and aluminum concentrations were as follows:

Data Set	Ammonia (mg/L)	Aluminum (µg/L)
• 1980 NEIC	30	3,400
• 1991 E&E (north)	1,220	15,600
• 1991 E&E (south)	848	23,300

The conditions that apparently led to the high ammonia and metals concentrations in the 1980 NEIC and 1991 E&E samples are no longer present. The high concentrations appear to have been the result of accumulated wastewater seepage through the berm. This seepage no longer occurs because the wastewater pond and associated water table mounding that led to the seeps no longer exists.

Current surface water quality in the NCL East would be affected by overflow from the ditch south of the WMU (elevated in salts, metals, and ammonia as discussed above); water from the NCL North area (probably unaffected by the Site); dissolution and suspension of contaminated solid waste materials in NCL East; stormwater runoff from the waste management area (probably limited except after large winter storms); and runoff from areas not impacted by the Site.

6.4 Groundwater

This section discusses the impacts of Halaco's operations and waste disposal practices on groundwater quality. As discussed below, there is strong evidence that Halaco's wastes have adversely affected shallow groundwater at the Site, but the lateral and horizontal extent of the impact is not known. Section 6.4.1 discusses groundwater impacts on the eastern portion of the site (the waste management area); Section 6.4.2 discusses impacts on the western portion of the site (the smelter parcel).

As discussed in Section 5, when Halaco discharged wastewater to the WMU from about 1970 to 2002, water table "mounding" under the WMU would have resulted in groundwater flow radially outward from the historical wastewater disposal areas and vertically downward within the Semiperched Aquifer. Impacts on groundwater continue even though

wastewater discharge and mounding no longer occur and local groundwater flow directions have changed.

6.4.1 Waste Management Area

General Chemistry

The long-term monitoring data show elevated levels of salinity, high pH, and elevated levels of magnesium in wells in or adjacent to the waste management area. The EC routinely exceeded 100,000 μmhos/cm and pH occasionally exceeded 8 in old wells MW-1 through MW-4 during the time that wastewater was discharged to the waste pond (Figure 6-14). EC and pH appear to potentially decrease for some wells in response to the end of waste discharge to the pond in September 2002 (Figure 6-16).

Even after the wastewater discharge ended in 2002, EC levels remained high in 2003 and 2004 (Figure 6-16), 2006 (Figure 6-18), and March 2008 (Table 6-1). Table 6-1 provides the March 2008 EC data, the 2003 and 2004 EC data, and an indication of the beach berm condition during each sampling event. This table is organized by subarea according to salinity level. These data indicate the following:

- MW-17 and MW-18 have been, in the last 2 years, the wells most affected by Halaco's wastes as indicated by their June 2006 magnesium levels (greater than 4,000 mg/L) and March 2008 EC levels (greater than 50,000 μmhos/cm). These two wells are located in the WMU near the former wastewater ponds.
- MW-2RA, MW-2RB, MW-16, and MW-19 have similarly high EC levels (greater than 50,000 μmhos/cm in March 2008) and elevated but lower magnesium levels (greater than 500 mg/L in June 2006). These three wells are located directly east, northeast, and north of the WMU area.
- MW-5 and MW-6 also have been affected, but more variably, as indicated by their March 2008 EC levels (greater than 50,000 μmhos/cm). These two wells are located west of the WMU and next to the OID. EC levels in these wells appear to change in response to changing water level and water chemistry in the OID (Figure 6-16). The response appears greater for MW-5. For example, the EC for MW-5 increased to 27,800 μmhos/cm on February 6, 2004, when the beach berm was breached and then decreased to 11,300 μmhos/cm when the beach berm was reestablished (Table 6-1). The mechanism for these EC changes appears to be as follows:
    - Lower salinity surface water in the OID moves toward the WMU when the berm is intact and water levels are relatively high. This is consistent with the October 15 and December 3, 2007 groundwater elevation contours that show a gradient in this direction when the berm is intact (Figures 5-4 and 5-5).
    - Higher salinity groundwater affected by historical wastewater recharge from the former waste pond moves toward the OID when the berm is breached and water levels drop. Although the groundwater elevations do not indicate a westward gradient when the beach berm is breached on January 3, January 31, March 6, and April 1, 2008 (Figures 5-6 through 5-9), it is possible that groundwater flows to the

west near the OID bank but the well spacing and frequency of water level monitoring are not sufficient to show this detail.

- MW-1R, MW-3RA, and MW-3RB also have high salinity levels as indicated by their March 2008 EC levels (between 7,000 and 25,000 μmhos/cm). These three wells are located south of the WMU along the ditch. EC levels in these wells appear to be declining from November 25, 2003, through November 24, 2004. It is not clear whether this change is a short-term response to surface water conditions in the ditch or part of a longer-term decline.
- MW-S1 and MW-S2 have salinity levels similar to nearby MW-3RA and MW-3RB for the most recent sampling event in 2004. These shallow groundwater sampling points are also located south of the WMU along the ditch.
- MW-4RA and MW-4RB have the lowest salinity levels as indicated by their 2004 EC levels (less than 10,000 μmhos/cm), consistent with the March 2008 EC levels. These two wells are located north of the WDA next to the NCL North ponds. The low EC levels in these wells may be due to their distance from the former disposal pond and proximity to the NCL North ponds that recharge groundwater in this area in response to the downward vertical gradient observed at the MW-4 well cluster.

As discussed above for the wastewater general chemistry, potassium and sulfate concentrations may provide a distinct signature for Halaco's wastewater. In the August 6, 2004 sampling event (one of two sampling events in which potassium was known to have been measured in groundwater), this signature was observed most strongly in MW-2RA, MW-2RB, and MW-6, located directly to the east and west of the former waste pond (Figure 6-19). These wells have a characteristically high percentage of potassium and low percentage of sulfate similar to the 1980 NEIC, 1999 RWQCB, and 2001 Halaco wastewater samples. The high potassium is shown in Appendix I.3 the 2003 and 2004 monitoring data.

The high potassium, low sulfate signature may also be present in MW-3RA and MW-3RB, but absent in MW-5, MW-1R, MW-4RA, and MW-4RB. Mixing from precipitation, surface water in the OID and ditch, and other changes along the longer wastewater flow path would make the groundwater from these wells less reflective of Halaco's wastewater.

Nitrogen

Analysis of ammonia in groundwater also provides strong evidence that Halaco's wastes have adversely affected groundwater quality. In the most recent sampling event in 2004 (as shown in Figure 6-17), MW-2RA, MW-2RB, MW-5, MW-6 had the highest ammonia levels (100 to 1,000 mg/L); MW-S1, MW-S2, MW-1R, MW-3RA, and MW-3RB had the next highest levels (10 to 100 mg/L); and MW-4RA and MW-4RB had the lowest levels (less than 1 mg/L).

Similar to general chemistry, the wells located directly to the east and west of the former waste pond had the highest ammonia levels (MW-2RA, MW-2RB, MW-5, and MW-6) and the wells located south of the former waste pond had lower levels (MW-S1, MW-S2, MW-1R, MW-3RA, and MW-3RB). The wells located farthest to the north of the former waste pond (MW-4RA and MW-4RB) had low levels of ammonia (1 mg/L or less), similar to surface water in the OID.

Nitrate was detected at less than 4 mg/L in groundwater from wells MW-1R through MW-6 in 2003 and 2004, except in two samples from MW-5 and one from MW-6 at concentrations of 5 to 7.4 mg/L. MW-5 and MW-6 are located adjacent to the OID. The high nitrate levels may result from recharge of high nitrate water in the OID.

Metals

During the 1981 to 2002 monitoring period, there appears to be a moderately strong correlation between the levels of aluminum, copper, and zinc in groundwater for old wells MW-1 through MW-4 and the levels in wastewater (Appendix I.2). The correlation is limited in part by the numerous results below the analytical reporting limit.

In the 2003 and 2004 monitoring period, at new wells MW-1R through MW-6, aluminum, copper, and zinc were more consistently detected (Appendix I.3). Although these metals were more consistently detected, clear spatial patterns are not evident with respect to potential impacts from the former pond due to the variability of concentrations over time.

The 2006 samples were analyzed for a greater number of metals. Barium, beryllium, copper, iron, magnesium, manganese, nickel, vanadium, and zinc were consistently detected in groundwater from most or all wells (Figure 6-18). Antimony, arsenic, cadmium, chromium, cobalt, lead, and silver were detected less frequently. The highest concentrations of metals were detected at wells MW-17 and MW-18. Aluminum, copper, and zinc were detected at maximum concentrations of 2,920; 77; and 90 mg/L, respectively. MW-5, MW-6, MW-1R, and MW-4RA show the lowest metals concentrations, except for some metals in MW-2RA that are lower.

Organics

O&G was detected in groundwater at generally the same times and concentrations as in wastewater in the long-term monitoring data, providing further evidence that Halaco's wastewater discharge has adversely affected groundwater. A similar finding was made for surface water. O&G in groundwater was routinely detected at between 1 and 10 mg/L and occasionally detected at between 10 and 100 mg/L through 2001.

O&G and TPH were only sporadically detected in groundwater during the 2003 and 2004 monitoring period after discharge to the waste pond ended in 2002. O&G and TPH were not detected in the most recent 2004 monitoring event.

VOCs were not detected during the 2003 and 2004 monitoring period, except for a single detection of cis-1,2-dichloroethene, which was detected at 0.62 micrograms per liter (μg/L) after the installation of MW-4RA in March 2003.

VOCs were not detected in the 2006 EPA Integrated Assessment samples, except for the following low levels:

- Choromethane was detected at MW-6 at 2.8 μg/L
- 2-butanone was detected at between 7 and 40 μg/L in wells MW-17 through MW-19
- Benzene was detected at MW-19 at 0.68 μg/L

Radionuclides

Halaco analyzed for Th 228, Th 230, and Th 232 three to four times for each of the wells (MW-1R through MW-6) during the 2003 and 2004 monitoring period and analyzed for Ra 226 and Ra 228 three times for MW-6 and once for MW-2A during this period. The three thorium isotopes were below the reporting limit or detected at less than 1 pCi/L in most samples. When detected, Th 228, Th 230, and Th 232 were less than 4 pCi/L, except for a detection of Th 230 at 12 pCi/L at MW-3RA.

Radium isotopes were detected in the three samples analyzed from MW-6 and one sample analyzed from MW-2A. Ra 226 was detected between 13.7 and 29.2 pCi/L at MW-6 and at 1.9 pCi/L from MW-2A. Ra 228 was detected between 42 and 26.2 pCi/L at MW-6 and at 11 pCi/L at MW-2A.

In 2006, thorium, cesium 137, and potassium 40 were analyzed for at each of the groundwater monitoring wells. Cs 137 was not detected. Most of the thorium results were below the reporting limit or less than 1 pCi/L.

6.4.2 Smelter Parcel

There are five wells located on or adjacent to the smelter parcel. The five wells have been sampled once for a range of parameters (in 2006) and once for EC (in 2008). In addition, groundwater samples were collected from temporary boreholes from the southeast smelter area and analyzed for radionuclides in 2007.

General Chemistry

The general chemistry for the June 2006 and March 2008 data indicate the following:

- MW-12 has the highest salinity level as indicated by its June 2006 magnesium level (2,700 mg/L) and March 2008 EC level (109,000 μmhos/cm). This well is located in the southeast smelter area which is underlain by Halaco's waste discharged to the OID.
- MW-11 had the next highest level of magnesium (425 mg/L). The well was dry in March 2008 so there are no EC data. This well is located in the process area and may be influenced by waste in the process and southeast smelter areas.
- MW-13 has the next highest levels of magnesium (296 mg/L) and EC (19,000 μmhos/cm). This well is located at the northern area of the smelter parcel and may be influenced by historical stormwater discharge to this area.
- MW-14 and MW-15 have the lowest levels of magnesium (179 and 100 mg/L, respectively) and EC (6,600 and 9,200 μmhos/cm). These wells are located offsite at the southwest and northwest corners of the smelter parcel.

Nitrogen

Nitrogen data are not available for the smelter parcel wells.

Metals

Groundwater from the five smelter-area wells was analyzed for arsenic and 16 metals in 2006. MW-12 had the highest concentrations of barium, cobalt, and copper, in addition to

magnesium. The highest concentrations of zinc and aluminum were detected at MW-11 and MW-14.

Organics

VOCs were not detected in the 2006 samples, except for a low level of benzene that was detected at 0.74 μg/L at MW-12.

Radionuclides

Groundwater from the five smelter-area wells was analyzed for the radionuclides Cs 137, K 40, Th 228, Th 230, and Th 232 in 2006. Cs 137 was not detected in any samples, K 40 was highest in MW-12, and the thorium isotopes were detected at low levels (less than 2 pCi/L) in all cases, except for Th 228 at 105 pCi/L in MW-12. The 105 pCi/L result is questionable because the Th 232 activity in the same sample was 200 times lower. Th 228 and Th 232 activities should be similar.

Thorium and radium data are also available from 2007 grab borehole samples.

SECTION 7

Preliminary Conclusions

This section provides preliminary conclusions about the sources of contamination, types of contamination, surface water and groundwater as contaminant transport pathways, and the extent of surface water and groundwater contamination at the Halaco Site.

7.1 Sources of Contamination

The source of contamination at the site is Halaco's smelting operation conducted from 1965 through 2004. In its smelting operation, Halaco melted scrap metals in natural-gas-fired rotary furnaces, and then cast the molten metal into various shapes and sizes. The process generated large amounts of "process waste" consisting of residual metal, dirt, and "fluxes" added to improve the recovery of the targeted metals. Additional wastes were generated by Halaco's air pollution control system, and the storage, use, and disposal of fuel, oil, and solvents. (See Appendix A for a more complete description of Halaco's operations.)

The smelter parcel and waste management areas are past and possibly continuing sources of contamination to surface water and groundwater. From about 1965 to 1970, Halaco directly discharged its process waste to the OID, and used some of the waste solids as fill in the southeast portion of the smelter parcel. After about 1970, Halaco disposed of its process waste in the waste management area. The buried wastes at the smelter parcel and the massive waste pile in the waste management area may be continuing sources of contamination to surface water and groundwater. Another possible continuing source of contamination in the smelter area is spilled or leaked diesel fuel, oil, and solvents.

The northern portion of the smelter parcel includes an administration building, parking area, and undeveloped area. These areas are not known to be significant sources of contamination.

7.2 Types of Contaminants

The primary contaminants in Halaco's wastes are chloride salts, metals, thorium, thorium decay products, and ammonia. Metals found in the waste include aluminum, barium, beryllium, cadmium, chromium, copper, lead, magnesium, manganese, nickel, and zinc.

The fuels, oils, and solvents reportedly disposed at the site included a variety of petroleum hydrocarbons. They may have contained VOCs, but VOCs have been detected only sporadically at the site at low levels. Limited or no data are available for other organic compounds, such as semi-volatile organic compounds, PCBs, dioxins, and furans.

7.3 Hydrologic Conditions

The Halaco Site is located on the Southern Oxnard Plain along the Pacific Ocean. Although the area is relatively flat, local topography is an important factor in surface water and shallow groundwater flow.

7.3.1 Historical Waste Discharge

The discharge and management of wastewater and waste solids have altered surface water and groundwater flow at the Site in several ways. First, waste solids used as fill at the southeast corner of the smelter parcel appear to have pushed the OID channel to the east. Second, the disposal of Halaco's wastes in a disposal pond at the waste management area created a massive waste pile in an area that historically served as a wetland area. Finally, downward percolation of liquids from the waste pond would have locally increased groundwater levels. This "mounding" of groundwater would have resulted in radial flow away from the pond areas, both laterally outward and vertically downward within the Semiperched Aquifer. This flow historically caused seeps to form at the base of the dikes containing the pond.

7.3.2 Surface Water

Surface water features near the Site are the Hueneme Drain and J Street Drain to the west of the Site and the OID, which bisects the Site. These features drain into a lagoon between the Site and the ocean. Areas of standing water can occur in NCL to the north and east of the Site as a result of flow from the OID.

The lagoon, OID, and ponds in the NCL North area are interconnected and their surface water elevations rise and fall together. The lagoon, OID, and NCL North water levels are relatively high and stable when the beach berm separating the lagoon from the ocean is intact. The lagoon, OID, and NCL North water levels drop several feet when the beach berm breaches in response to increased precipitation and flow in the OID, J Street, and Hueneme Drains. Water levels in these areas rise and fall with the ocean tides when the beach berm is breached.

Surface water from the lagoon, OID, and NCL North areas can flow into the NCL East area when the berm is intact and surface water levels are high enough to overcome one or both of the topographic divides separating the NCL East area from the lagoon, OID, and NCL North areas. Surface water from the NCL East area dissipates slowly by percolation and evaporation when the surface water levels in the lagoon, OID, and NCL North areas are below the topographic divides separating these areas from the NCL East area.

7.3.3 Groundwater

Groundwater beneath the Site occurs in the Semiperched Aquifer and the deeper aquifers that make up the underlying regional groundwater system. The Semiperched and deeper aquifers are separated by an aquitard. The shallowest groundwater at the site is in the Semiperched Aquifer, which occurs to a depth of approximately 50 to 100 feet. The regional aquifer system, which begins below the aquitard separating the Semiperched and regional aquifers occurs to a depth of more than 1,000 feet. Groundwater in the Semiperched Aquifer is generally of poor quality and is little used, if at all, as a source of water supply. The

regional aquifer system contains good quality groundwater and is an important regional source of water supply, except in coastal areas of saline intrusion due to historical overdraft conditions. The Oxnard Aquifer, the shallowest aquifer in the regional aquifer system, is affected by saline intrusion near the Halaco Site.

Semiperched Aquifer

Water levels and hydraulic gradients within the shallow portion of the Semiperched Aquifer at the Halaco Site are influenced by surface water elevations in the lagoon, OID, NCL East, and NCL North areas. The 2003 through 2008 water level data indicate that the higher surface water elevations in the lagoon to the south of the site relative to lower groundwater elevations to the north of the Site (at or below sea level) cause an overall northward gradient across the Halaco Site. There is also an east-to-west component of the gradient whose magnitude is influenced by surface water elevations in the lagoon, OID, NCL East, and NCL North.

The cause of the lower groundwater elevations to the north of the Site is not known, but may be infiltration of groundwater into the City of Oxnard's sanitary sewer collection system. Sewer collection trunk lines run west along McWane Blvd. at the north edge of the Halaco site and in Perkins Road northwest of the Site before discharging to the City's wastewater collection headworks facility.

Groundwater gradients do not appear to be significantly influenced by ocean tides when the beach berm is intact and the lagoon elevation is high. The effect of tides on groundwater gradients when the beach berm is breached has not been measured.

Regional Aquifer System

From about the mid-1900s, groundwater elevations in the regional aquifer system were below sea level across the Oxnard Plain, including the area of the Halaco Site. These depressed water levels would have created a downward gradient from the Semiperched Aquifer to the underlying Oxnard Aquifer.

Recent data from CM-4-200, the closest groundwater monitoring well to the Halaco Site that extends to the Oxnard Aquifer, show a neutral-to-upward gradient from the Oxnard Aquifer to the Semiperched Aquifer. The groundwater elevation in the Oxnard Aquifer has been above sea level since the early 1990s in response to the regional groundwater supply pumping cutbacks and other water management strategies implemented across the Oxnard Plain.

7.4 Nature and Extent of Contamination

7.4.1 Surface Water

Surface waters evaluated for contamination include the lagoon and OID, the small wetland drainage area (ditch) immediately to the south of the WMU, and the area of standing water in the NCL East. Although they are not discussed in this report, the sediments associated with these surface water bodies are also contaminated.

OID and Lagoon

Four processes have likely contributed to contamination of surface water in the lagoon and OID: direct discharge of waste materials from 1965 to 1970, stormwater runoff from 1965 to present, erosion and suspension of contaminated bank sediments, and groundwater to surface water discharge when groundwater elevations near the drainages were higher than surface water elevations. The latter source (groundwater to surface water discharge) may have become insignificant when wastewater discharge to the WMU (and the resultant mounding of groundwater) ended in about 2002.

There is some evidence that Halaco's wastes have affected surface water quality, particularly sampling results for ammonia and O&G. However, Halaco's impact on surface water is difficult to distinguish from two other sources of many of the same chemical constituents: (1) runoff from the Oxnard Plain that drains into the Hueneme Drain, J Street Drain, and OID and (2) ocean seawater that enters the lagoon when the beach berm breaches. Seawater mixing with non-ocean surface water in the lagoon and OID during periodic beach berm breaches affects water chemistry in the lagoon and OID. This mixing is dependent on the duration of the berm breach and can result in water quality in the lagoon and OID to the northern portion of the Halaco Site that resembles seawater.

Wetland Area (Ditch) to South of WMU

Surface water (and sediment) in the small wetland drainage area (ditch) immediately to the south of the WMU is affected by contaminants from Halaco's waste disposal activities.

NCL East

Surface water (and sediment) in the NCL East area appears to have been affected by Halaco's waste disposal activities. Stormwater runoff and historical seeps caused by high groundwater levels under the former waste pond likely contributed to contamination of surface water in this area, when it was present. Groundwater discharge to surface water in the NCL East area does not appear to be a current transport mechanism because groundwater elevations are (1) below land surface elevations in the NCL East area when the beach berm has been breached and groundwater elevations are relatively low or (2) below surface water elevations in the NCL East area when the beach berm is intact and groundwater elevations are higher.

7.4.2 Groundwater

There is strong evidence that Halaco's wastes have adversely affected shallow groundwater at the Site, but the horizontal and vertical extent of the impact is not known. When Halaco discharged wastewater to the WMU from about 1970 to 2002, water table "mounding" under the WMU would have resulted in groundwater flowing radially outward from the historical wastewater disposal areas and vertically downward within the Semiperched Aquifer. Impacts on groundwater continue even though wastewater discharge and mounding no longer occur and local groundwater flow directions changed after wastewater discharges ended in 2002.

Semiperched Aquifer

Groundwater in the Semiperched Aquifer (including fill materials) has been affected by historical activities at the Halaco Site. Groundwater contamination occurs at least to the depth of the current groundwater monitoring system. The current groundwater monitoring system is screened to a maximum depth of approximately -10 feet elevation on the smelter parcel and -20 feet elevation on the waste management area. The vertical extent of contamination below these depths and the horizontal extent of contamination beyond the existing monitoring well network are not known.

Regional Aquifer System

Groundwater in the regional aquifer system may have been affected by activities at the Halaco Site. Historical groundwater elevations in the UAS and LAS were below sea level, which would have provided a downward gradient from the Semiperched Aquifer to the underlying Oxnard Aquifer, the shallowest aquifer within the UAS. Although the downward gradient indicates the potential for impact on the underlying Oxnard Aquifer, and the extent of contaminant movement through the intervening aquitard, if any, is unknown.

Groundwater elevations in the Oxnard Aquifer have been above sea level, resulting in neutral-to-upward groundwater gradients, since the early 1990s. This upward gradient would eliminate the potential for shallow groundwater underlying the Halaco Site to move downward through the underlying aquitard into the Oxnard Aquifer.

SECTION 8

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Tables

Table 3-1
Monitoring Well Construction
Halaco Site, Oxnard, California

Location	Well	Well Log Construction Information							Survey Information						Revised Well Construction Information (based on total depth measurement on 3-6-08)					
									2007 SAGE Survey (1988 NAVD)											
		Date Installed	Surface Comp-letion (S/F)	Total Depth (feet, BTOC)	Total Depth (feet, bgs)	Top of Screen (feet, bgs)	Screen Length (feet)	Well Diameter (inches)	Inner TOC Elevation (feet, 1988 NAVD)	Outer TOC Elevation (feet, 1988 NAVD)	Ground Surface Elevation (feet, 1988 NAVD)	Calcu-lated Inner TOC Stickup (feet, ags)	2003 Padre Associates Survey TOC Elevation (feet, NGVD 1929)	Difference in TOC between 2003 and 2007 Surveys (feeet)	Field Measured Total Depth (feet, BTOC)	Calculated Total Depth (feet, bgs)	Calculated Top of Screen Elevation (feet, 1988 NAVD)	Calculated Bottom of Screen Elevation (feet, 1988 NAVD)	Calculated Total Depth minus Well Log Total Depth (feet)	Comment
Wells Installed by Padre Associates (2003)																				
1	MW-1R	11/6/03	S	19.94	17.5	12.5	5	2	10.46	10.93	8.16	2.30	7.87	2.59	20.00	17.70	-4.34	-9.34	0.20	-
2	MW-2RA	11/6/03	S	11.79	9	4	5	2	10.01	10.56	7.91	2.10	7.44	2.57	11.92	9.82	3.91	-1.09	0.82	-
	MW-2RB	11/6/03	S	29.87	27	17	10	2	9.81	10.64	7.91	1.90	7.25	2.56	30.00	28.10	-9.09	-19.09	1.10	-
3	MW-3RA	11/5/03	S	10.11	8	3	5	2	9.93	10.95	8.22	1.71	7.34	2.59	11.19	9.48	5.22	0.22	1.48	-
	MW-3RB	11/5/03	S	21.79	20	15	5	2	10.00	10.84	8.09	1.91	7.4	2.60	22.41	20.50	-6.91	-11.91	0.50	-
4	MW-4RA	2/20/03	S	19.75	18.5	3.5	15	2	10.51	11.76	9.56	0.95	8.75	1.76	20.22	19.27	6.06	-8.94	0.77	-
	MW-4RB	2/20/03	S	31.27	30	20	10	2	11.29	11.29	9.52	1.77	9.23	2.06	31.32	29.55	-10.48	-20.48	-0.45	-
5	MW-5	2/20/03	S	22.07	20	10	10	2	20.20	20.43	18.76	1.44	17.8	2.40	22.23	20.79	8.76	-1.24	0.79	-
6	MW-6	2/20/03	S	20.02	18.5	3.5	15	2	16.14	16.32	14.87	1.27	13.54	2.60	19.72	18.45	11.37	-3.63	-0.05	-
Wells Installed by Weston Solutions (2007)																				
11	MW-11	6/19/06	F	n/a	12	2	10	3/4	13.57	13.82	13.69	-0.12	n/a	n/a	7.32	7.44	11.69	1.69	-4.56	Potential material in well
12	MW-12	6/19/06	S	n/a	13	3	10	3/4	14.81	16.33	14.15	0.66	n/a	n/a	12.72	12.06	12.09	2.09	-0.94	-
13	MW-13	6/19/06	F	n/a	13	3	10	3/4	9.85	10.06	9.86	-0.01	n/a	n/a	10.53	10.54	6.86	-3.14	-2.46	Potential material in well
14	MW-14	6/21/06	F	n/a	12	2	10	3/4	7.91	8.17	7.86	0.05	n/a	n/a	10.84	10.79	5.86	-4.14	-1.21	-
15	MW-15	6/21/06	F	n/a	16	6	10	3/4	8.25	8.42	8.39	-0.14	n/a	n/a	15.63	15.77	2.39	-7.61	-0.23	-
16	MW-16	6/20/06	F	n/a	17	4	13	3/4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Wellhead submerged
17	MW-17	6/22/06	S	n/a	26	16	10	3/4	45.82	47.00	42.49	3.33	n/a	n/a	45.74	42.41	10.08	0.08	16.41	Wellheads raised (+) or
18	MW-18	6/26/06	S	n/a	33	23	10	3/4	45.83	45.87	41.81	4.02	n/a	n/a	48.91	44.89	6.92	-3.08	11.89	lowered (-) during EPA
19	MW-19	6/21/06	F	n/a	25	15	10	3/4	17.37	17.73	17.64	-0.27	n/a	n/a	17.65	17.92	9.72	-0.28	-7.08	wastepile regrading

Notes:

n/a = Not available
ags = Above ground surface
bgs = Below ground surface
S = Stickup well completion (above ground monument)
F = Flush mount well completion (below ground vault)
TOC = Top of casing
BTOC = Below top of casing

Table 5-1
Monthly Water Level Elevation Data
October 2007 through September 2008
Halaco Site, Oxnard, California

Date	Groundwater																	Surface Water		
	MW-1R	MW-2RA (north)	MW-2RB (south)	MW-3RA (west)	MW-3RB (east)	MW-4RA (west)	MW-4RB (east)	MW-5	MW-6	MW-11	MW-12	MW-13	MW-14	MW-15	MW-17	MW-18	MW-19	NCL-E	NCL-N	OID (8' mark)
MPE (feet, NAVD 1988)	10.46	10.01	9.81	9.93	10.00	10.51	11.29	20.20	16.14	13.57	14.81	9.85	7.91	8.25	45.82	45.83	17.37	na	na	9.52
Depth to Water (feet below measuring point)																				
10/15/2007	2.82	4.00	3.55	1.40	2.12	2.59	5.52	11.66	8.95	6.22	7.86	3.47	0.52	8.14	39.50	41.56	12.60	nm	nm	nm
12/3/2007	2.95	2.71	3.53	1.76	2.30	3.33	6.04	12.03	8.88	6.32	7.73	3.40	0.80	nm	39.22	40.20	12.20	direct	direct	1.35
1/3/2008	4.61	3.15	5.08	3.64	4.32	7.92	8.79	14.84	11.03	3.11	7.02	3.68	1.92	9.05	36.94	41.42	12.11	direct	dry	3.97
1/31/2008	5.13	3.04	4.93	3.42	4.63	5.92	7.09	15.57	12.01	7.31	8.44	3.76	2.61	7.84	41.04	41.77	13.15	direct	dry	4.42
3/6/2008	4.74	3.04	4.84	3.98	4.23	7.08	7.92	14.81	10.80	dry	9.04	4.05	2.81	9.23	40.89	41.33	13.21	direct	dry	3.48
4/1/2008	4.11	4.52	4.59	3.03	3.48	6.44	7.47	13.32	10.85	dry	7.53	4.26	2.04	9.28	40.65	41.57	13.84	direct	dry	2.34
5/2/2008	3.39	3.42	3.91	2.05	2.57	5.71	7.08	12.39	9.52	6.83	8.11	3.87	1.62	8.82	38.42	40.67	12.62	direct	direct	1.61
6/2/2008	3.04	2.78	3.85	2.00	2.44	4.93	6.62	12.48	9.42	6.45	7.99	3.52	1.36	8.62	39.23	39.56	12.84	direct	direct	1.50
7/3/2008	2.99	2.72	3.59	1.67	2.34	3.32	6.04	12.20	9.63	6.51	7.65	3.28	1.12	8.48	39.65	40.38	12.25	direct	direct	0.25
8/4/2008	2.91	2.65	3.46	1.63	2.29	3.21	5.82	11.97	9.23	6.25	7.34	3.40	0.78	8.34	40.02	40.83	12.31	direct	direct	0.22
9/2/2008	2.94	2.74	3.68	1.72	2.30	5.08	6.54	12.27	9.33	6.34	7.93	3.55	0.91	8.65	39.38	40.41	12.28	direct	direct	1.63
Water Level Elevation (feet, NAVD 1988)																				
10/15/2007	7.64	6.01	6.26	8.53	7.88	7.92	5.77	8.54	7.19	7.35	6.95	6.38	7.39	0.11	6.32	4.27	4.77	nm	nm	8.57(1)
12/3/2007	7.51	7.30	6.28	8.17	7.70	7.18	5.25	8.17	7.26	7.25	7.08	6.45	7.11	-0.23(1)	6.60	5.63	5.17	7.88	7.89	8.17
1/3/2008	5.85	6.86	4.73	6.29	5.68	2.59	2.50	5.36	5.11	10.46	7.79	6.17	5.99	-0.80	8.88	4.41	5.26	7.50	dry	5.55
1/31/2008	5.33	6.97	4.88	6.51	5.37	4.59	4.20	4.63	4.13	6.26	6.37	6.09	5.30	0.41	4.78	4.06	4.22	7.62	dry	5.10
3/6/2008	5.72	6.97	4.97	5.95	5.77	3.43	3.37	5.39	5.34	dry	5.77	5.80	5.10	-0.98	4.93	4.50	4.16	7.38	dry	6.04
4/1/2008	6.35	5.49	5.22	6.90	6.52	4.07	3.82	6.88	5.29	dry	7.28	5.59	5.87	-1.03	5.17	4.26	3.53	6.80	dry	7.18
5/2/2008	7.07	6.59	5.90	7.88	7.43	4.80	4.21	7.81	6.62	6.83	6.70	5.98	6.29	-0.57	7.40	5.16	4.75	7.25	7.80	7.91
6/2/2008	7.42	7.23	5.96	7.93	7.56	5.58	4.67	7.72	6.72	6.45	6.82	6.33	6.55	-0.37	6.59	6.27	4.53	7.59	7.89	8.02
7/3/2008	7.47	7.29	6.22	8.26	7.66	7.19	5.25	8.00	6.51	6.51	7.16	6.57	6.79	-0.23	6.17	5.45	5.12	8.60	8.82	9.27
8/4/2008	7.55	7.36	6.35	8.30	7.71	7.30	5.47	8.23	6.91	6.25	7.47	6.45	7.13	-0.09	5.80	5.00	5.06	8.65	8.24	9.30
9/2/2008	7.52	7.27	6.13	8.21	7.70	5.43	4.75	7.93	6.81	6.34	6.88	6.30	7.00	-0.40	6.44	5.42	5.09	7.75	7.85	7.89

Notes:

MPE = Measuring point elevation
- Groundwater: Top of PVC well casing, north side.
- Surface Water:
  - OID: "8-foot" mark on staff gauge.
  - NCL-E and NCL-N: Staff gauges are set to directly read elevation.

na = Not applicable
nm = Not measured
direct = Direct read from staff gauge
(1) = Elevation back-calculated from transducer data.

Table 5-2
Daily Precipitation, Station 32A (Oxnard Civic Center)
2007/2008 Water Year (inches)
Halaco Site, Oxnard, California

Early Season		Storm Event 1		Storm Event 2		Storm Event 3		Storm Event 4		Late Season	
10/12/07	0.21	12/17/07	0.3	1/4/08	1.32	1/22/08	0.12	2/20/08	0.16	4/3/08	0.01
10/13/07	0.03	12/18/07	1.13	1/5/08	0.04	1/23/08	1.25	2/21/08	0.02	4/4/08	0.05
10/17/07	0.01	12/19/07	0.09	1/6/08	0.59	1/24/08	1.68	2/22/08	0.33		
11/11/07	0.02	12/20/07	0.1	1/7/08	0.03	1/25/08	0.45	2/24/08	0.78		
11/12/07	0.01			1/10/08	0.01	1/27/08	0.75				
11/21/07	0.01					1/28/08	0.58				
11/22/07	0.01					1/29/08	0.01				
11/30/07	0.1										
12/1/07	0.01										
12/6/07	0.01										
12/7/07	0.07										
Total	**0.49**	**Total**	**1.62**	**Total**	**1.99**	**Total**	**4.84**	**Total**	**1.29**	**Total**	**0.06**

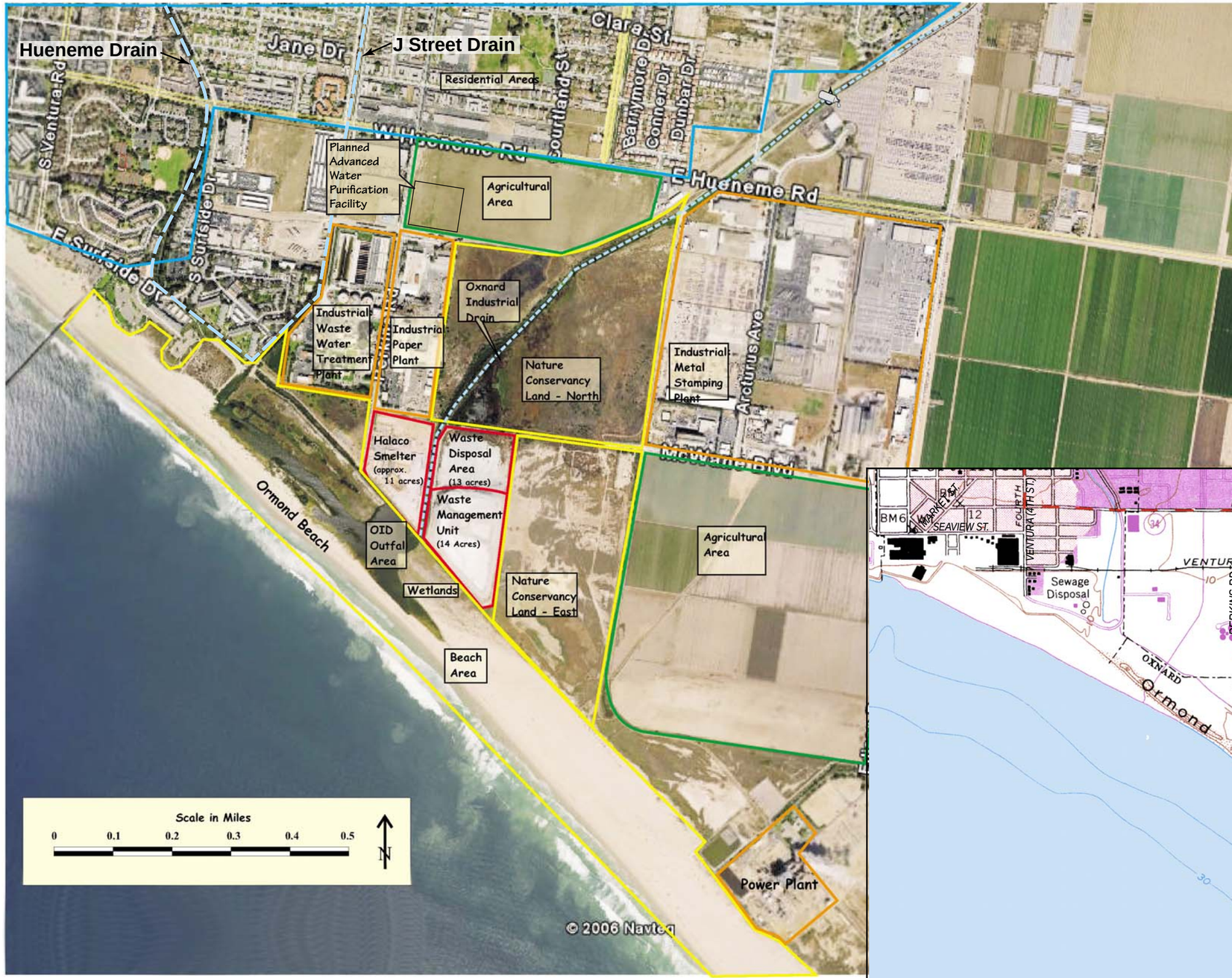
Table 6-1
Electrical Conductivity of Surface Water and Groundwater
Post Onsite Discharge Monitoring
(umhos/cm)
Halaco Site, Oxnard, California

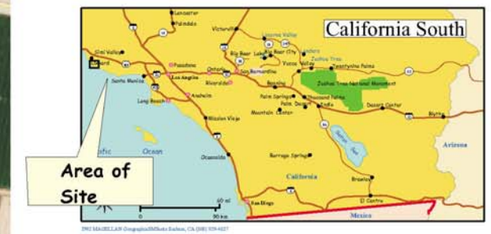
				EPA Data	Halaco Monitoring Data				
Media	**Area**	**Subarea**	**Location**	**3/6/2008 (Breach)**	**11/25/03 (Breach)**	**2/6/04 (Breach)**	**4/30/04 (Non-breach)**	**8/6/04 (Non-breach)**	**11/24/04 (Breach)**
Surface Water	Surface Water	OID North	SWS-4	nm	67,000	37,900	5,450	3,930	24,100
		OID South	SWS-1	nm	70,500	42,000	3,480	4,200	25,800
		Lagoon	SWS-2	nm	nm	nm	5,850	5,040	48,100
		WMU Ditch	SWS-5 (west)	nm	nm	nm	15,800	14,200	nm
			SWS-7 (middle)	nm	nm	nm	nm	13,800	nm
			SWS-6 (east)	nm	nm	nm	nm	13,600	nm
		Ocean	SWS-3	nm	nm	53,500	47,900	41,100	45,600
Groundwater	Waste Management Area	WMU	MW-17	56,000					
			MW-18	62,000					
		East, Northeast and North of WMU	MW-2RA	91,000	124,000	94,600	81,200	75,600	86,700
			MW-2RB	73,000	98,000	74,400	65,200	57,200	66,800
			MW-16	Submerged					
			MW-19	62,000					
		West of WMU	MW-5	61,000	21,800	27,800	11,100	12,300	26,000
			MW-6	61,000	71,500	81,700	88,600	63,500	72,500
		South of WMU	MW-1R	25,000	86,000	63,800	56,300	30,000	22,400
			MW-3RA	7,000	32,000	21,200	16,200	15,600	11,900
			MW-3RB	11,000	60,000	34,300	23,600	12,100	12,700
			MW-S1	nm	5,630	9,200	8,810	7,460	13,100
			MW-S2	nm	15,600	17,200	16,700	14,100	13,500
		North of WDA	MW-4RA	4,400	3,410	5,510	3,890	9,090	6,360
			MW-4RB	13,000	9,930	6,200	7,690	10,100	6,850
	Smelter Parcel	Process	MW-11	Dry					
		Southeast	MW-12	109,000					
		North	MW-13	19,000					
	Offsite	Southwest	MW-14	6,600					
		Northwest	MW-15	9,200					

Notes:

nm = Not measured
Breach = Beach berm is breached
Non-breach = Beach berm is not breached
= Monitoring well not yet installed

Figures





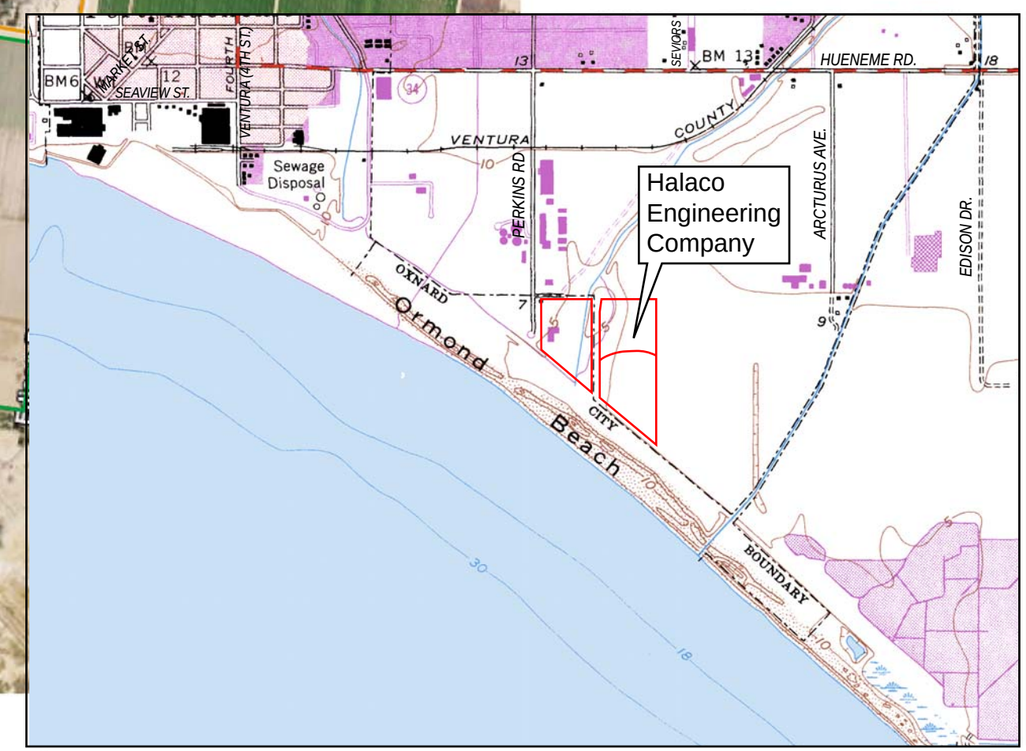


FIGURE 2-1
Site Location and Areas
Halaco Site, Oxnard, California

Source: Modified from Figure 2-1, Integrated Assessment Report (Weston, 2007)

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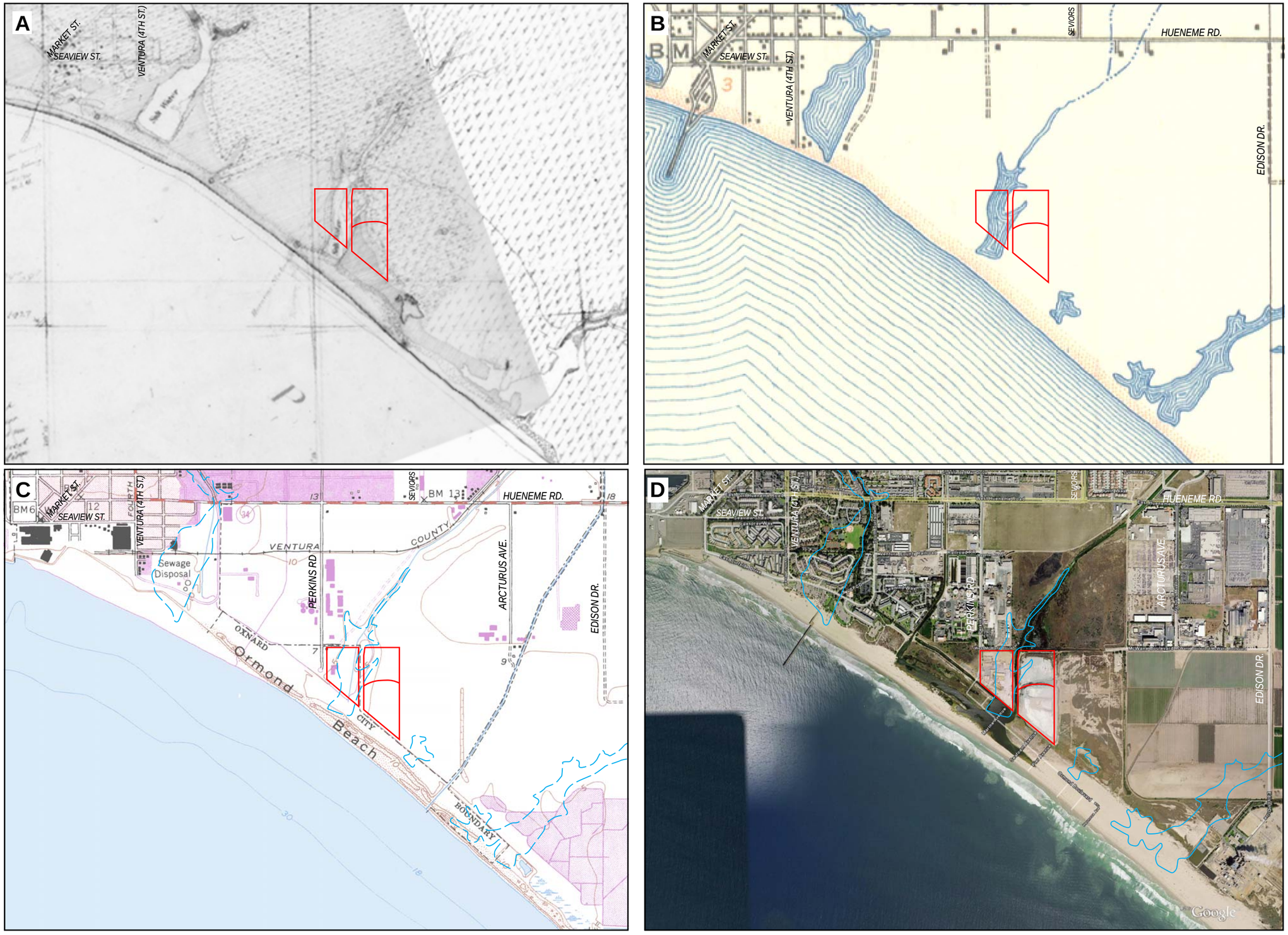
WB082007003SCO358156.DE.01 Halaco_sitelocareas2.ai 4/08



Legend:

Surface Water features identified in 1850's Coastal Survey (A) and 1904 USGS Topographic Map (B)

Halaco Site

A. US Coast Survey. River Santa Clara southward to Hueneme (1855) and Hueneme eastward to Point Mugu (1857).

B. US Geological Survey. Hueneme 15 minute Quadrangle (1904, Reprinted 1947). Annotated by CH2M HILL, 2007.

C. US Geological Survey. Oxnard 7.5 minute Quadrangle (1949). Photo revised (1967). Annotated by CH2M HILL, 2007.

D. Google Earth (2007). Aerial Image. Annotated by CH2M HILL, 2007.

FIGURE 2-2
Historical U.S. Coastal and Geological Survey Topographic Maps
Halaco Site, Oxnard, California

FIGURE 2-3
Aerial Photograph before EPA Removal Action - February 2007
Halaco Site, Oxnard, California

FIGURE 2-4
Aerial Photograph after
EPA Removal Action - April 2007
Halaco Site, Oxnard, California

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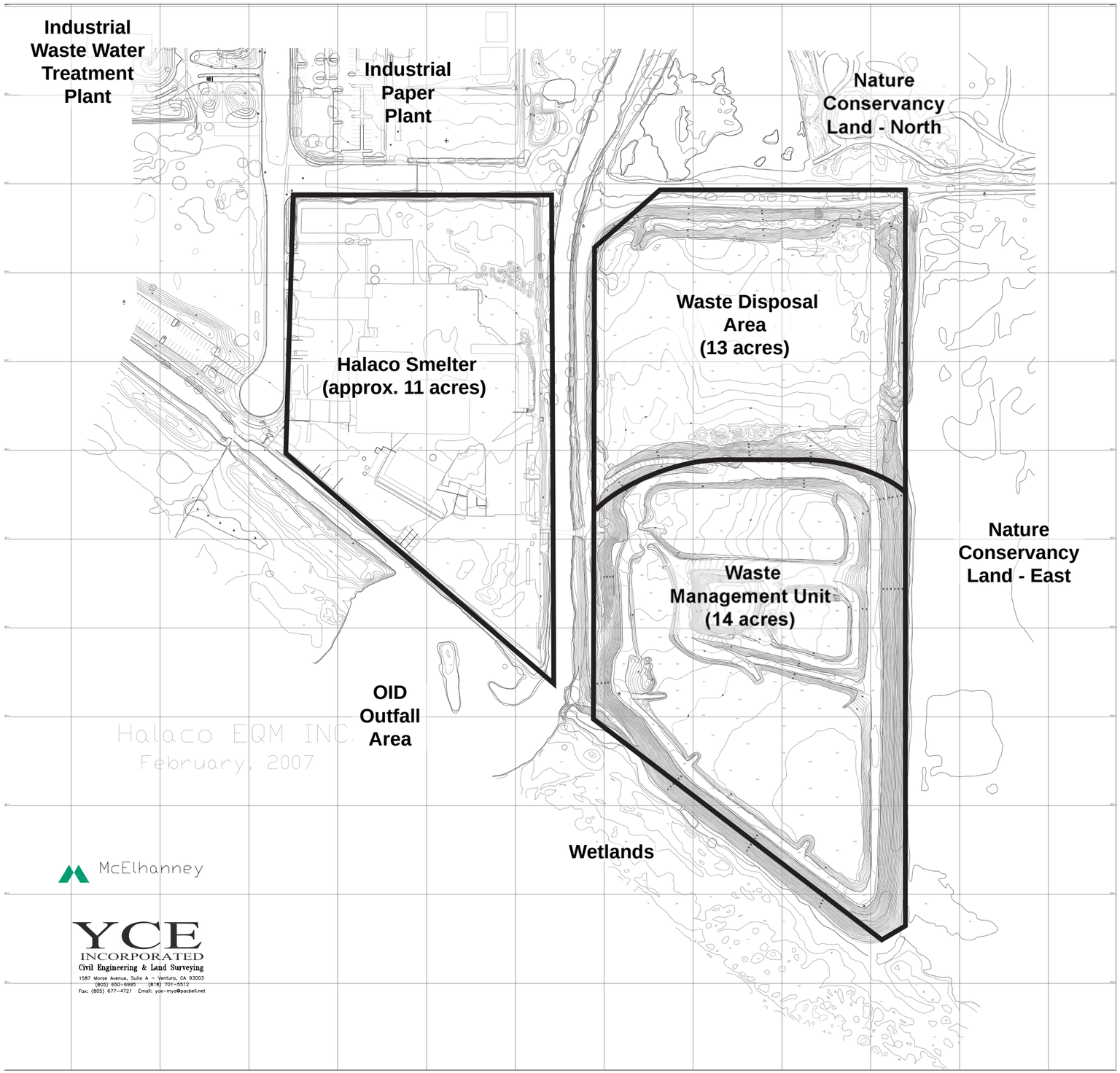

Contour interval = 1 foot

FIGURE 2-5
Topographic Map before EPA Removal Action - February 2007
Halaco Site, Oxnard, California

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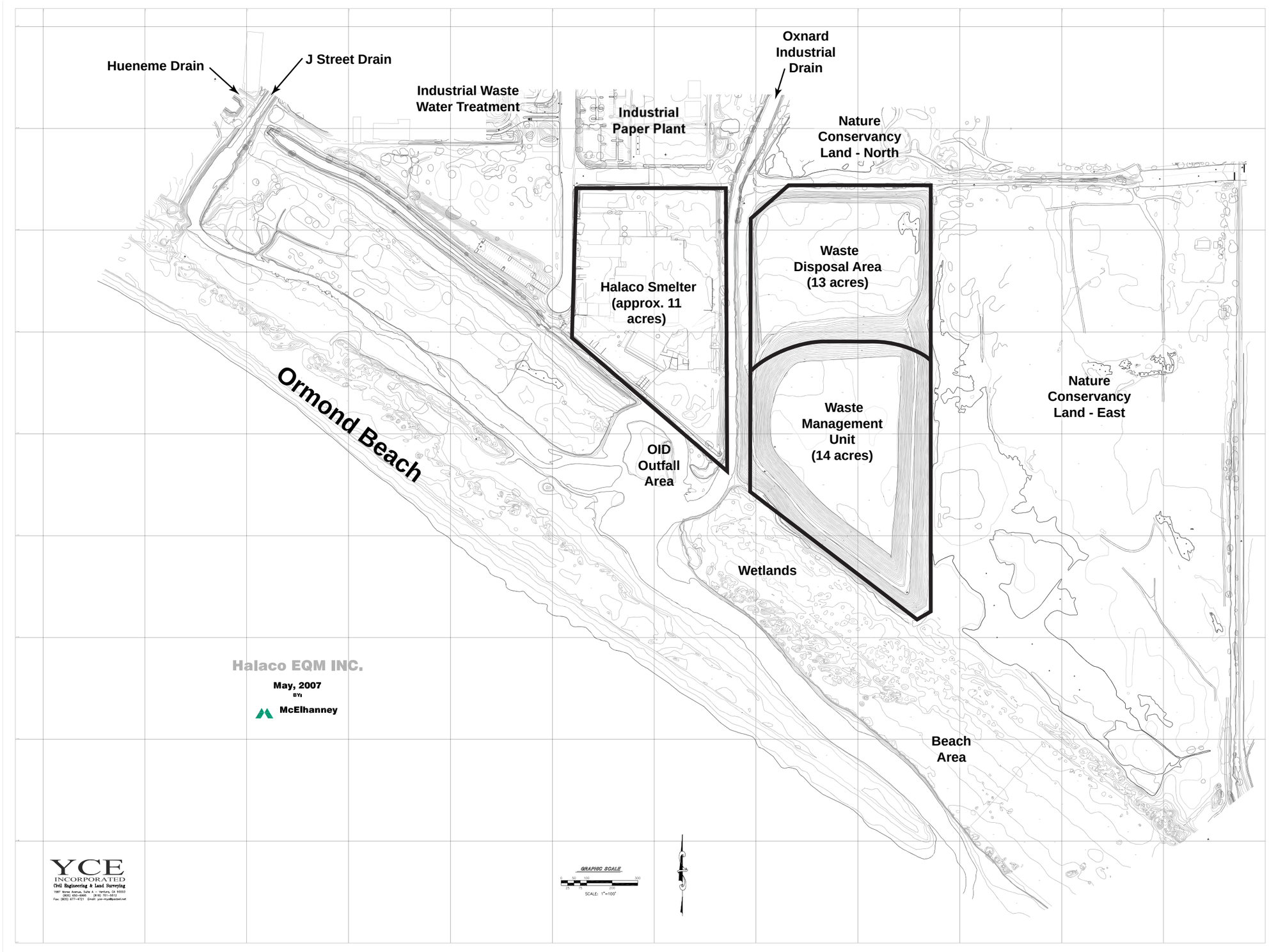
WB082007003SCO358156.DE.01 Halaco_topobefore2.ai 4/08



Contour interval = 1 foot

FIGURE 2-6
Topographic Map after EPA Removal Action - May 2007
Halaco Site, Oxnard, California

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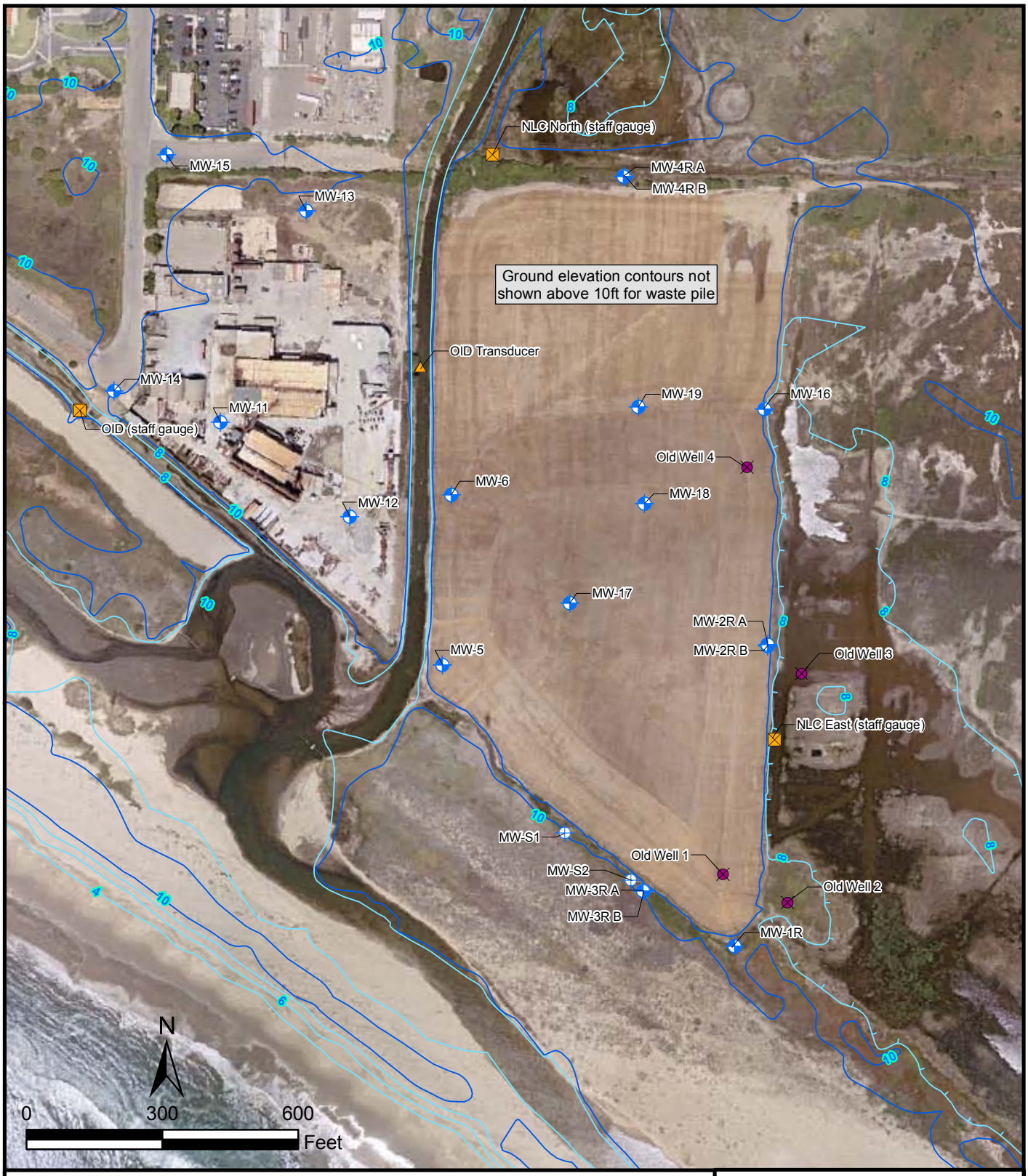


LEGEND

- Surface Water Pressure Transducer
- Surface Water Gauging Station
- Groundwater Monitoring Well
- Shallow Groundwater Sampling Locations
- Former Monitoring Well (destroyed)

Ground Elevation Contours (AMEC, 2006)

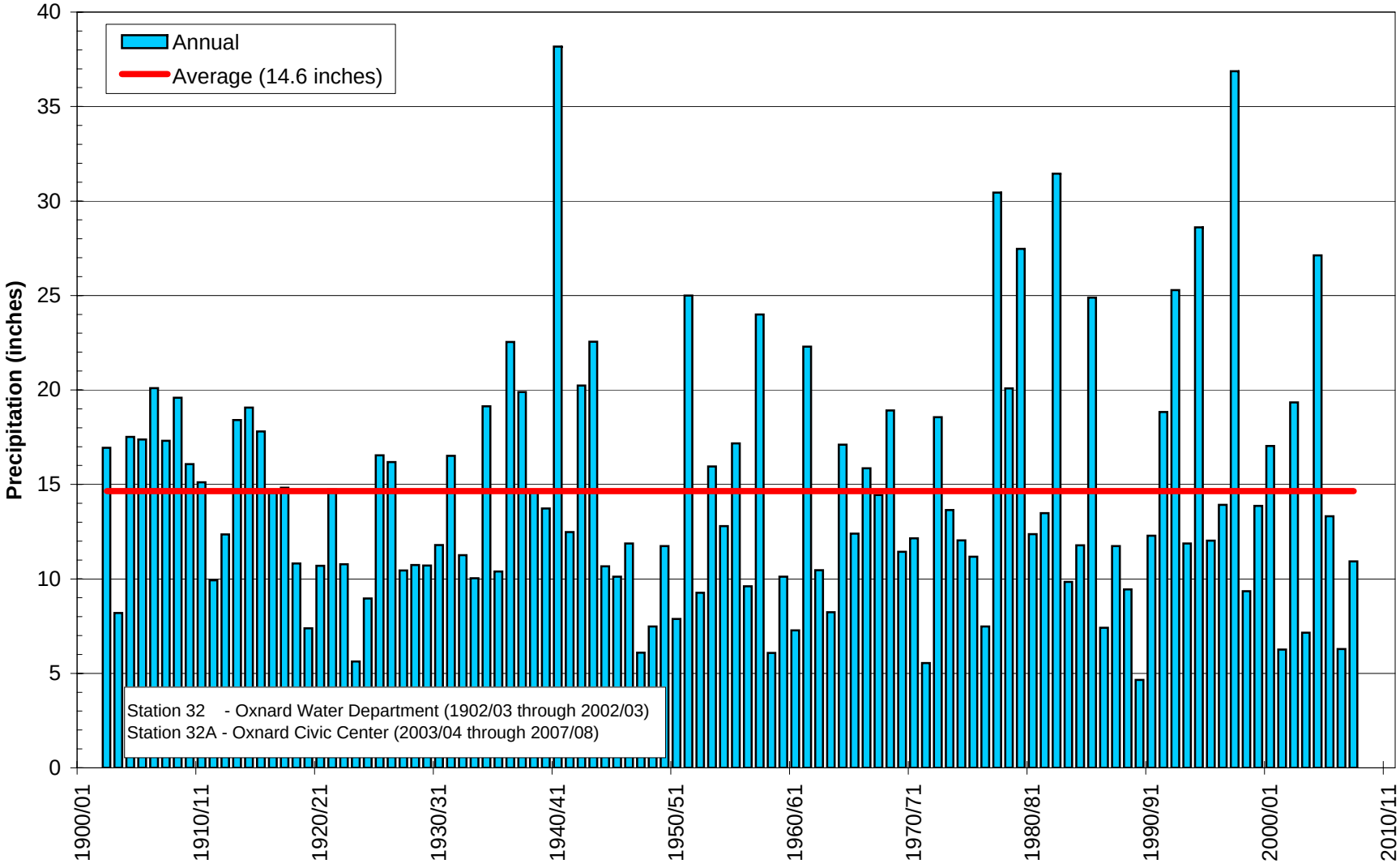
- 2-foot Contours
- 10-foot Contours

Aerial Source: YCE Incorporated April 12, 2007.
Datum: ft MSL NAVD 1988.

Figure 3-1
Halaco Groundwater Monitoring Well Locations

HALACO SITE
OXNARD, CALIFORNIA

Figure 4-1
Annual Precipitation
Stations 32 and 32A



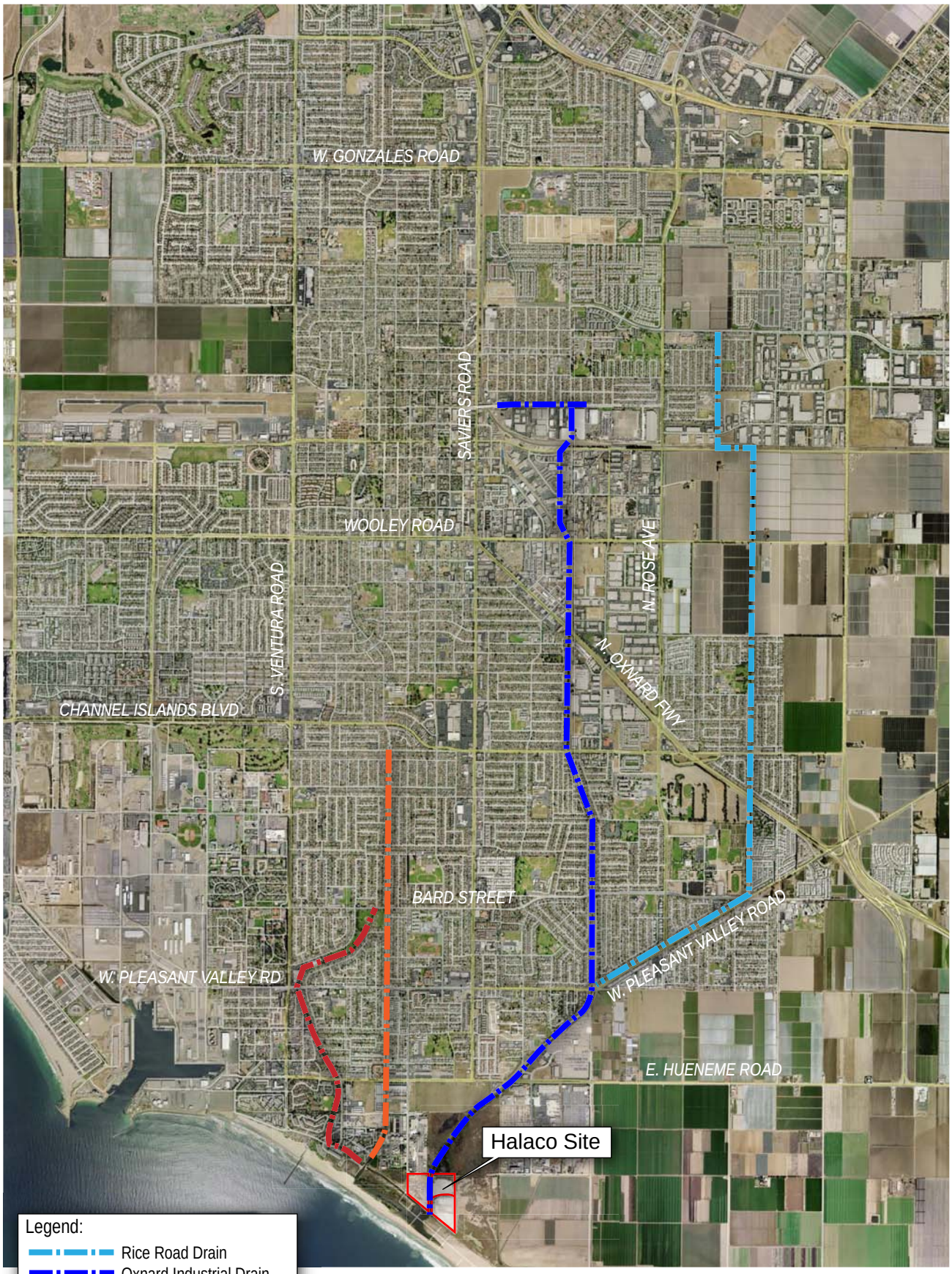


FIGURE 4-2
Surface Water Drainages
Halaco Site, Oxnard, California

Aerial image © Google Earth, 2008. Annotation by CH2M HILL, 2008.

WB082007003SCO358156.DE.01 Halaco_drainages.ai 4/08

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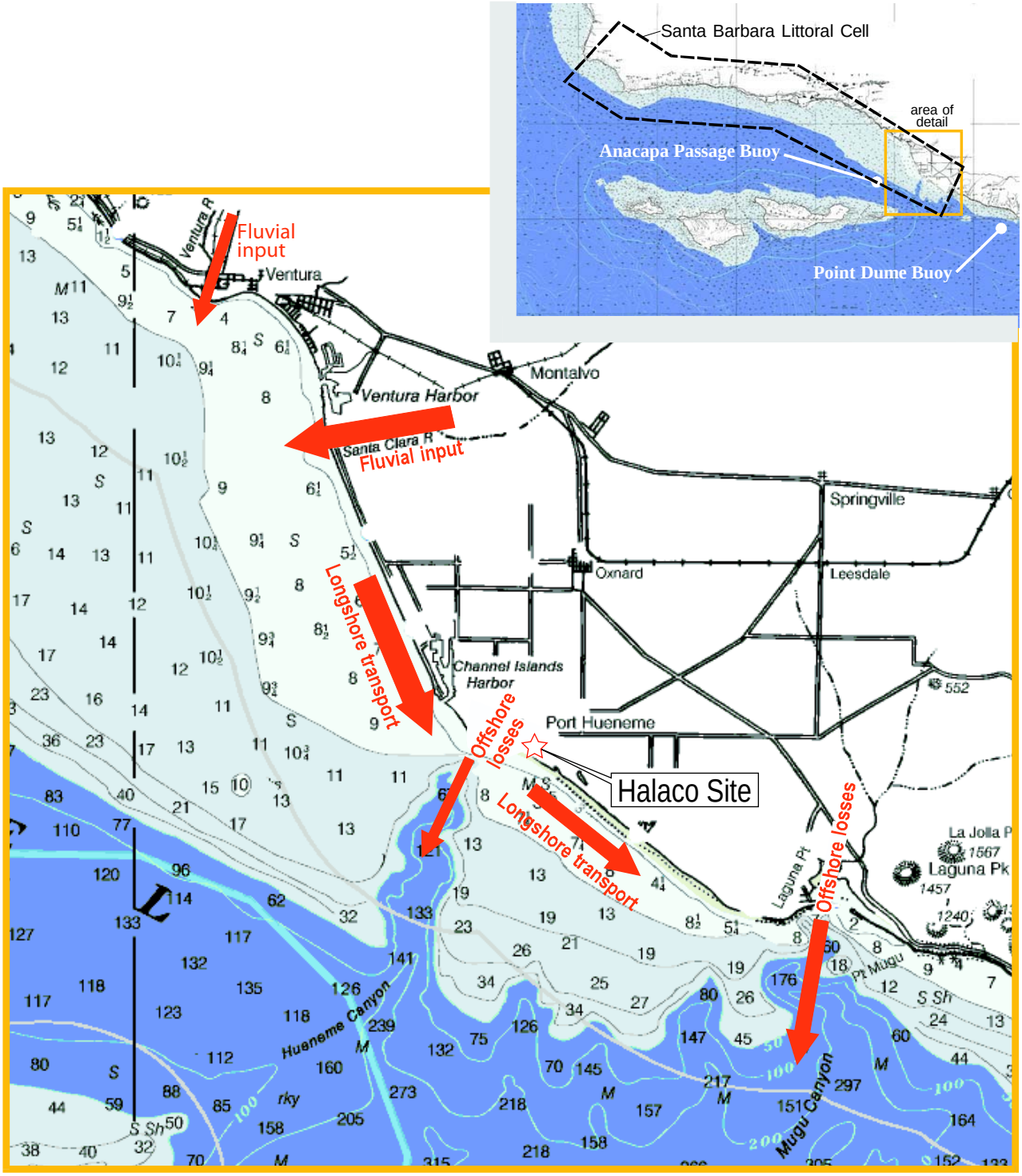
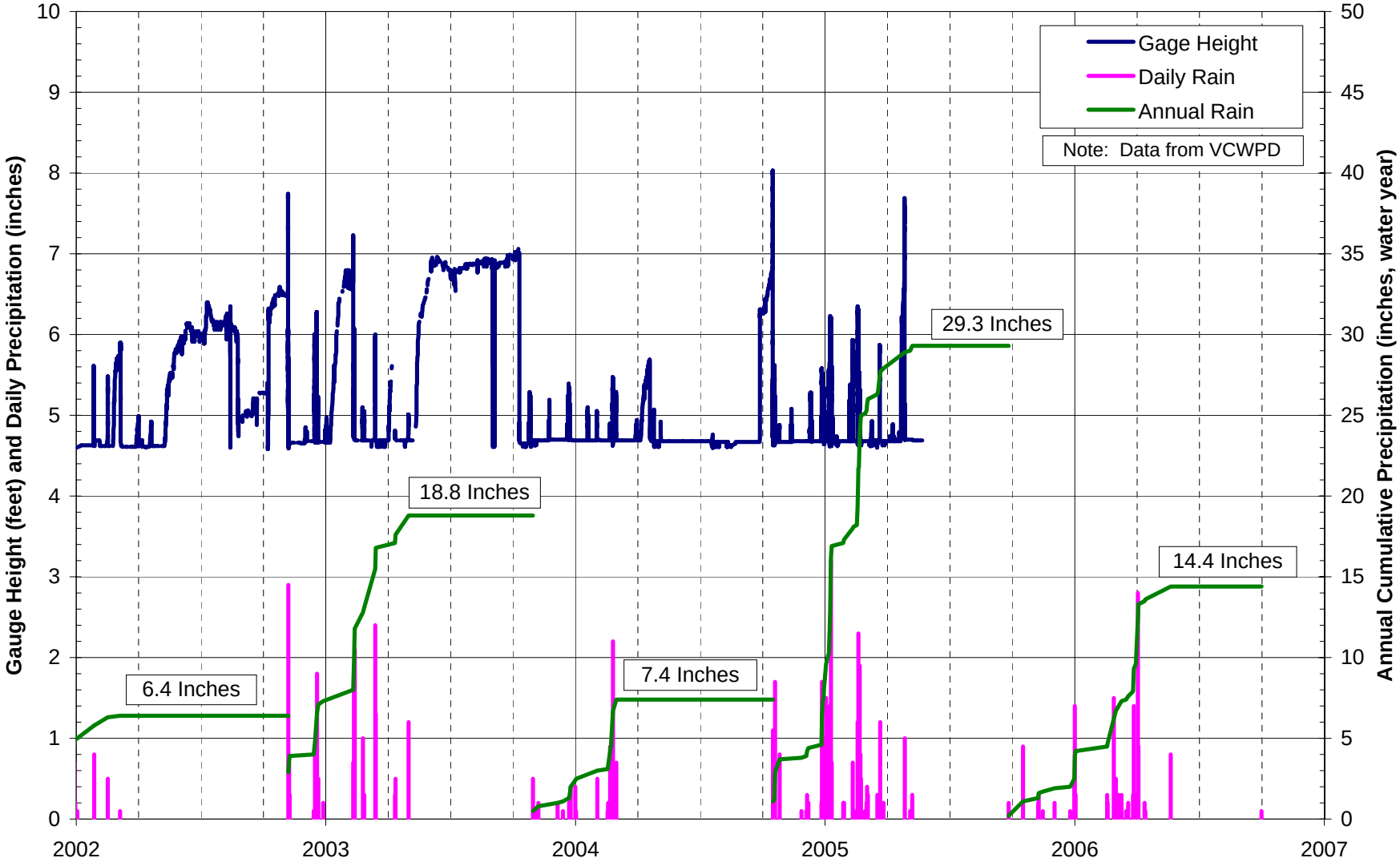
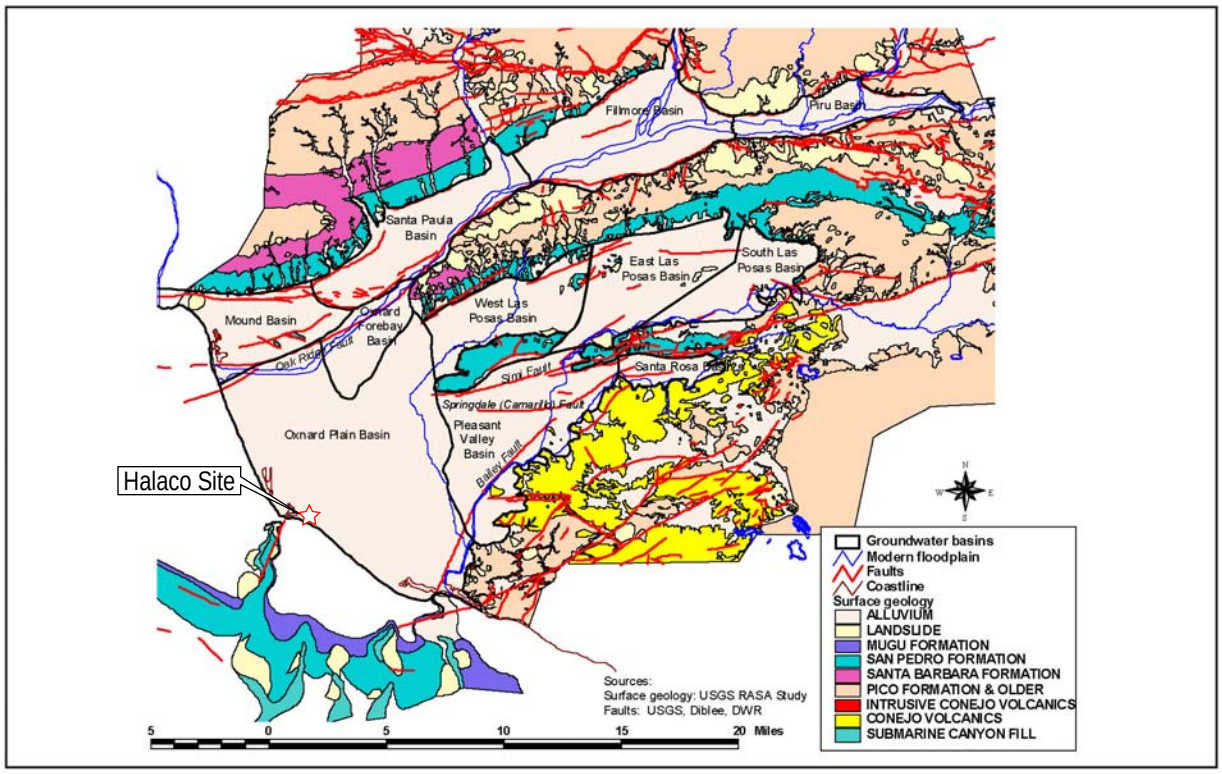


FIGURE 4-3
Ocean Current and Sediment Transport Directions
Halaco Site, Oxnard, California

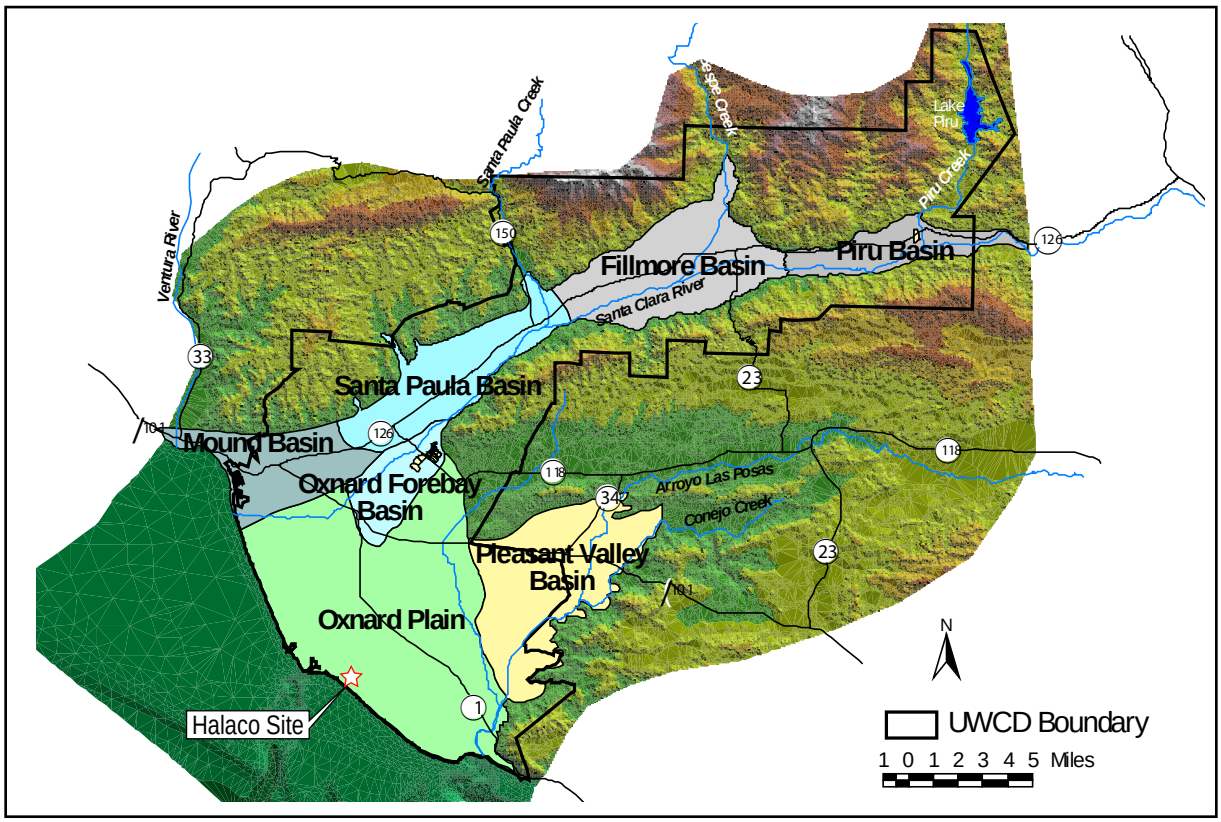
Source: PWA, 2007.

Figure 4-4
Surface Water Elevation Hydrograph
J Street Gauge 793 ALERT Site





(a) Surface Geology



(a) Groundwater Basins

FIGURE 4-5
Geology and
Groundwater Basins
Halaco Site, Oxnard, California

Source: UWCD, 2004

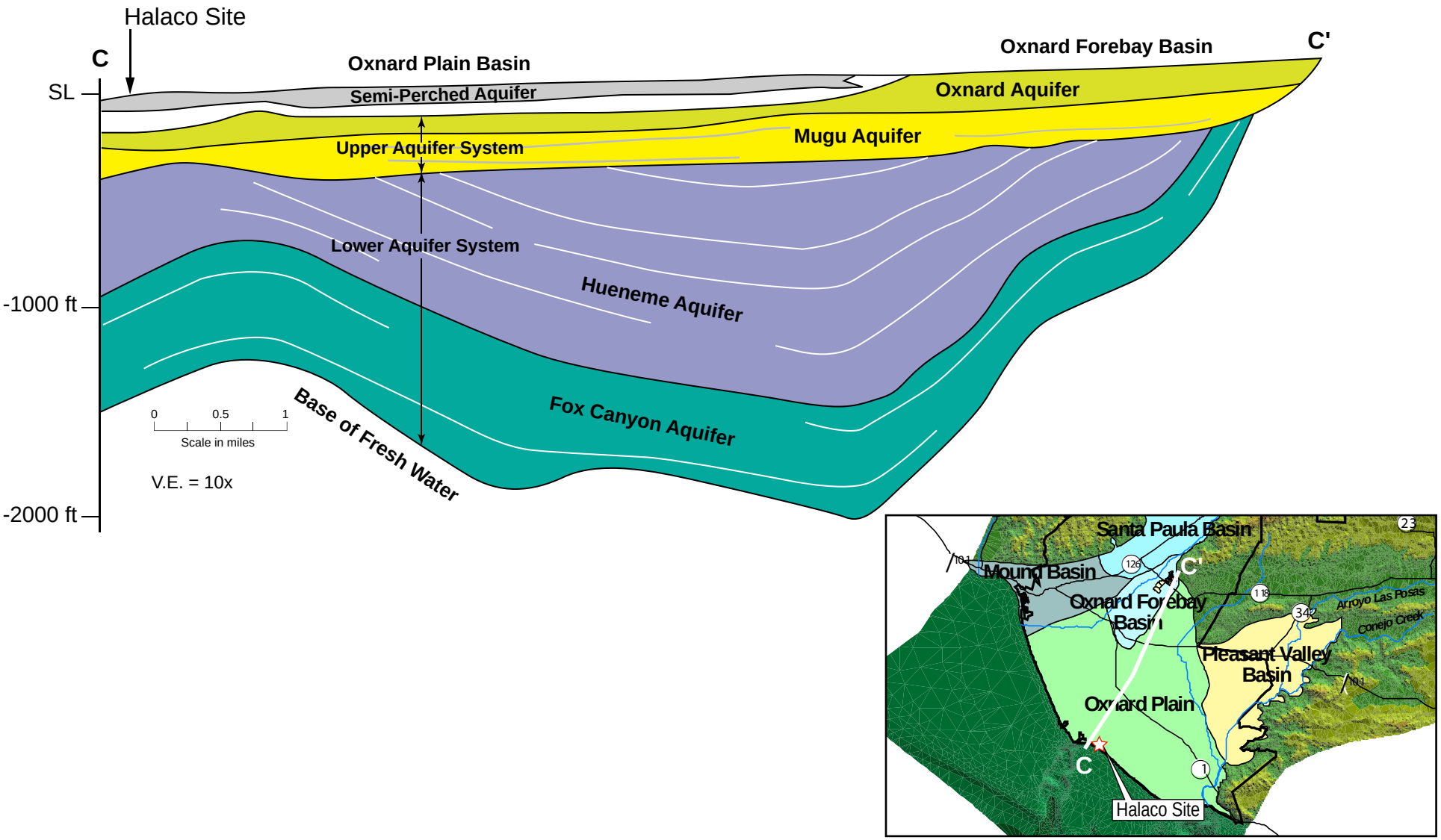


FIGURE 4-6
Geologic Cross Section
Halaco Site, Oxnard, California

Source: Modified from Mukae and Turner, 1975

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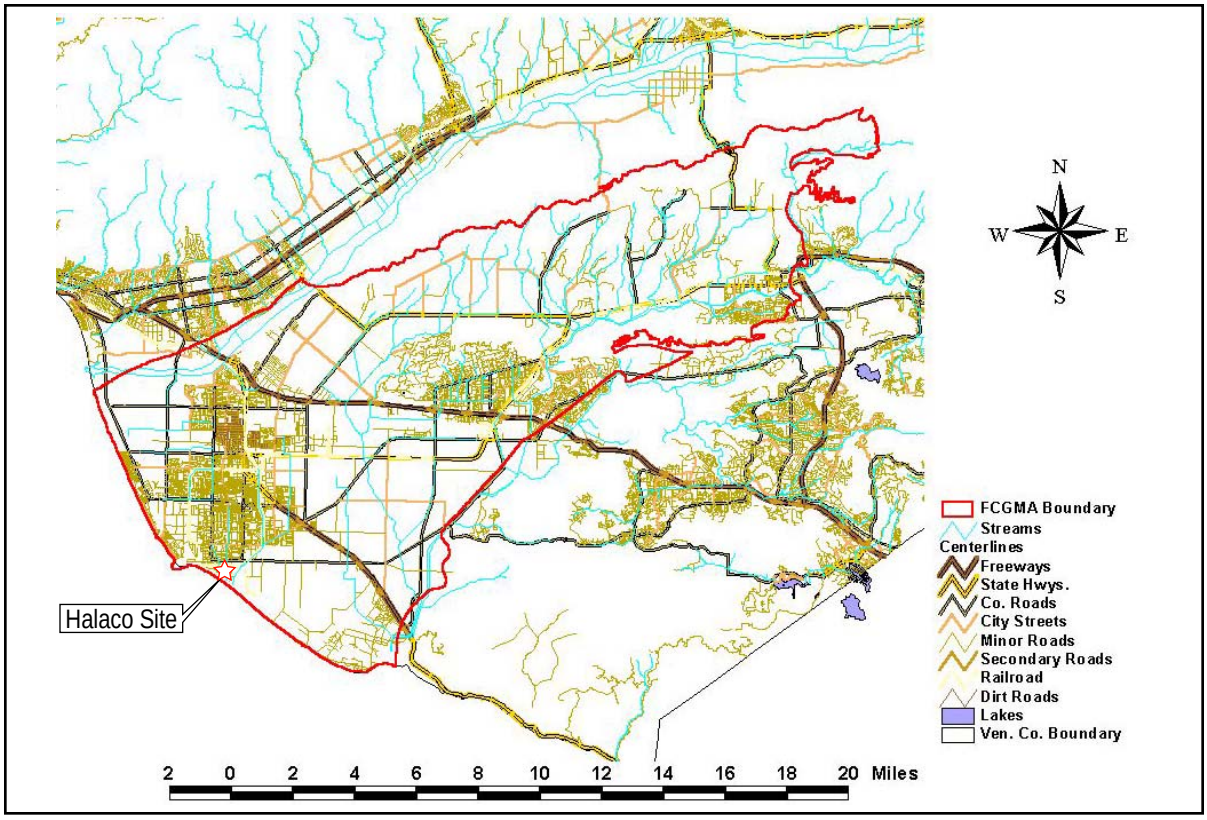
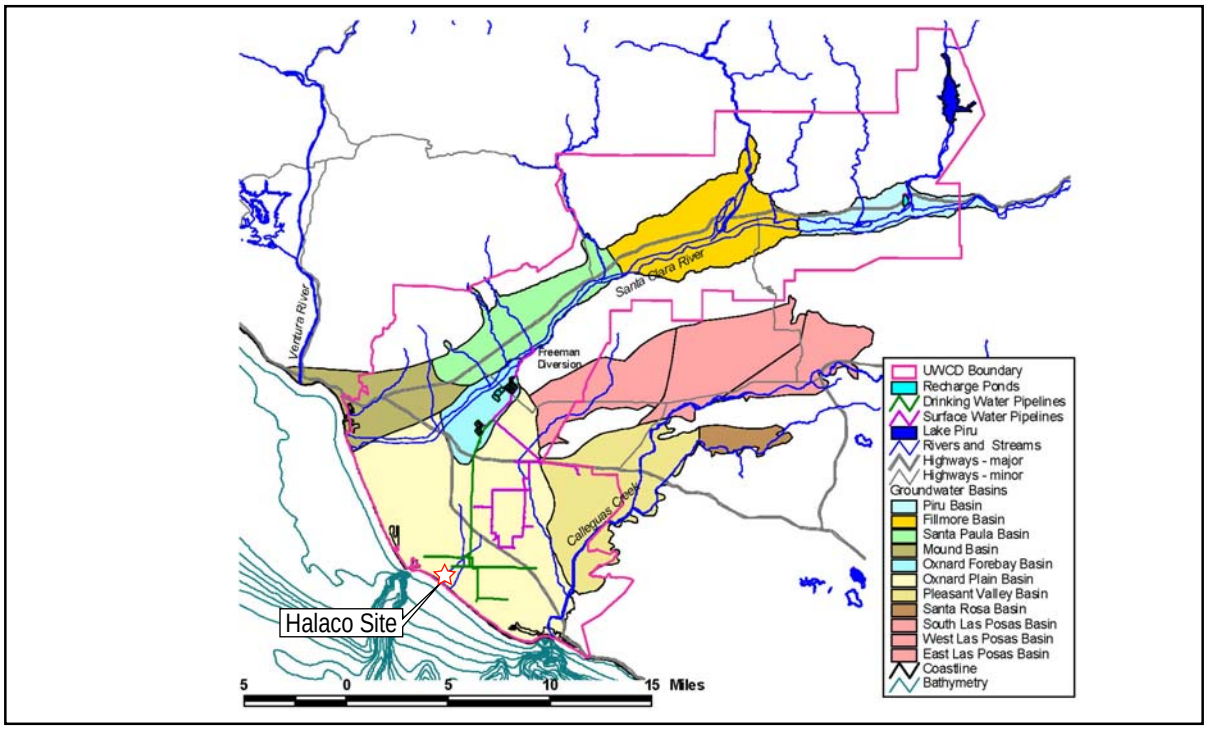
WB082007003SCO358156.DE.01 Halaco_crosssection.ai 4/08

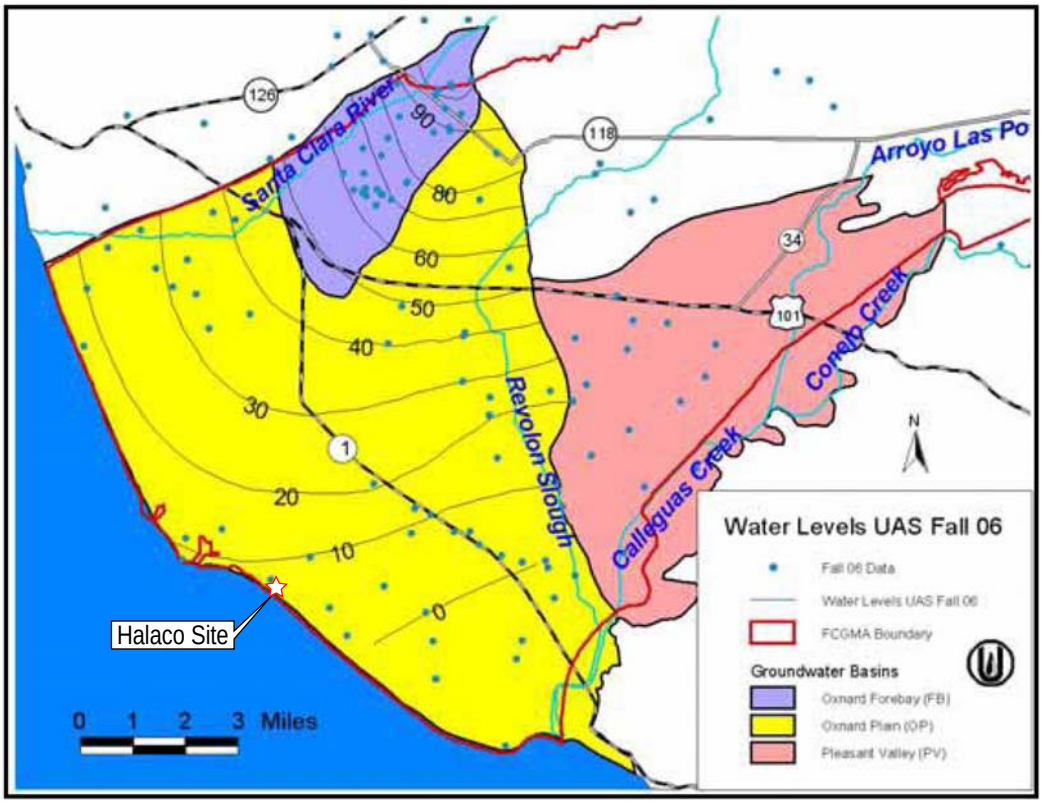


(a) Fox Canyon Groundwater Management Agency (Source: FCGMA website)

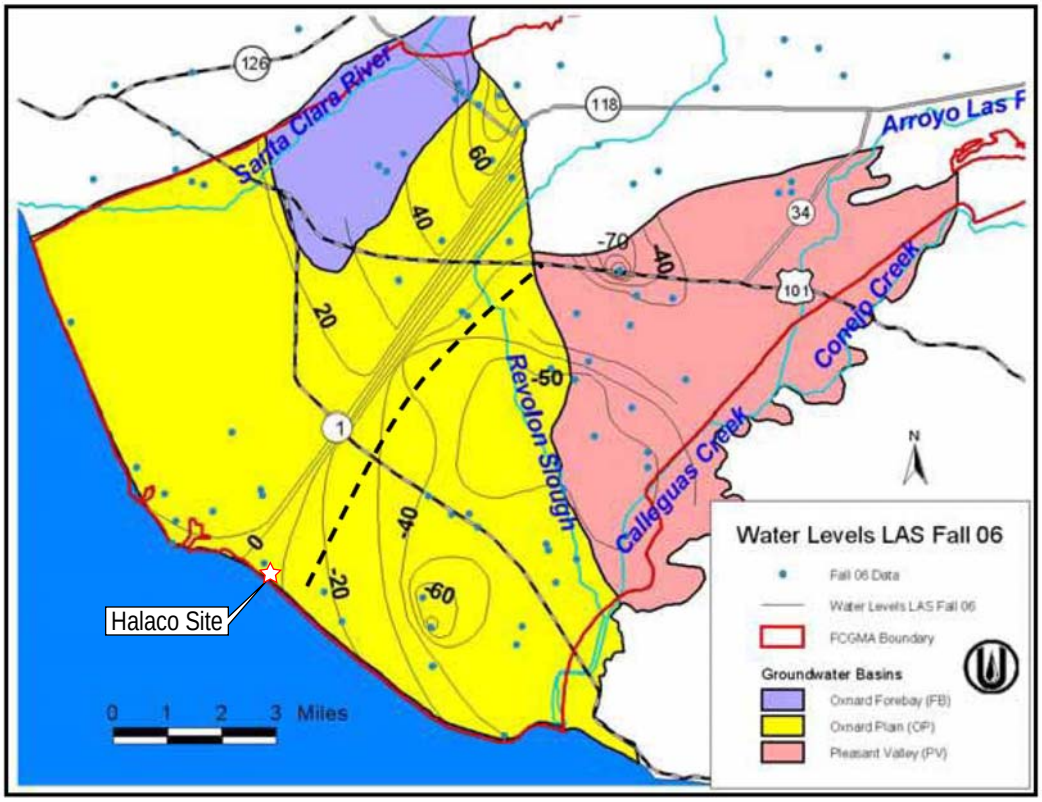


(b) United Water Conservation District (Source: UWCD, 2004)

FIGURE 4-7
FCGMA and UWCD Boundaries
Halaco Site, Oxnard, California



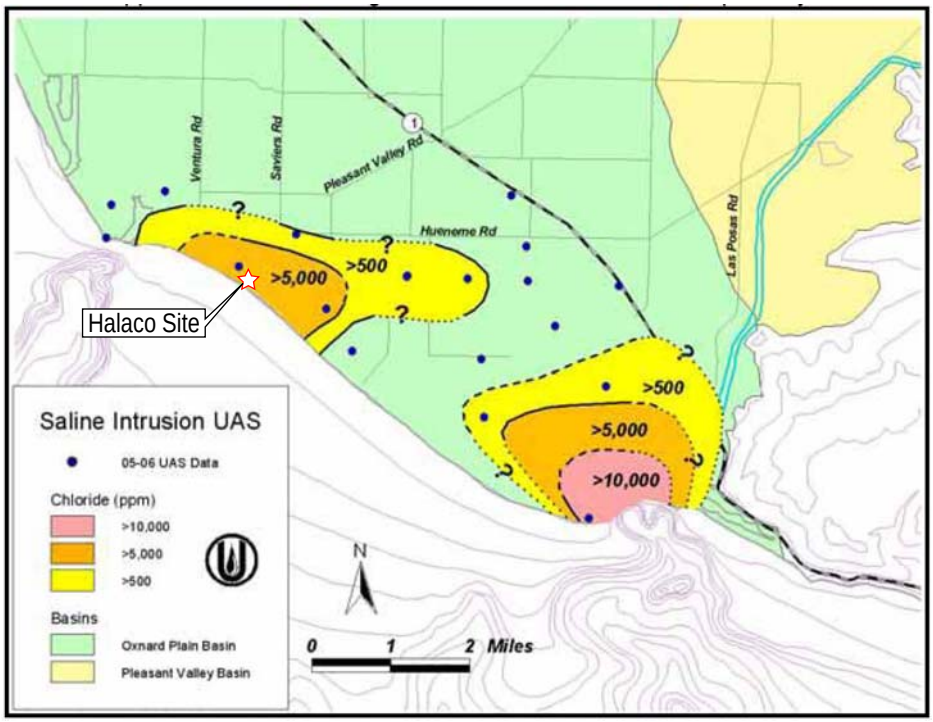
(a) Upper Aquifer System



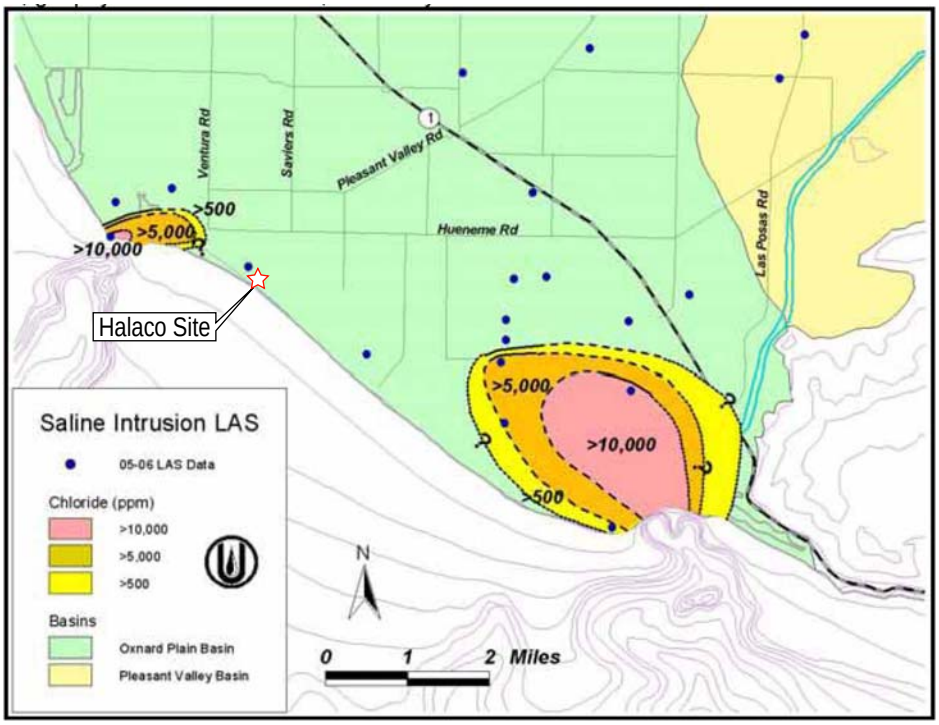
(b) Lower Aquifer System

FIGURE 4-8
Groundwater Elevations in
UAS and LAS - Fall 2006
Halaco Site, Oxnard, California

Source: Fox Canyon Groundwater Management Agency, 2007.



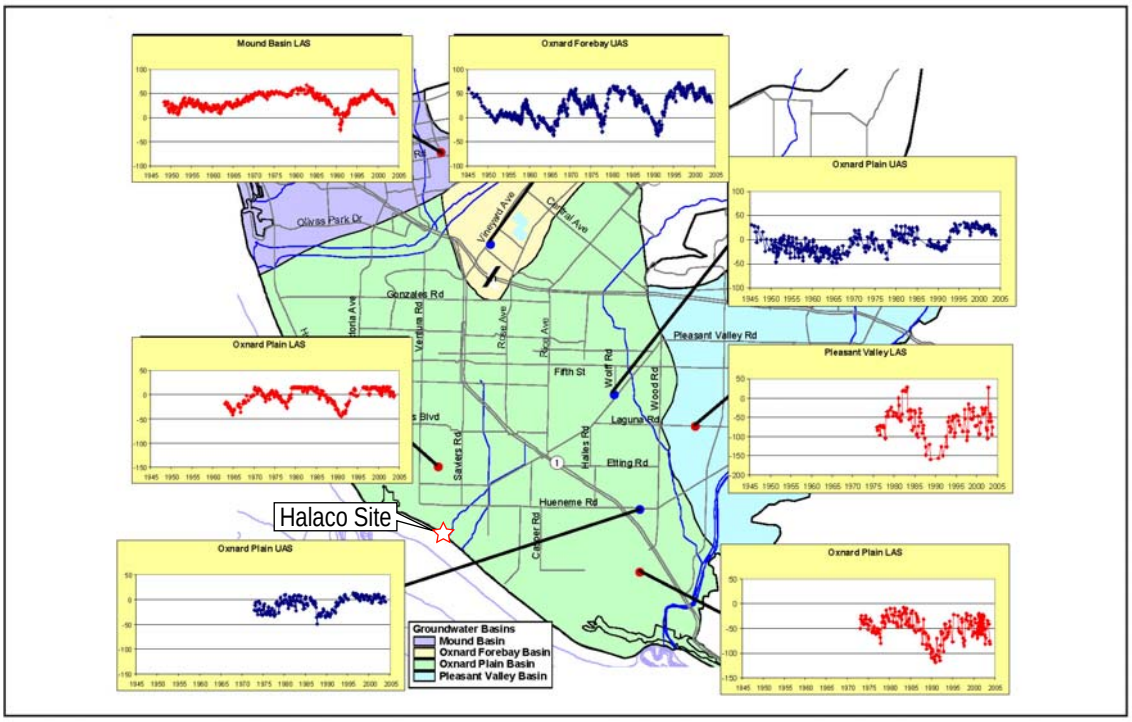
(a) Upper Aquifer System



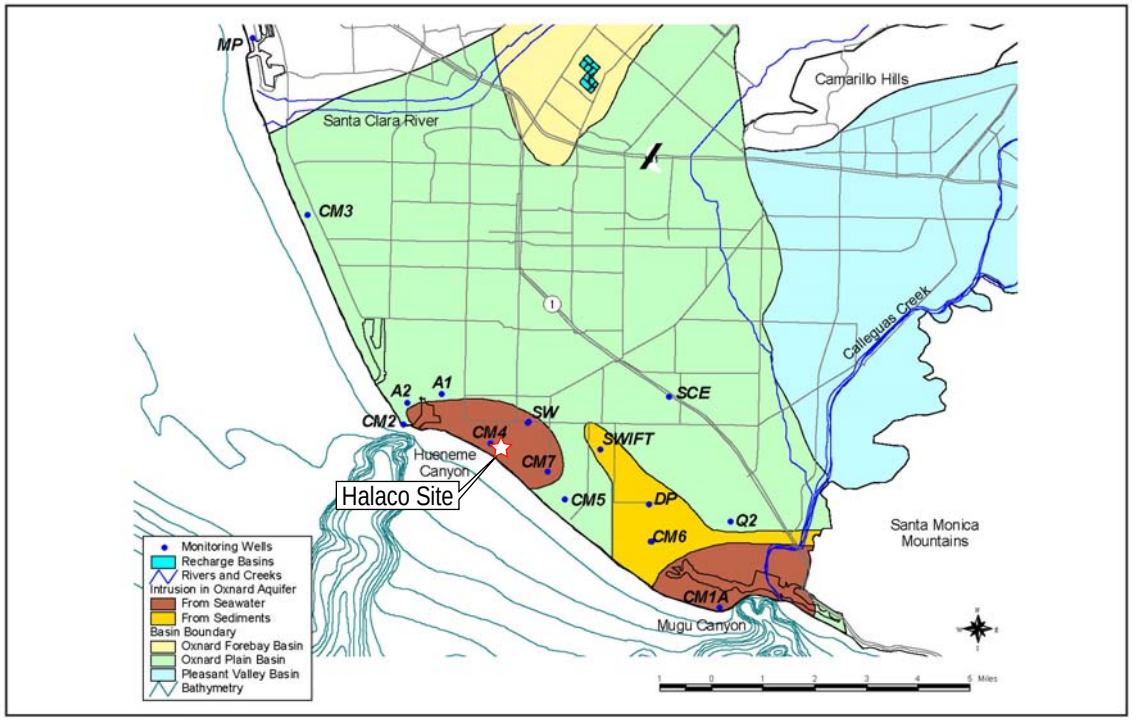
(b) Lower Aquifer System

FIGURE 4-9
Saline Intrusion in UAS and LAS - 2005 and 2006
Halaco Site, Oxnard, California

Source: Fox Canyon Groundwater Management Agency, 2007.



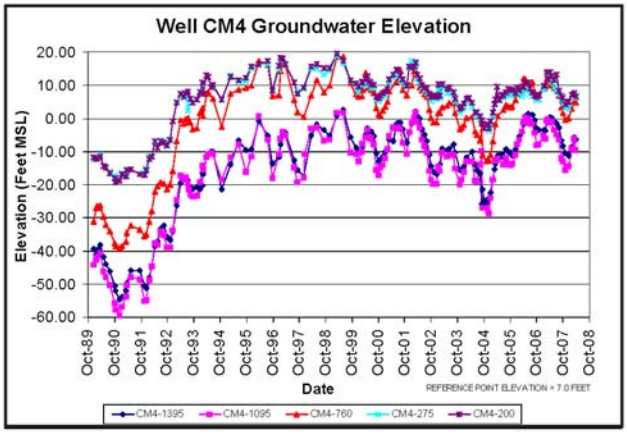
(a) Hydrographs: Blue - Upper Aquifer System, Red - Lower Aquifer System

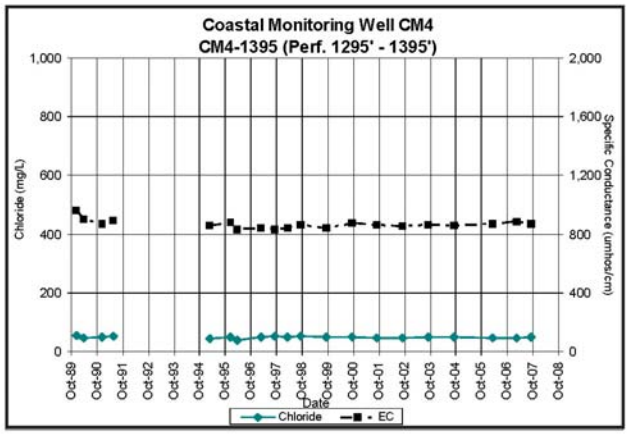


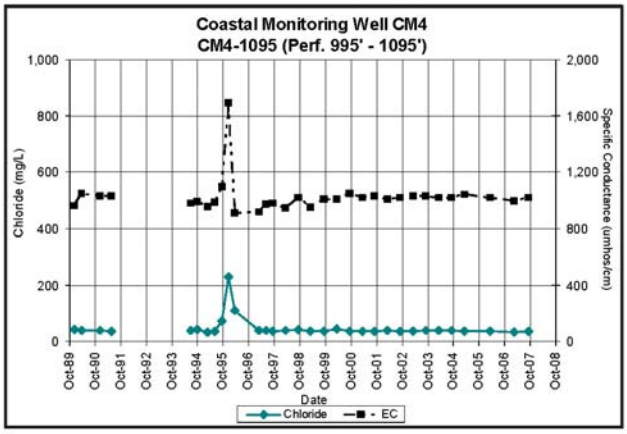
(b) Location of USGS RASA Wells

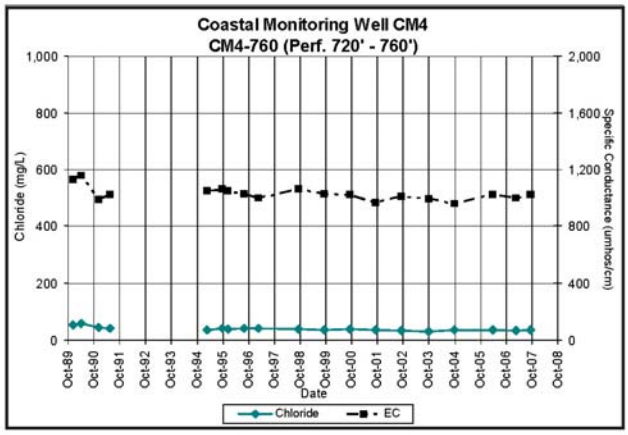
FIGURE 4-10
Hydrographs for UAS and LAS and Location of USGS RASA Wells
Halaco Site, Oxnard, California

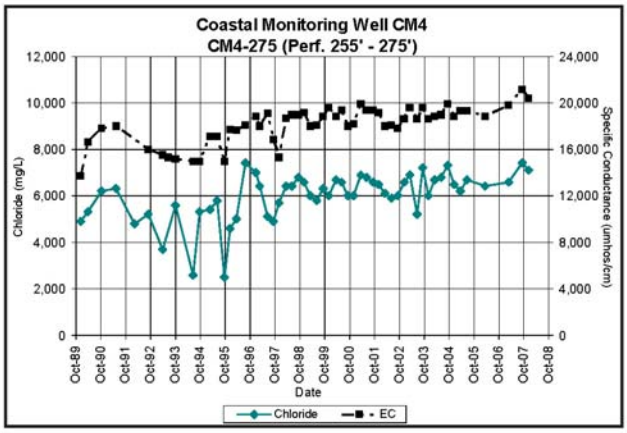
Source: UWCD, 2004











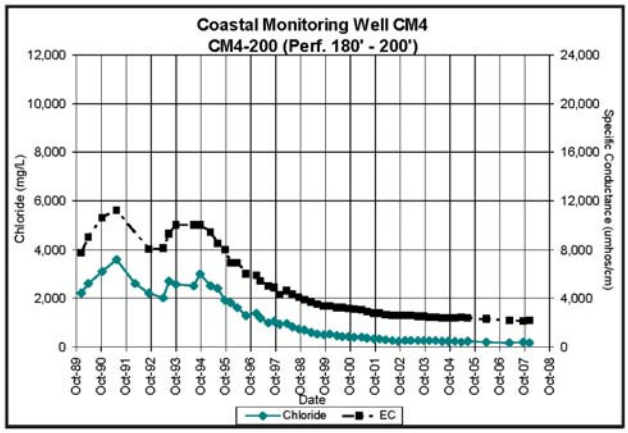


FIGURE 4-11
USGS RASA Well CM-4 Water Levels and Salinity Levels
Halaco Site, Oxnard, California

Source: UWCD, 2008.

CH2MHILL

Legend

Contours

- 2-foot Contours
- 10-foot Contours

Road Classification

- Freeway
- Major Road
- Local Road

Project Data for Ormond Beach Restoration Project

- Study Area Boundary
- City/County Boundary
- Parcels of Interest

Map Notes

Data Source:
Sampling Locations - AMEC
Study Area Boundary - AMEC
Parcel of Interest (approximate) - Aspen, AMEC
Imagery - Aspen Environmental
Roads - ESRI StreetMap

Projection
State Plane, California 405, NAD 83, Feet

Date: 11/08/2006 dfk
Path: w:martin/sd06/aquatic/ormond_beach/mxd/b4.mxd

N

1 inch equals 600 feet

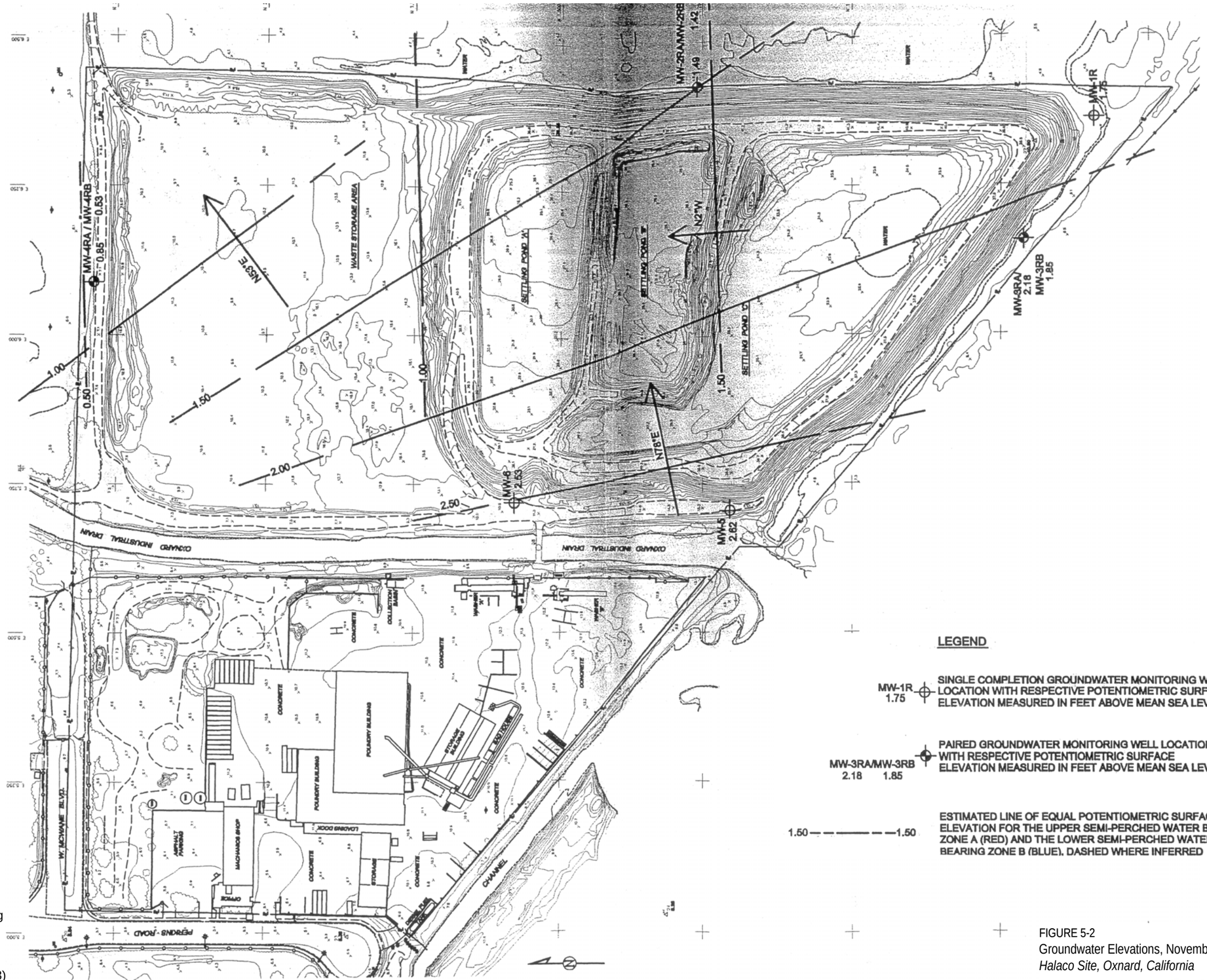
0 300 600 1,200
Feet

FIGURE 5-1
Ormond Beach Area Topography
Halaco Site, Oxnard, California

Source: Modified from AMEC, 2006.

WB082007003SCO358156.DE.01 Halaco_elevationdetail.ai 4/08

CH2MHILL



Source: Plate 3, Project Status Letter - Decommissioning/Abandonment of Pre-Existing Groundwater Monitoring Wells and Completion of New Groundwater Monitoring Well Network Along Perimeter of Waste Management Unit Area (Padre, 2003)

FIGURE 5-2
Groundwater Elevations, November 24, 2003
Halaco Site, Oxnard, California

0 500 1000

Scale in Feet

MW-2
4.80

Monitoring Well Location w/elevation in feet above mean sea level.

5.0

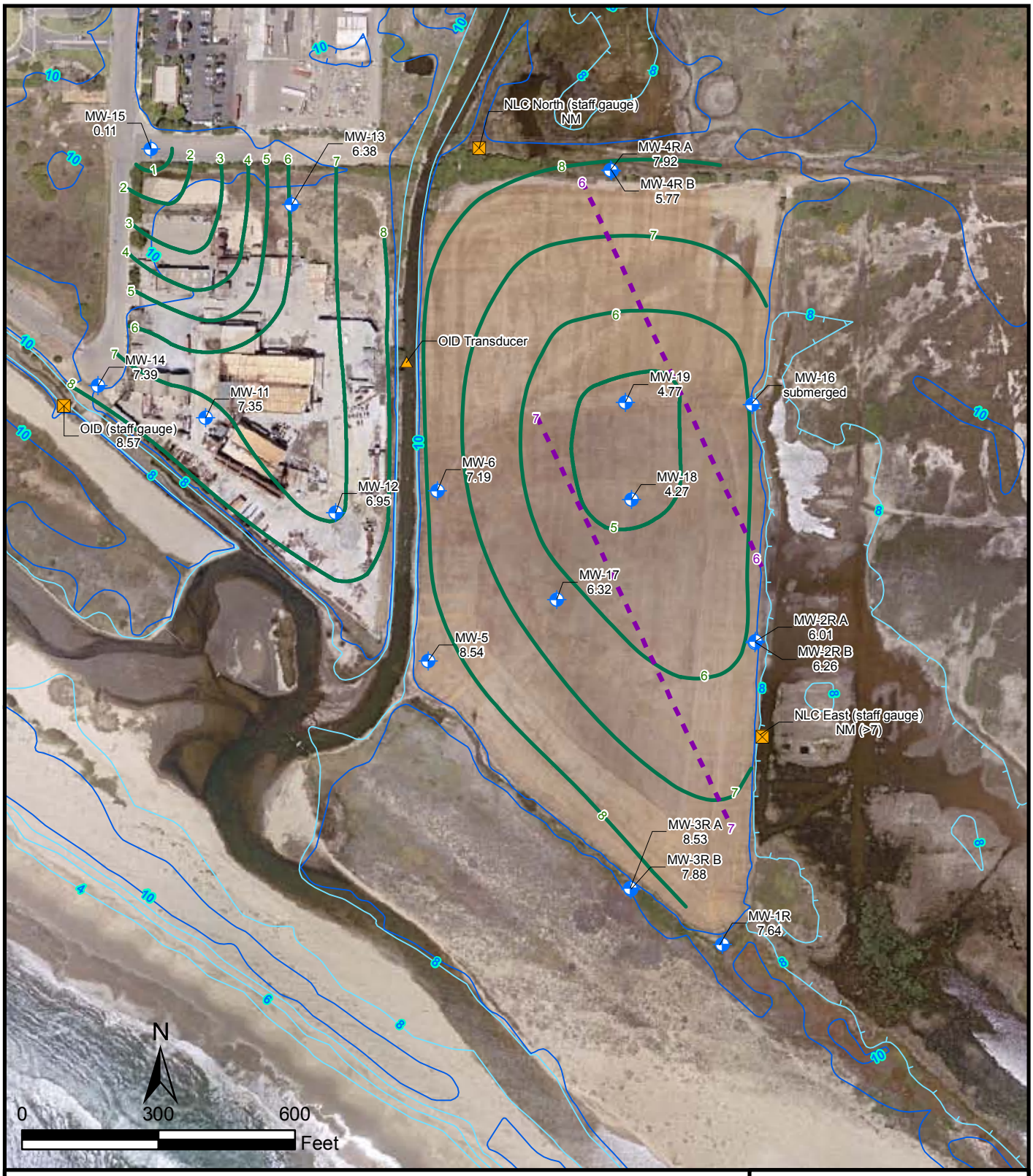
Groundwater elevation contours interpolated from field measurements in feet above mean sea level.

N

FIGURE 5-3
Groundwater Elevations, June 2006
Halaco Site, Oxnard, California

Source: Figure 3-3, Integrated Assessment Report (Weston, 2007)

CH2MHILL



LEGEND

Groundwater Monitoring Well

Surface Water Gauging Station

Surface Water Pressure Transducer

Ground Elevation Contours (AMEC, 2006)

2-foot Contours

10-foot Contours

Groundwater Elevation Contours, Shallow Wells

1-foot Contours

Groundwater Elevation Contours, Deeper Wells

1-foot Contours

Aerial Source: YCE Incorporated April 12, 2007.
Datum: ft MSL NAVD 1988.

Figure 5-4
Groundwater and Surface Water Elevations, 10/15/2007

HALACO SITE
OXNARD, CALIFORNIA

CH2MHILL

LEGEND

- Groundwater Monitoring Well
- Surface Water Gauging Station
- Surface Water Pressure Transducer

Ground Elevation Contours (AMEC, 2006)
- 2-foot Contours
- 10-foot Contours

Groundwater Elevation Contours, Shallow Wells
- 1-foot Contours

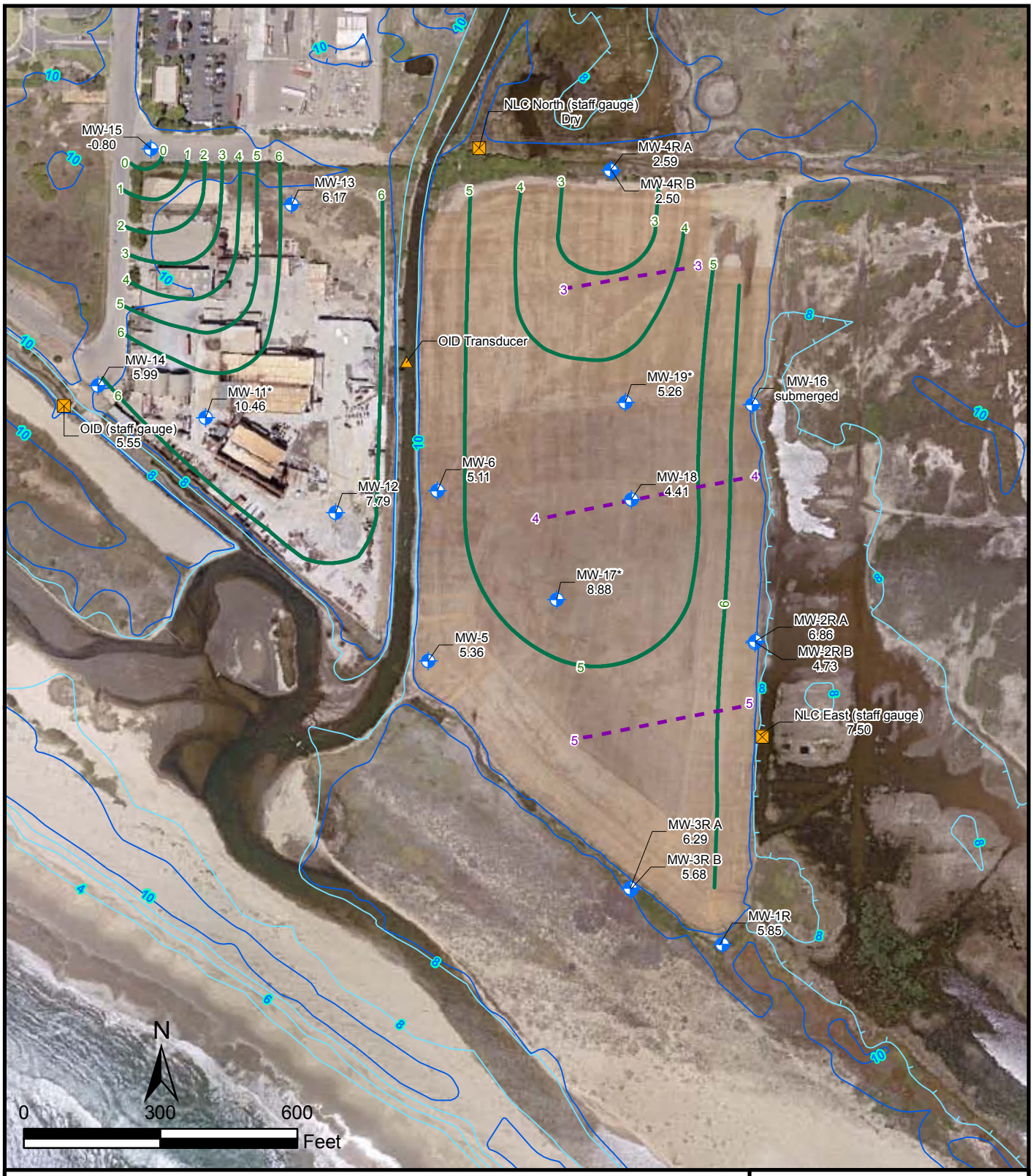
Groundwater Elevation Contours, Deeper Wells
- 1-foot Contours

Aerial Source: YCE Incorporated April 12, 2007.
Datum: ft MSL NAVD 1988.

Figure 5-5
Groundwater and Surface Water Elevations, 12/03/2007

HALACO SITE
OXNARD, CALIFORNIA

CH2MHILL



LEGEND

Groundwater Monitoring Well

Surface Water Gauging Station

Surface Water Pressure Transducer

Ground Elevation Contours (AMEC, 2006)

2-foot Contours

10-foot Contours

Groundwater Elevation Contours, Shallow Wells

1-foot Contours

Groundwater Elevation Contours, Deeper Wells

1-foot Contours

Aerial Source: YCE Incorporated April 12, 2007.
Datum: ft MSL NAVD 1988

* Data not used for contours; may be affected by local temporary recharge.

Figure 5-6
Groundwater and Surface Water Elevations, 01/03/2008

HALACO SITE
OXNARD, CALIFORNIA

CH2MHILL

LEGEND

Groundwater Monitoring Well

Surface Water Gauging Station

Surface Water Pressure Transducer

Ground Elevation Contours (AMEC, 2006)

2-foot Contours

10-foot Contours

Groundwater Elevation Contours, Shallow Wells

1-foot Contours

Groundwater Elevation Contours, Deeper Wells

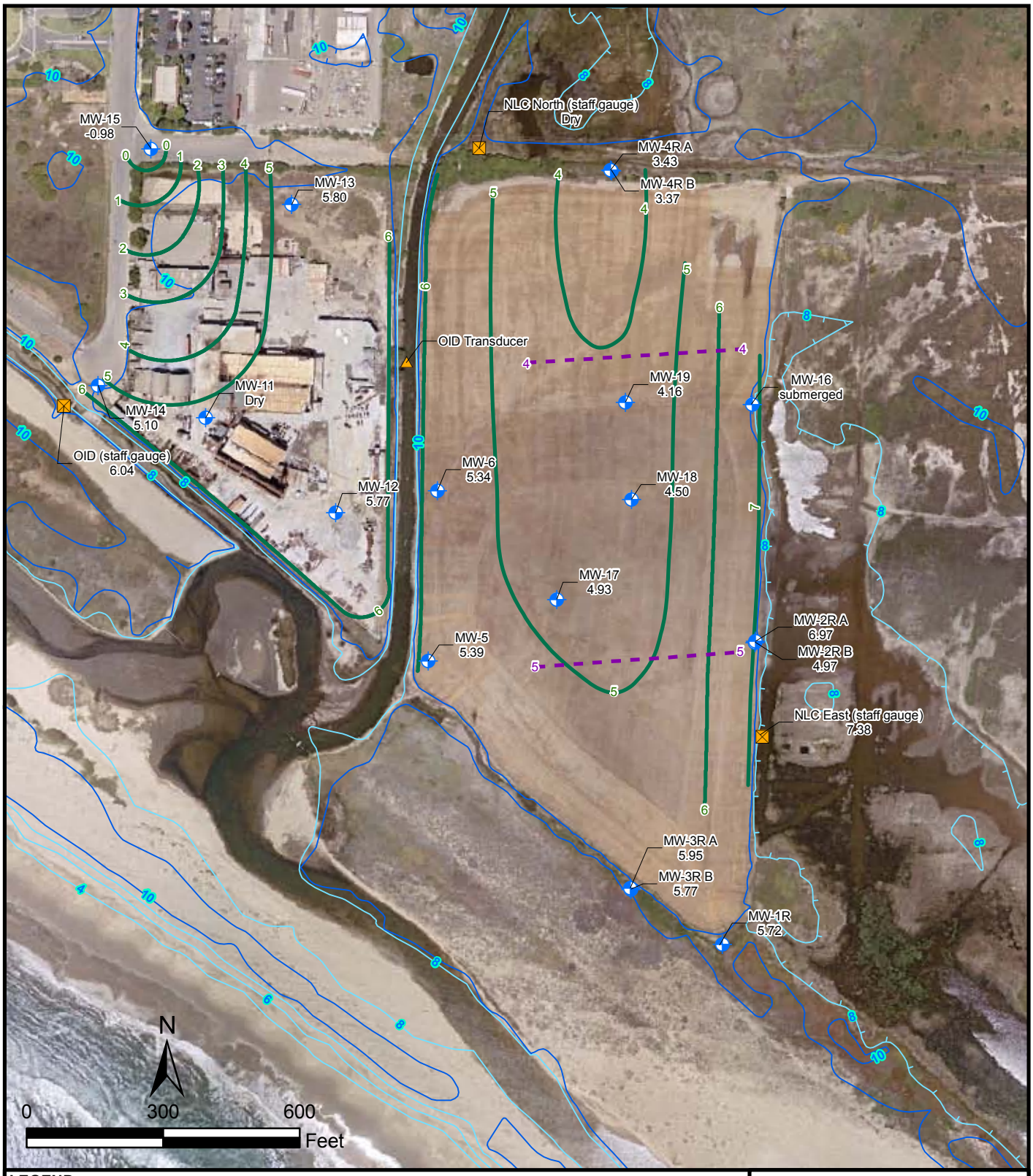
1-foot Contours

Aerial Source: YCE Incorporated April 12, 2007.
Datum: ft MSL NAVD 1988.

Figure 5-7
Groundwater and Surface Water Elevations, 01/31/2008

HALACO SITE
OXNARD, CALIFORNIA

CH2MHILL



LEGEND

Groundwater Monitoring Well

Surface Water Gauging Station

Surface Water Pressure Transducer

Ground Elevation Contours (AMEC, 2006)

2-foot Contours

10-foot Contours

Groundwater Elevation Contours, Shallow Wells

1-foot Contours

Groundwater Elevation Contours, Deeper Wells

1-foot Contours

Aerial Source: YCE Incorporated April 12, 2007.
Datum: ft MSL NAVD 1988.

Figure 5-8
Groundwater and Surface Water Elevations, 03/06/2008

HALACO SITE
OXNARD, CALIFORNIA

CH2MHILL

LEGEND

Groundwater Monitoring Well

Surface Water Gauging Station

Surface Water Pressure Transducer

Ground Elevation Contours (AMEC, 2006)

2-foot Contours

10-foot Contours

Groundwater Elevation Contours, Shallow Wells

1-foot Contours

Groundwater Elevation Contours, Deeper Wells

1-foot Contours

Aerial Source: YCE Incorporated April 12, 2007.
Datum: ft MSL NAVD 1988.

Figure 5-9
Groundwater and Surface Water Elevations, 04/01/2008

HALACO SITE
OXNARD, CALIFORNIA

CH2MHILL

Figure 5-10
Hydrologic Transects
Shallow Wells

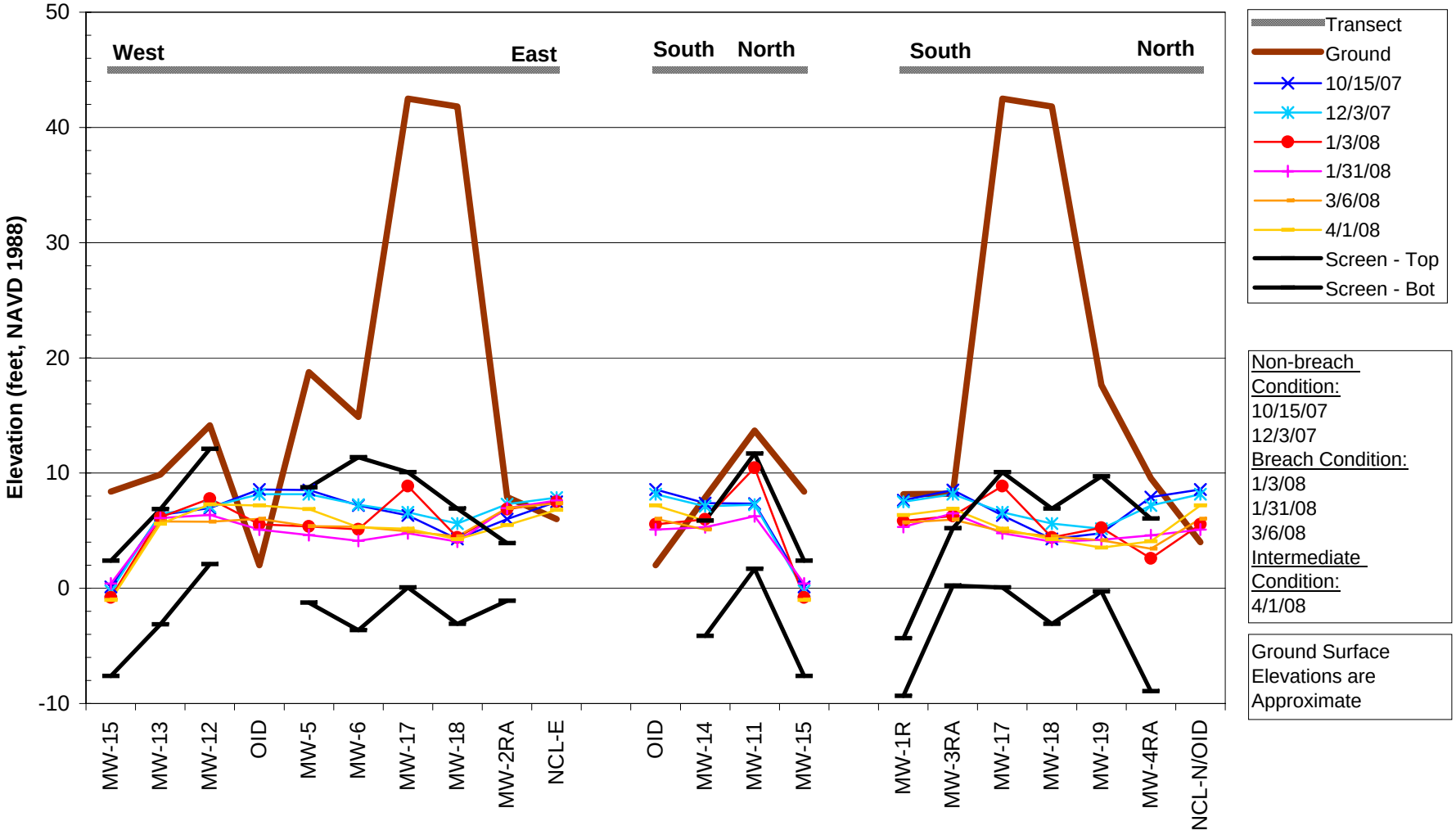


Figure 5-11
Hydrologic Transects
Well Clusters

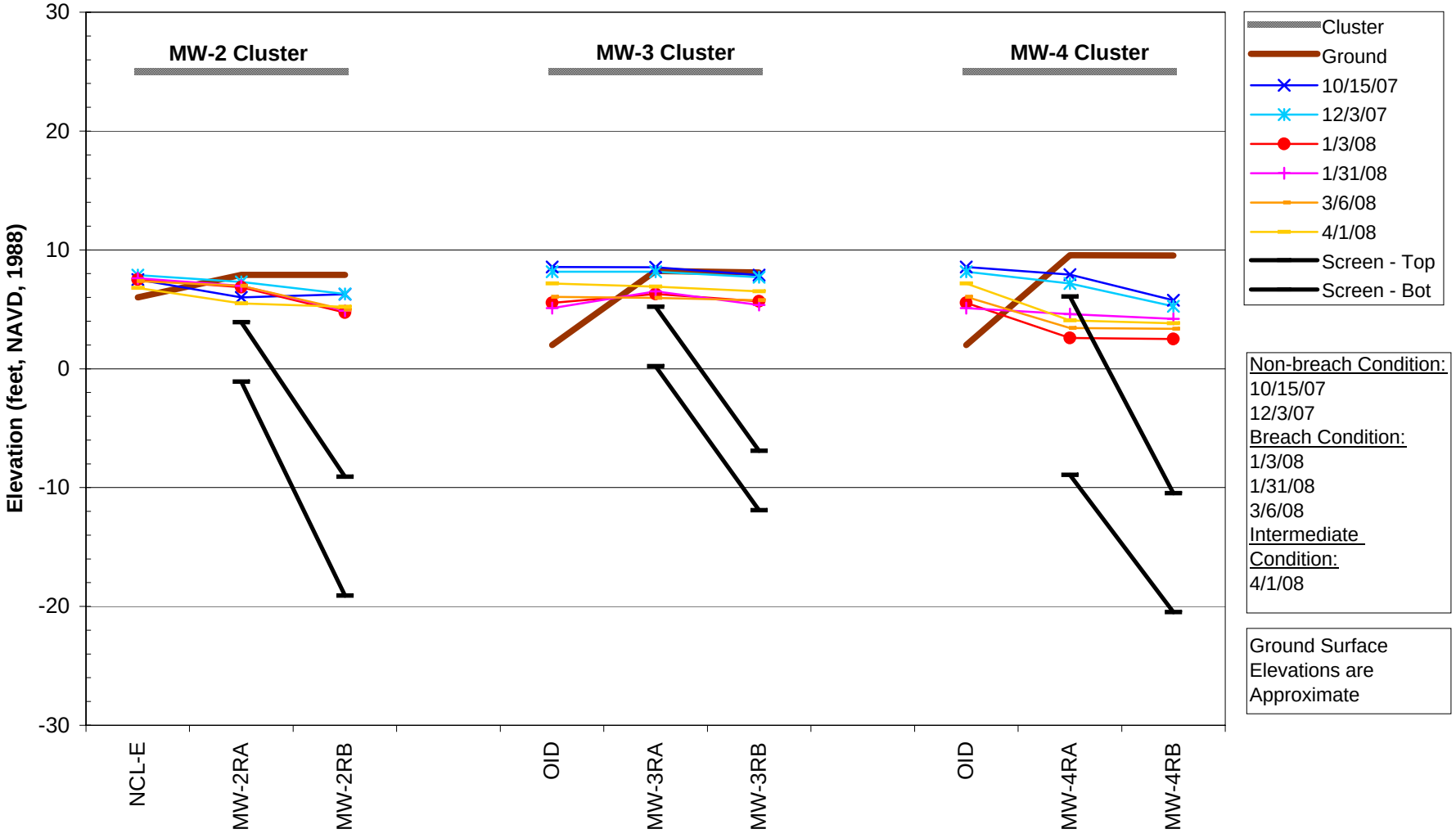


Figure 5-12
Surface Water Elevation Hydrograph
October 2007 - September 2008

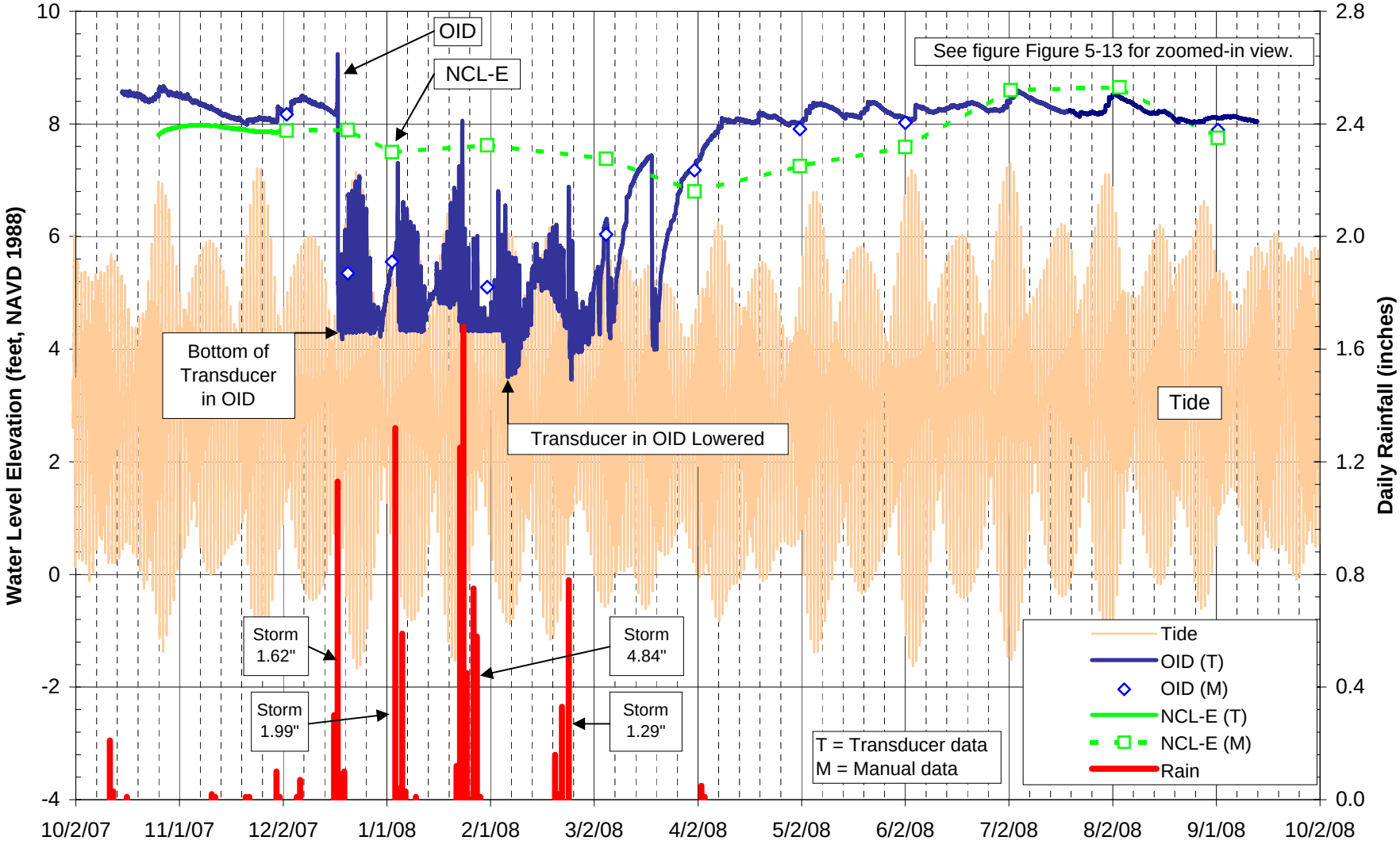


Figure 5-13
Surface Water Elevation Hydrograph
December 2007 - April 2008

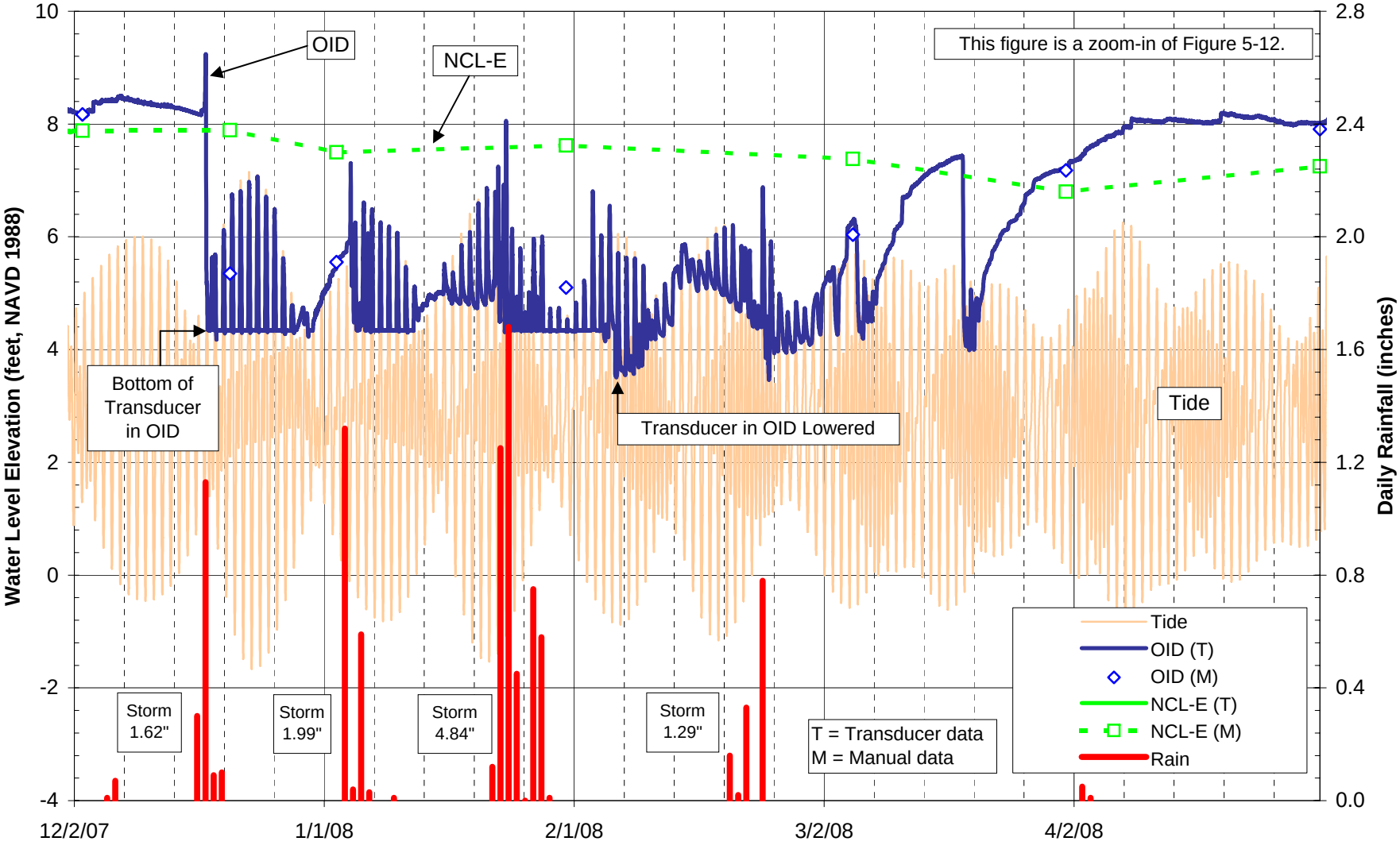


Figure 5-14
Surface Water Elevation Hydrograph
October 14, 2007 - November 4, 2007

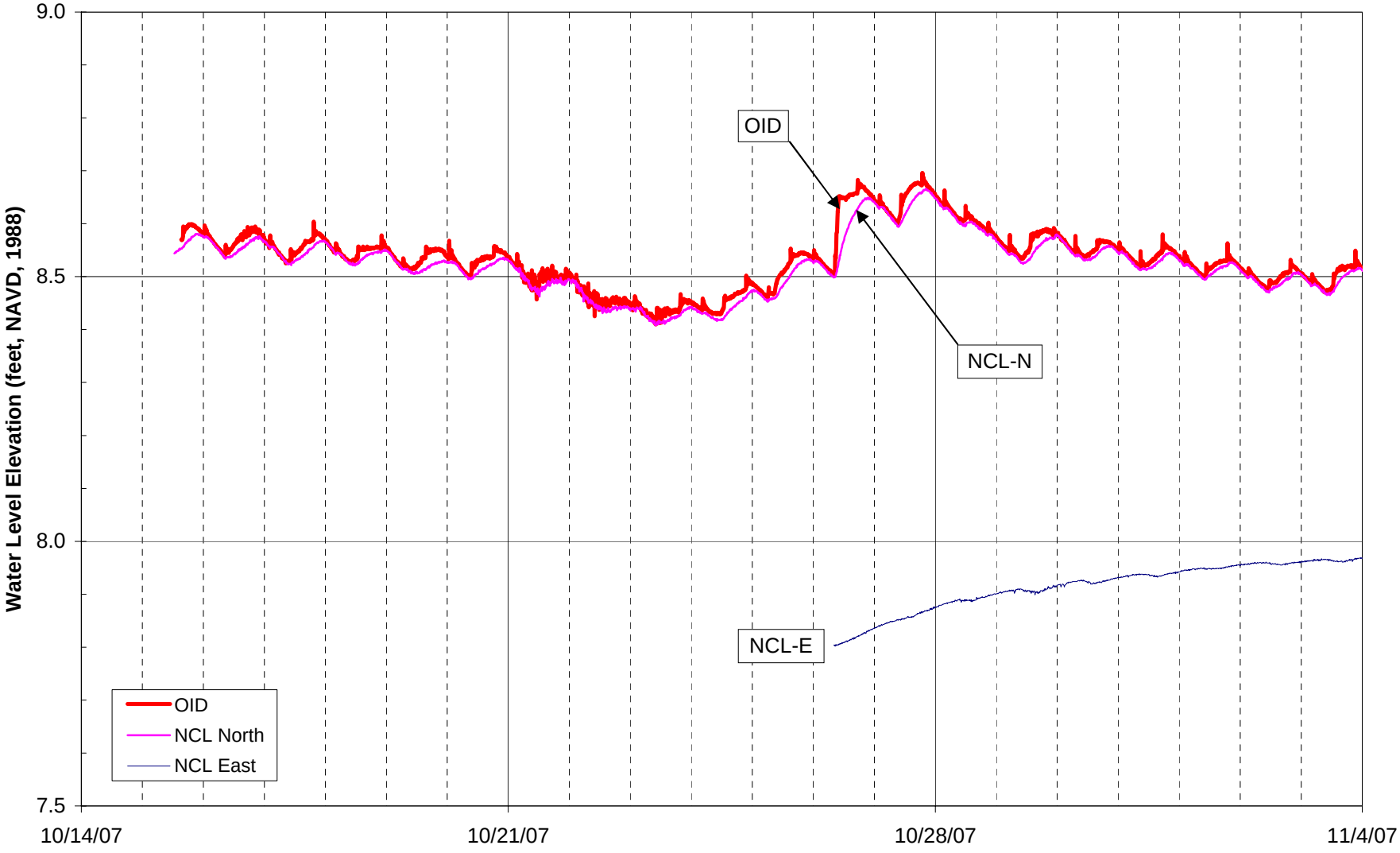


Figure 5-15
Groundwater Elevation Hydrograph, Transducer Data
October 15, 2007 - December 3, 2007

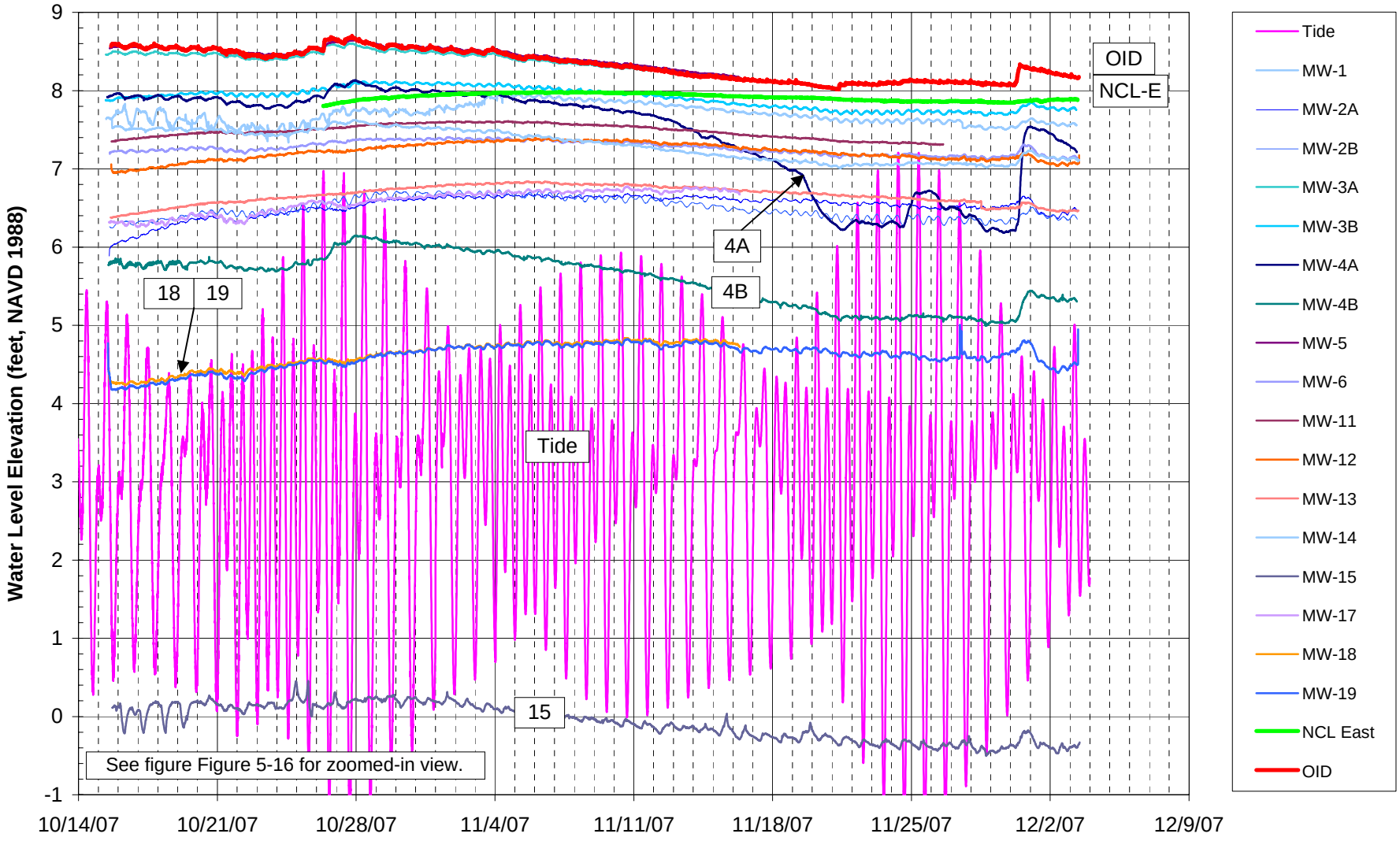


Figure 5-16
Groundwater Elevation Hydrograph, Transducer Data, Expanded Scale
October 15, 2007 - December 3, 2007

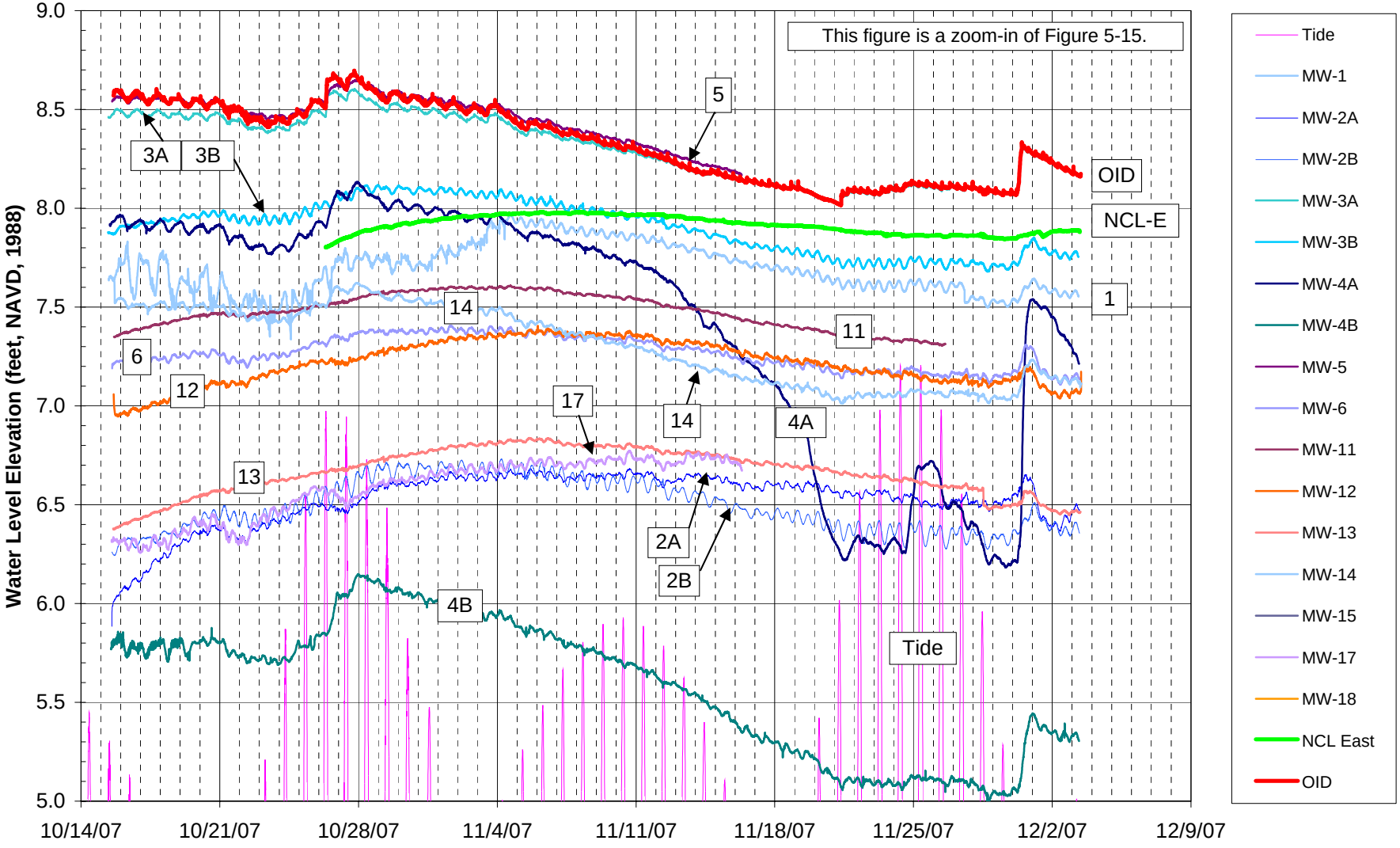


Figure 5-17
Groundwater Elevation Hydrograph, Manual Data
October 2007 - September 2008

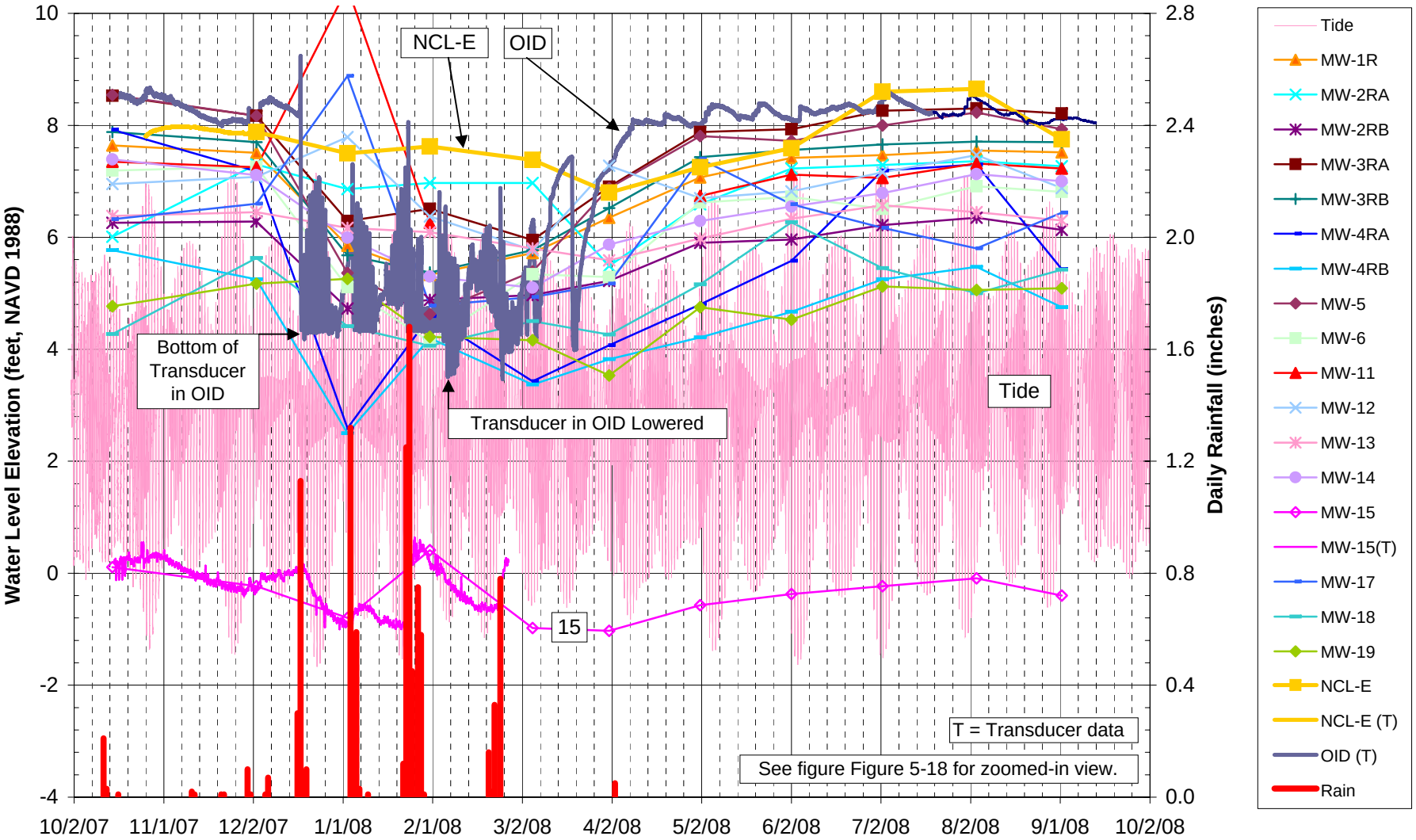


Figure 5-18
Groundwater Elevation Hydrograph, Manual Data, Expanded Scale
October 2007 - September 2008

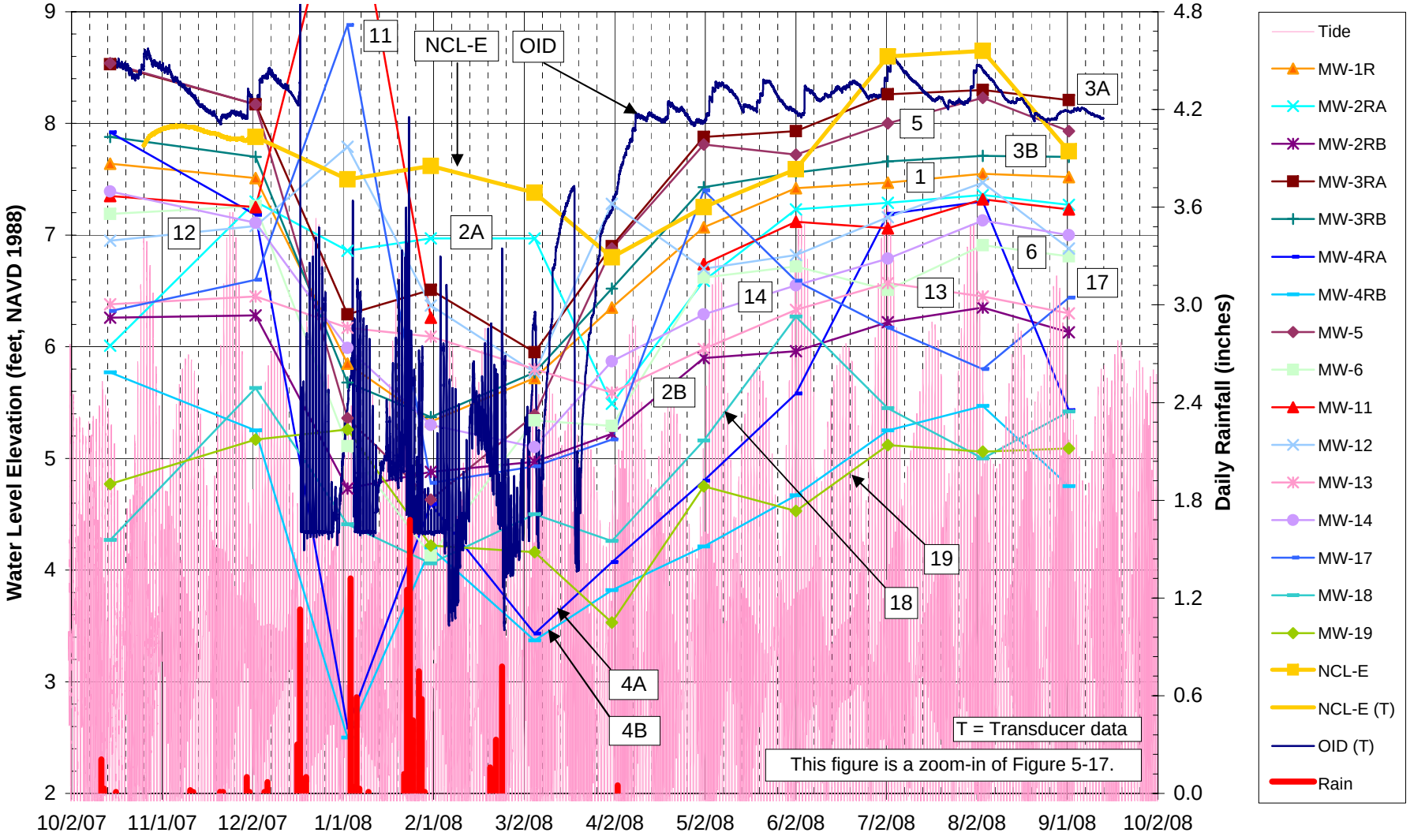


Figure 5-19
Groundwater Elevation Hydrograph, CM-4-200
October 19, 2007 - November 16, 2007

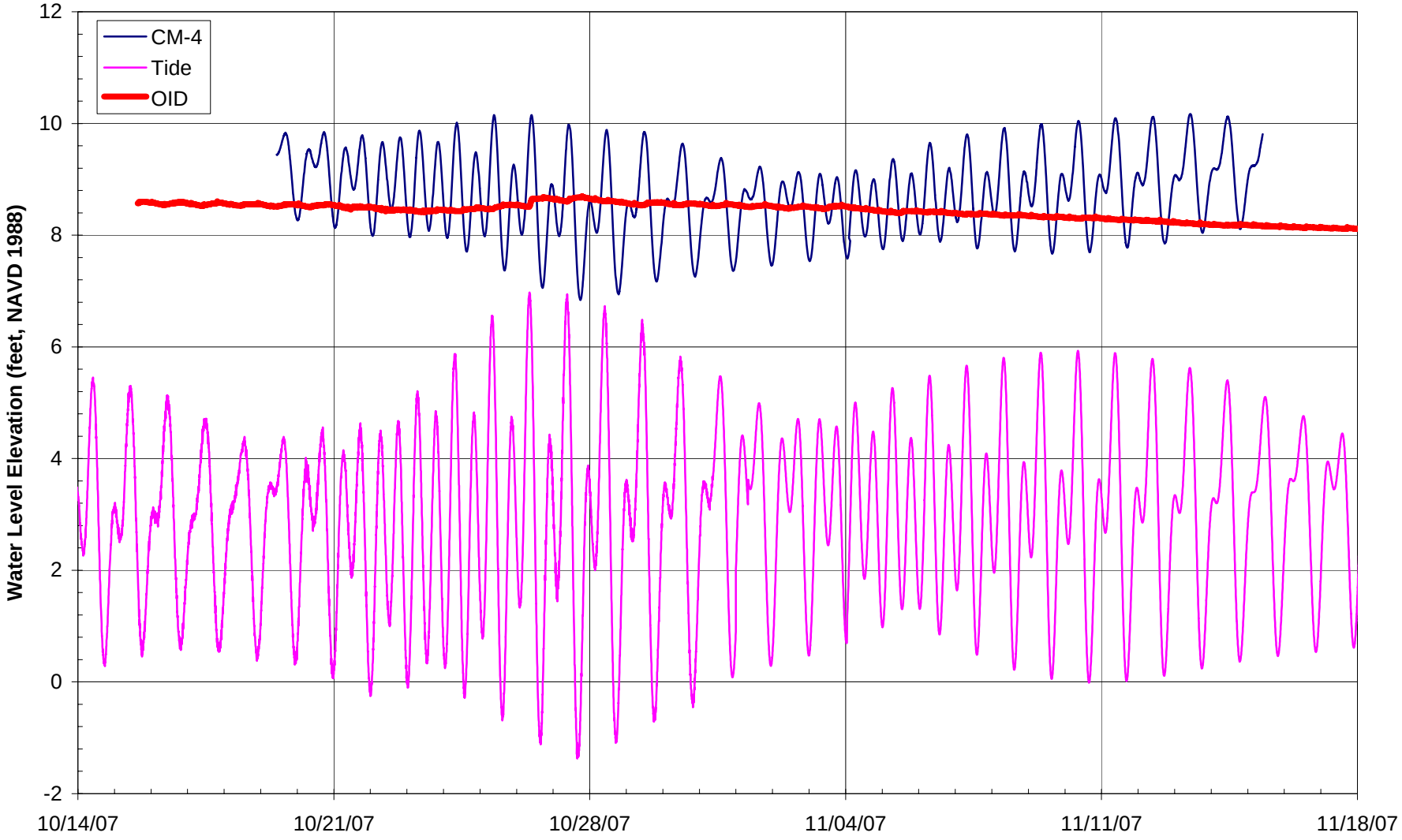


Figure 6-1
Wastewater - Electrical Conductivity, Magnesium, Oil & Grease, and pH
Long-term Monitoring

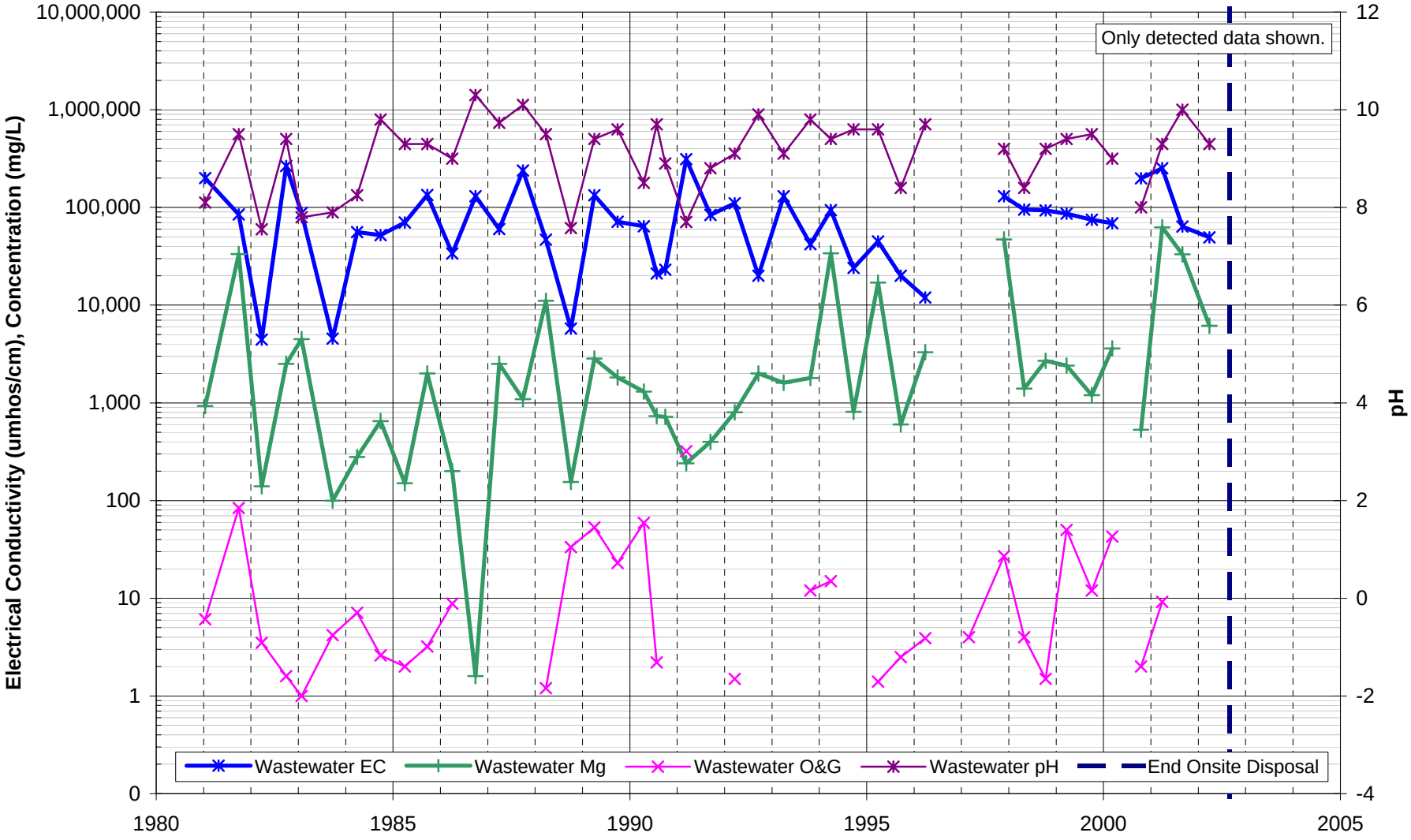


Figure 6-2
Wastewater - Electrical Conductivity, Aluminum, Copper, and Zinc
Long-term Monitoring

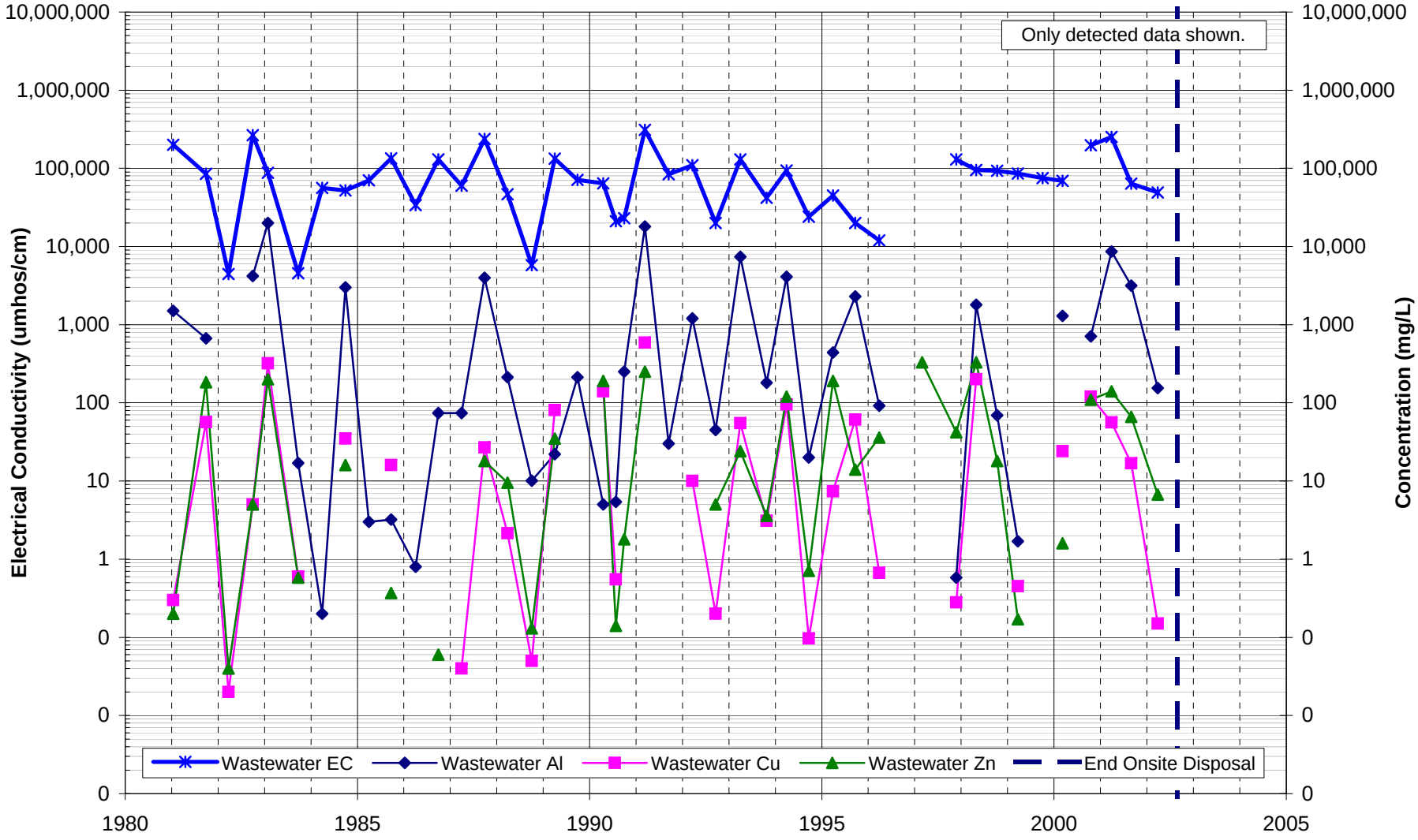


Figure 6-3
Wastewater - General Chemistry
1998/99 RWQCB and 2001 Halaco Samples

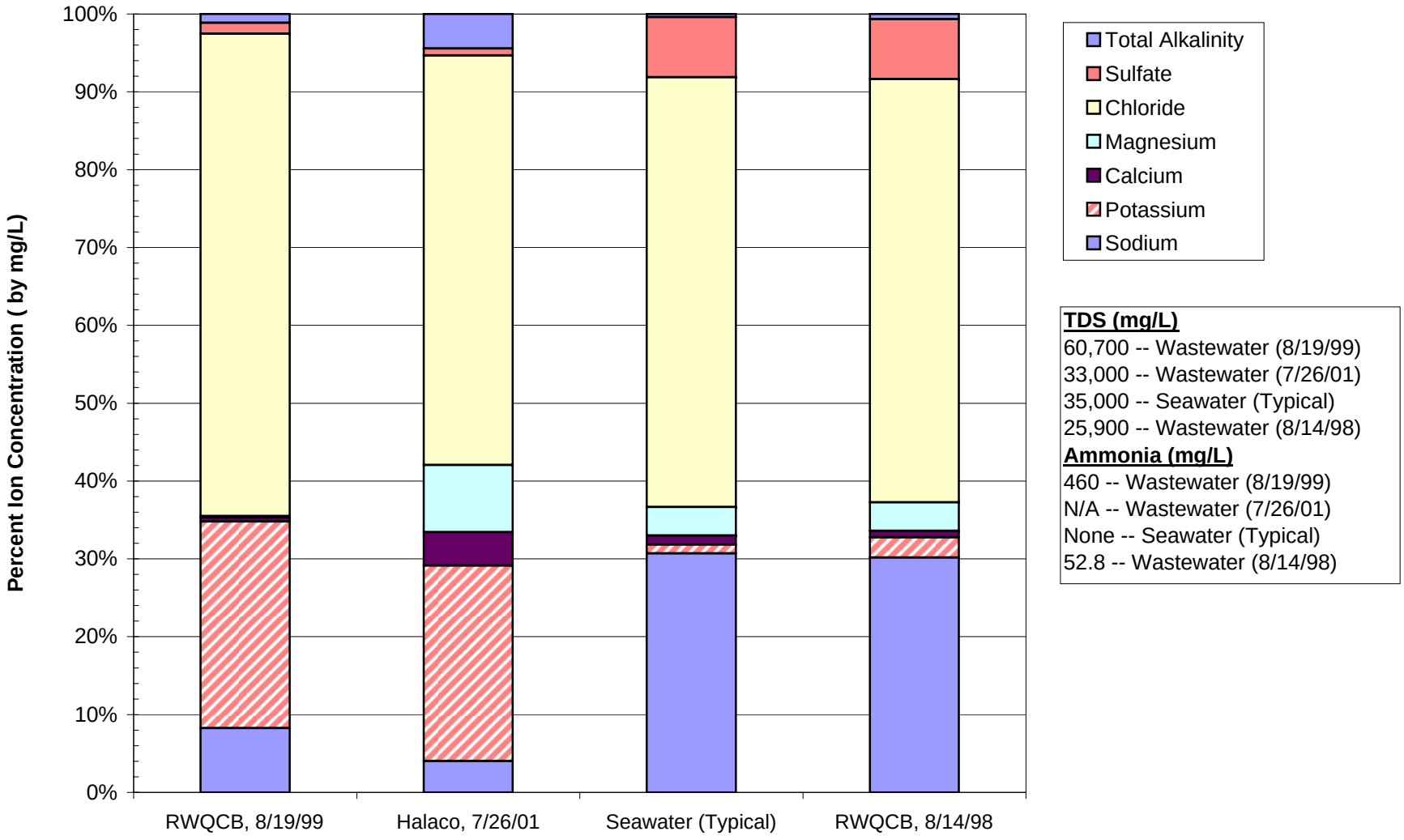


Figure 6-4
Wastewater - General Chemistry
1980 NEIC, 1998/99 RWQCB, and 2001 Halaco Samples

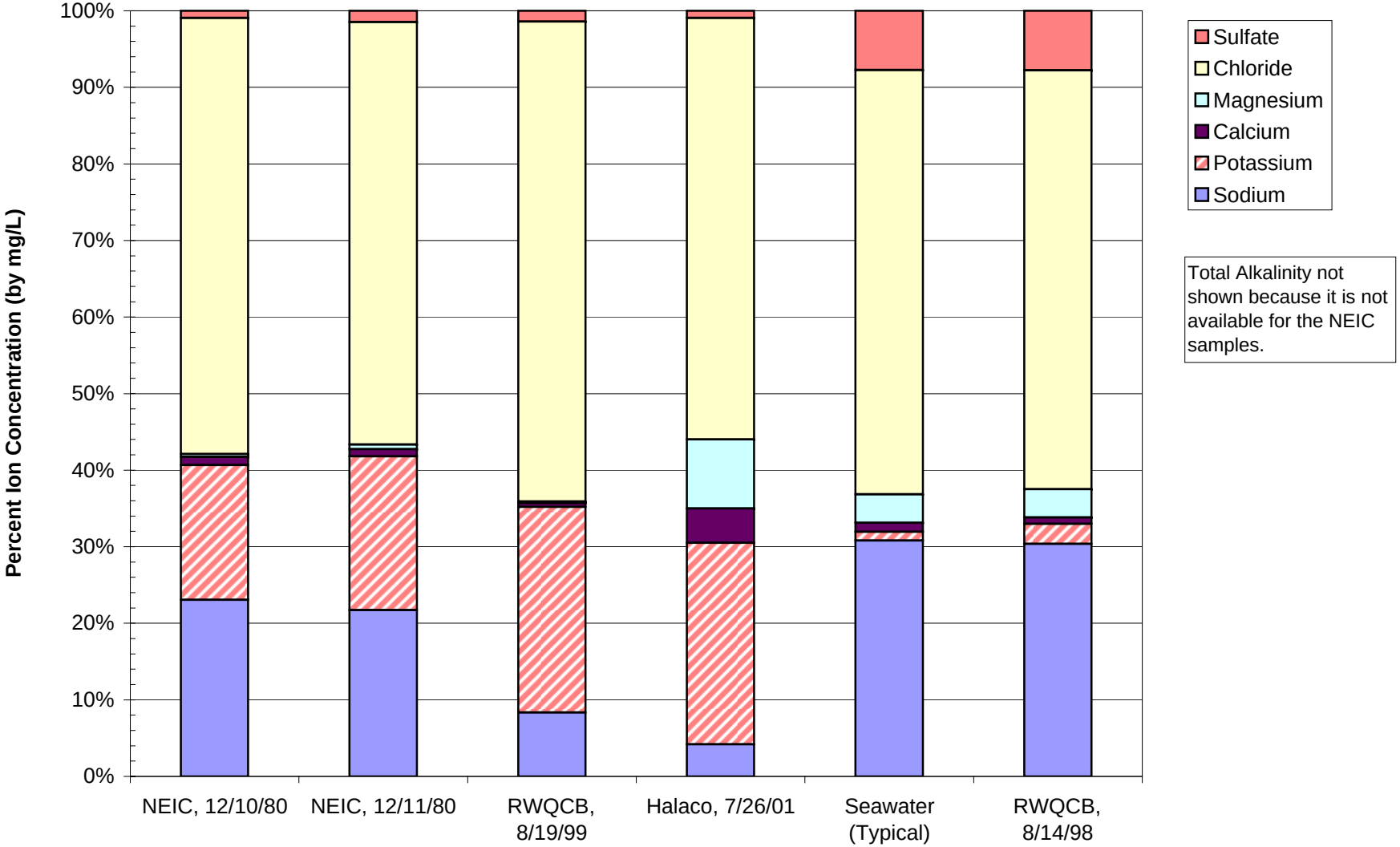


Figure 6-5
Wastewater Seeps - General Chemistry
1999 RWQCB Samples

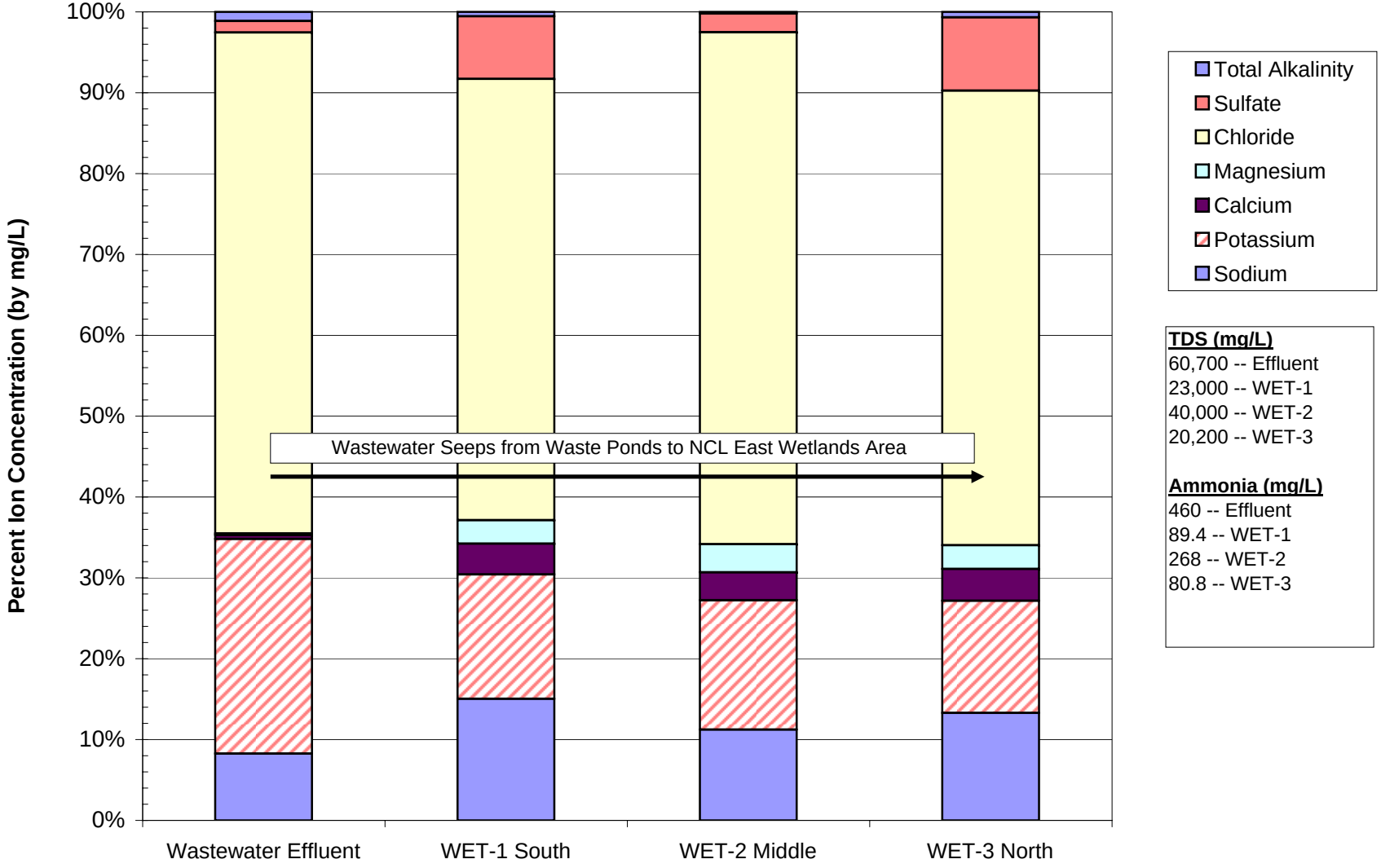


Figure 6-6
OID Surface Water - Electrical Conductivity
Long-term Monitoring

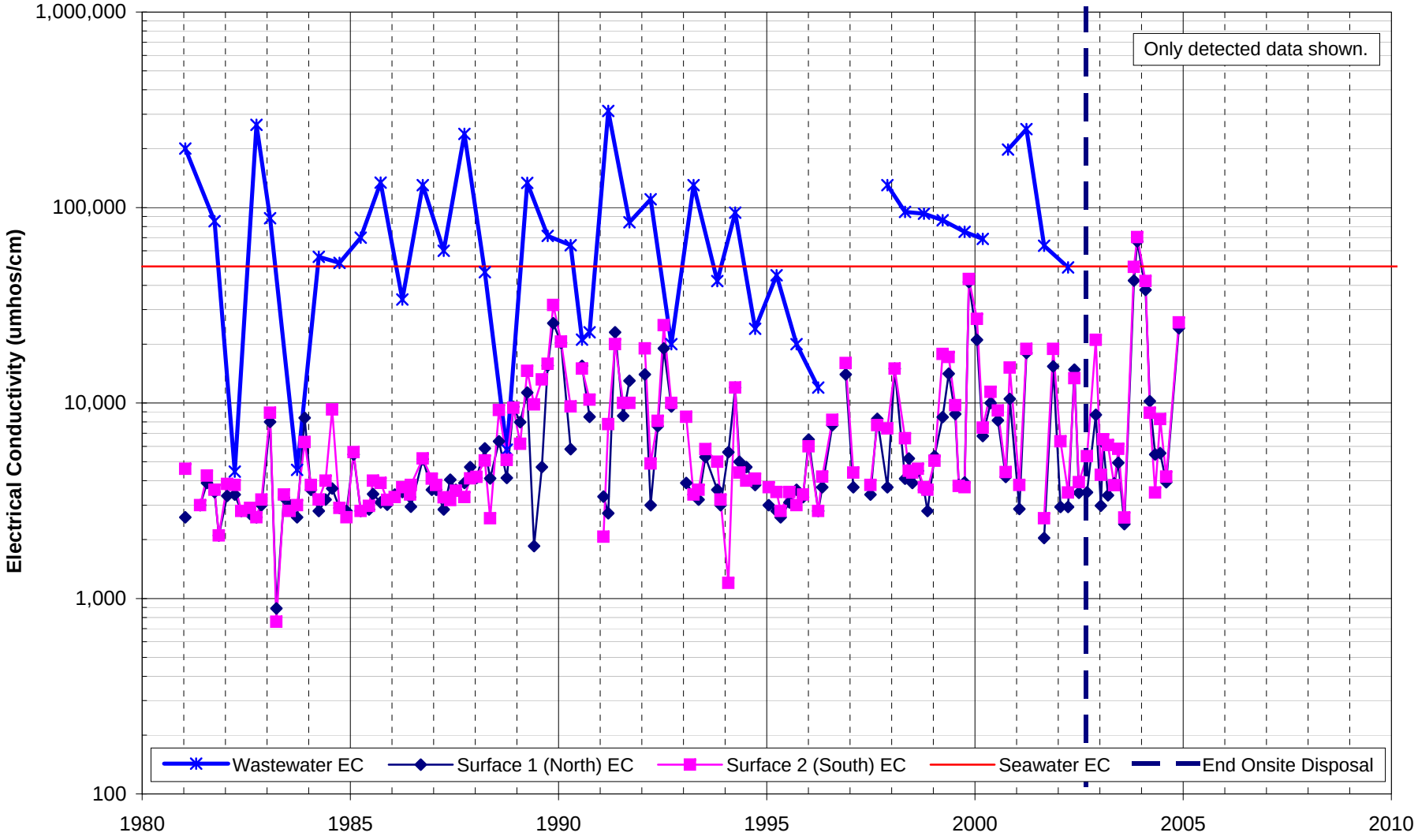


Figure 6-7
OID Surface Water - Oil & Grease
Long-term Monitoring

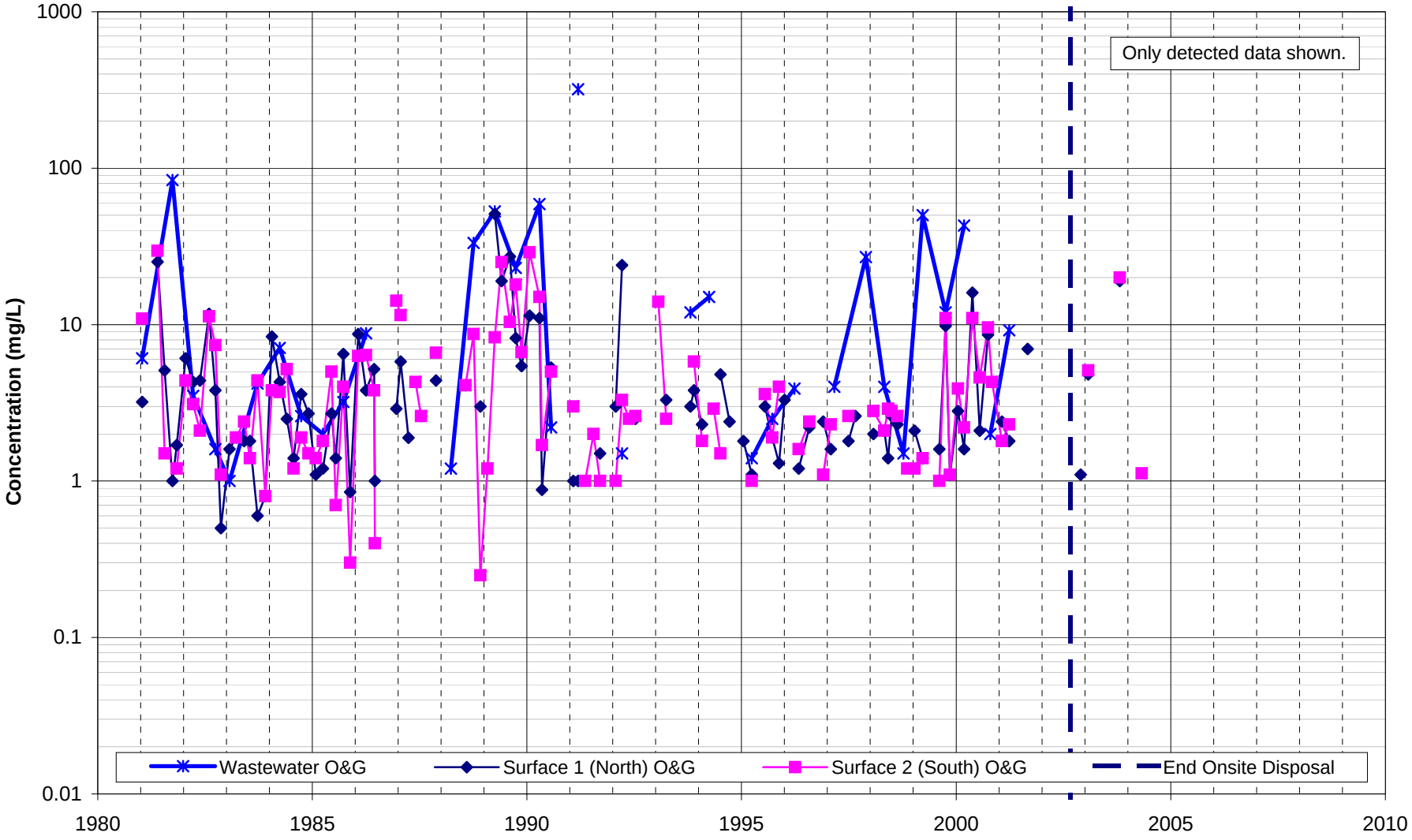


Figure 6-8
Surface Water - Electrical Conductivity and Magnesium
Post Onsite Discharge Monitoring

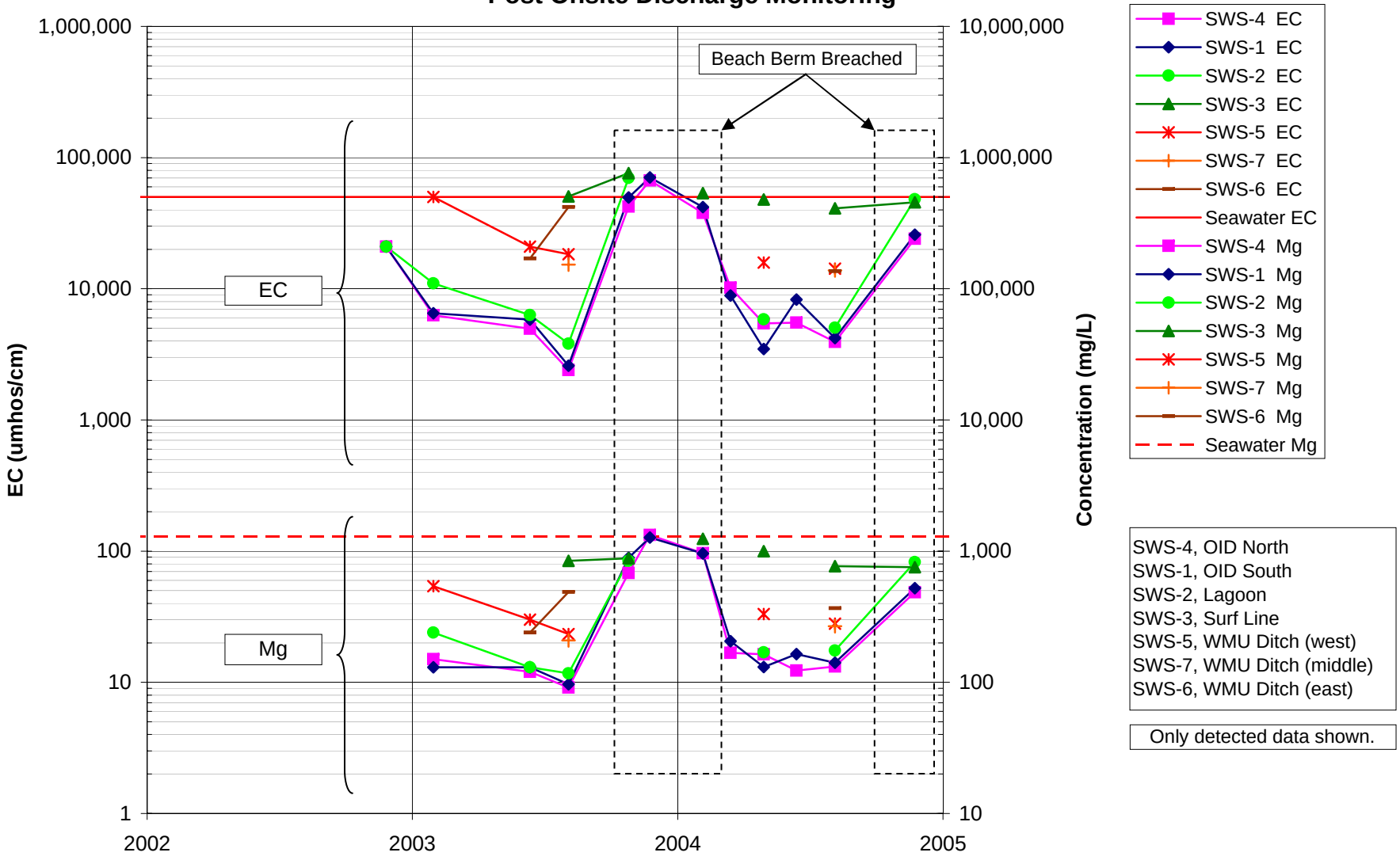


Figure 6-9
Surface Water - Electrical Conductivity, Magnesium, and Ammonia
Non-breach Conditions

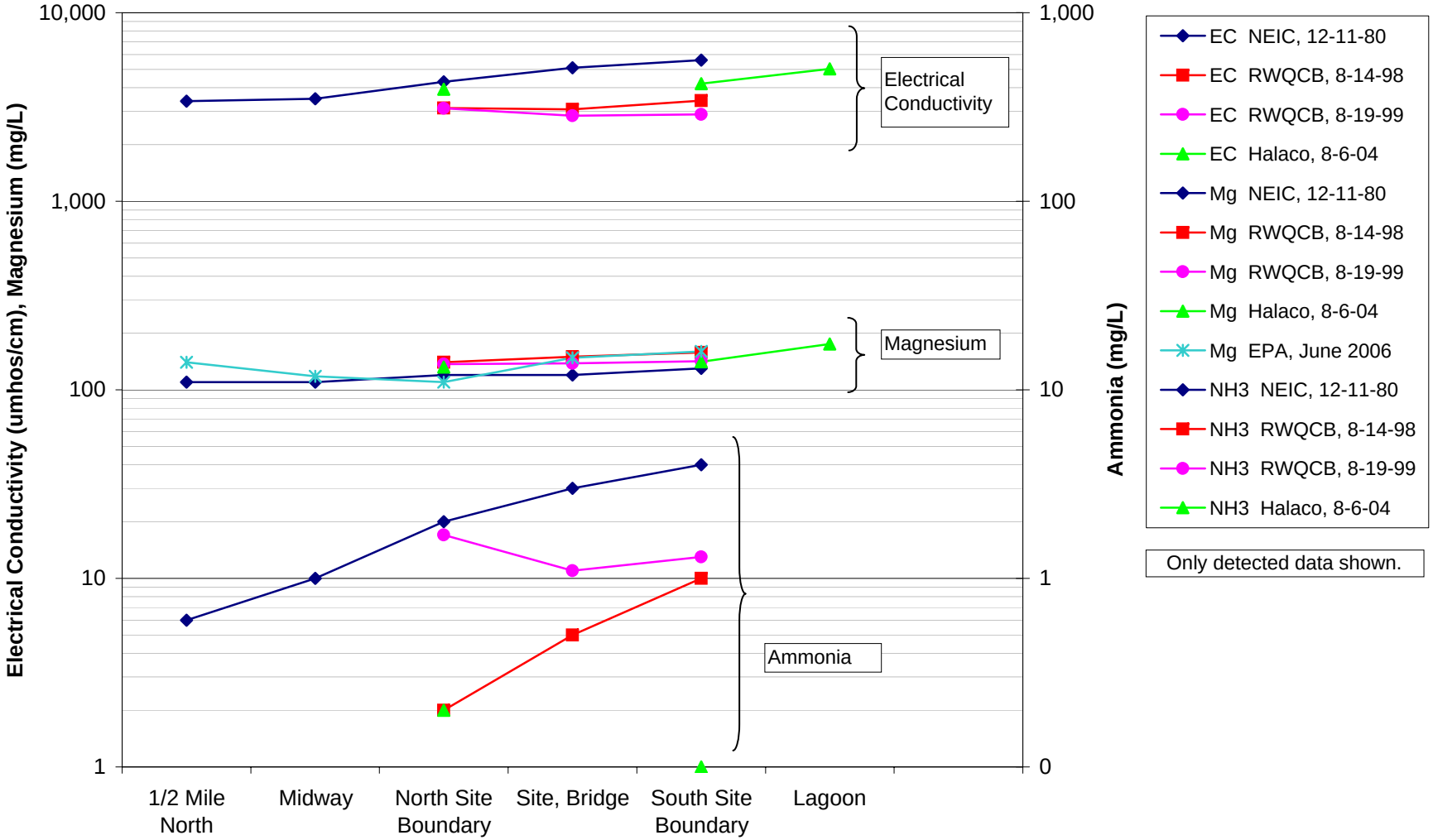


Figure 6-10
Surface Water - Aluminum, Copper, and Zinc
Non-breach Conditions

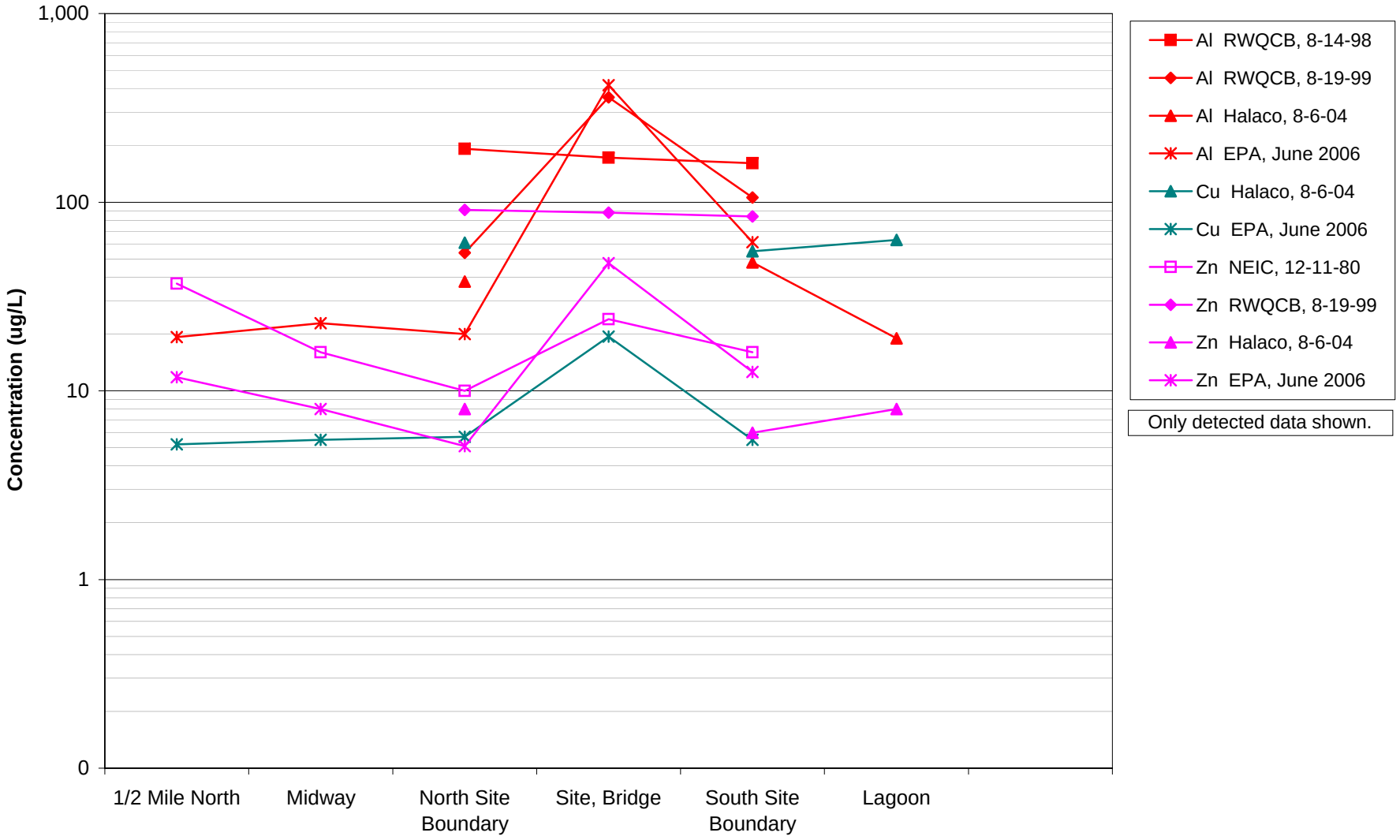


Figure 6-11
Surface Water - Metals
2006 EPA Integrated Assessment

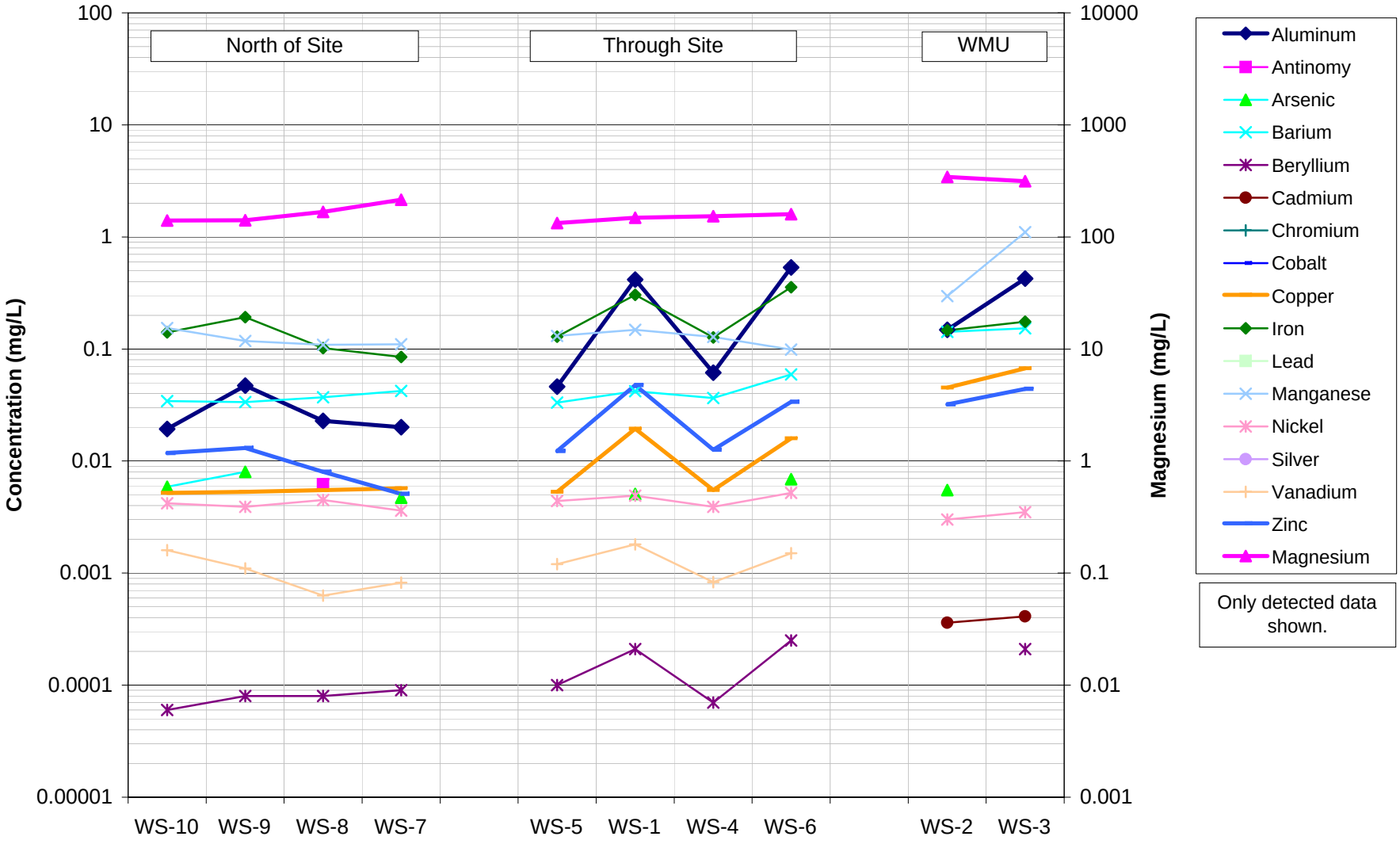


Figure 6-12
Surface Water - General Chemistry
Breach and Non-breach Conditions, 2004

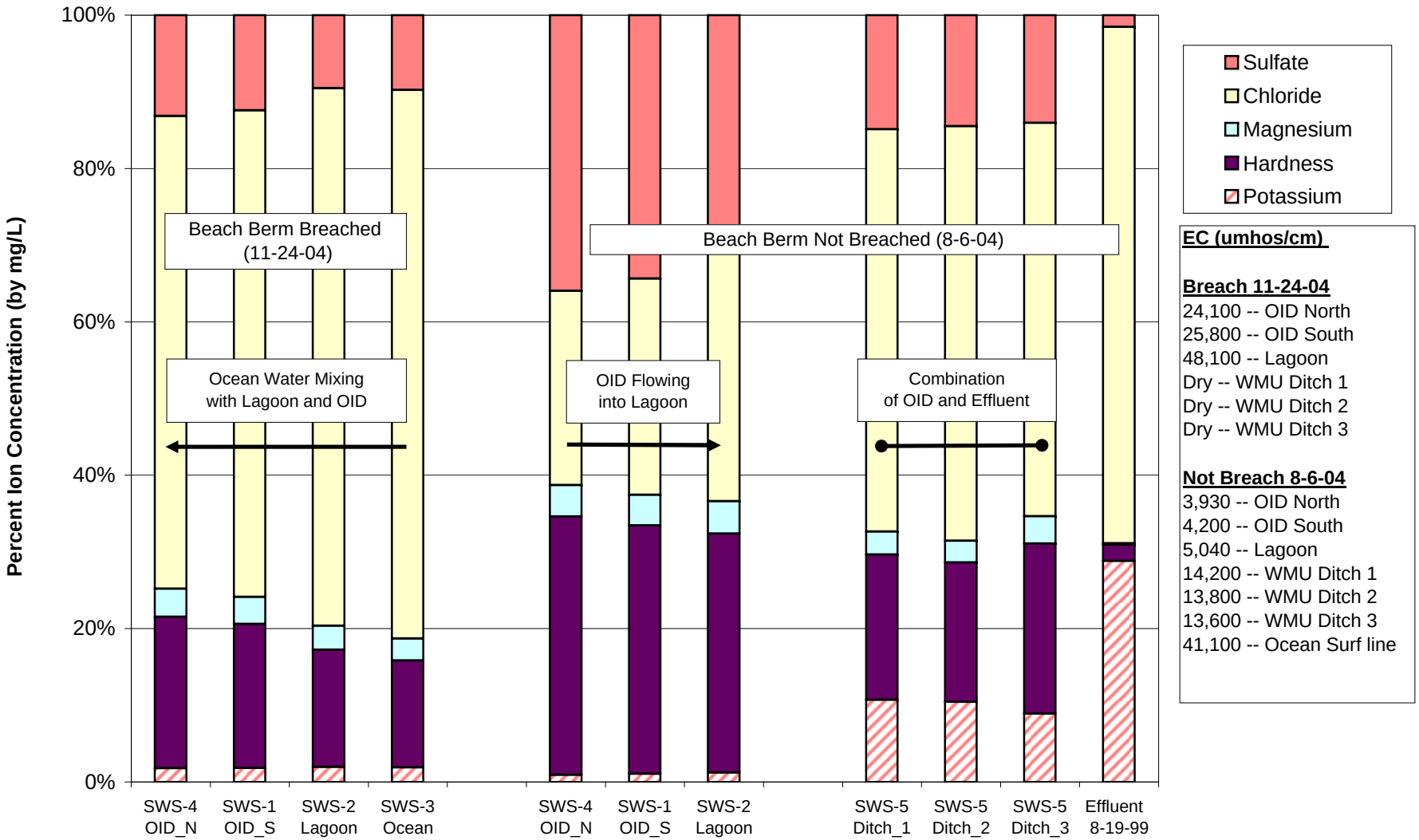


Figure 6-13
Surface Water - General Chemistry
Breach and Non-breach Conditions, 2003 and 2004

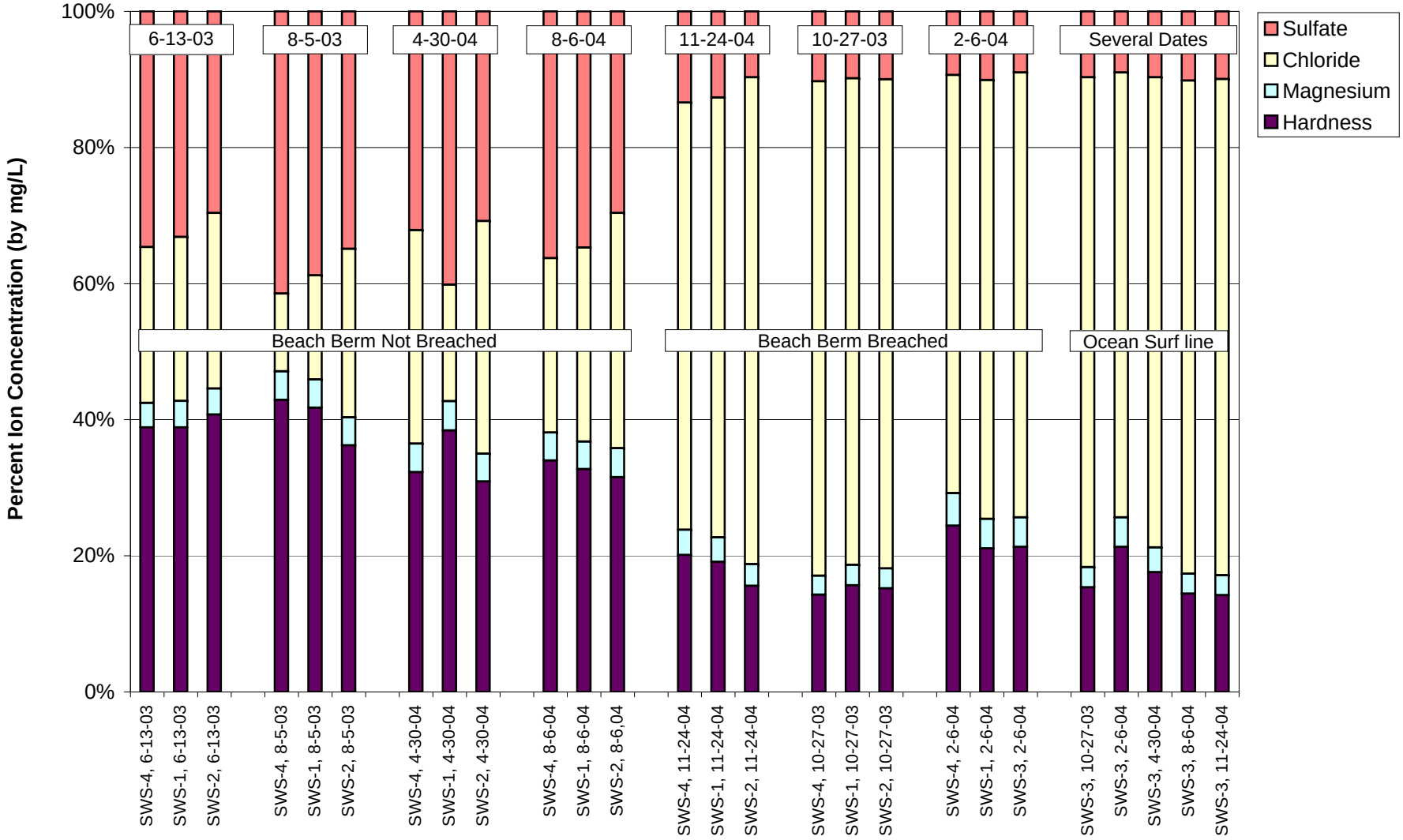


Figure 6-14
Groundwater - Electrical Conductivity
Long-term Monitoring

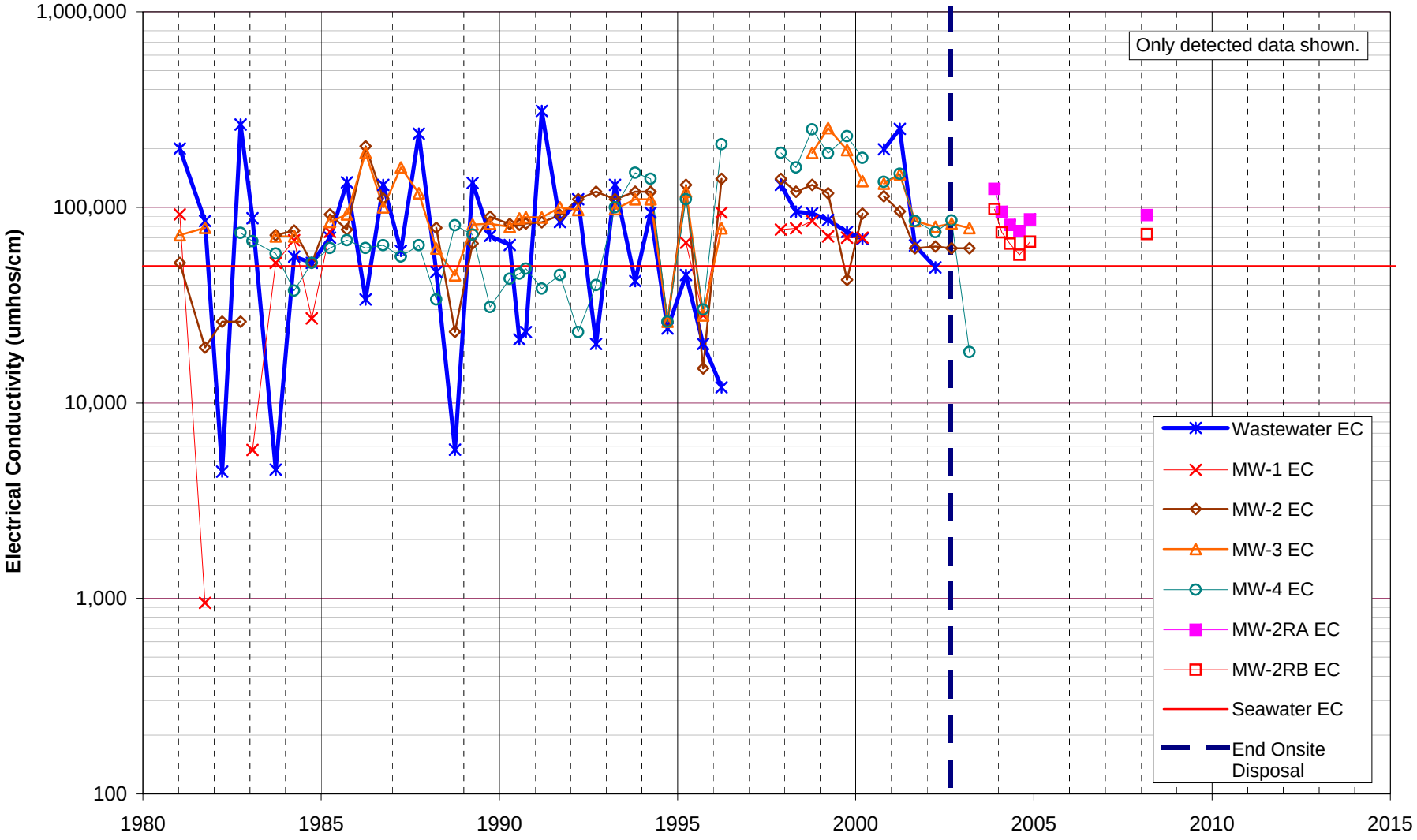


Figure 6-15
Groundwater - Oil & Grease
Long-term Monitoring

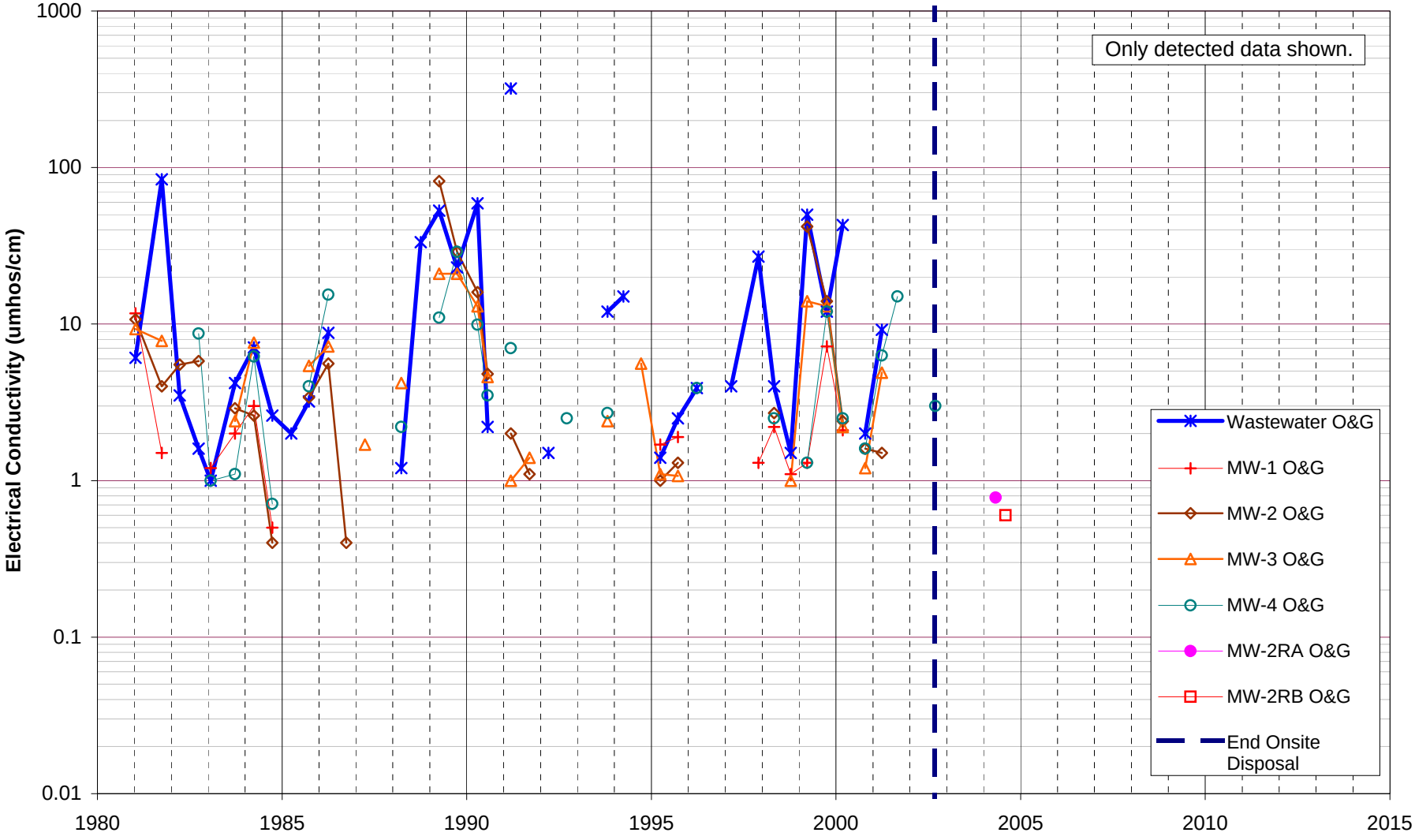


Figure 6-16
Groundwater - Electrical Conductivity
Post Onsite Discharge Monitoring

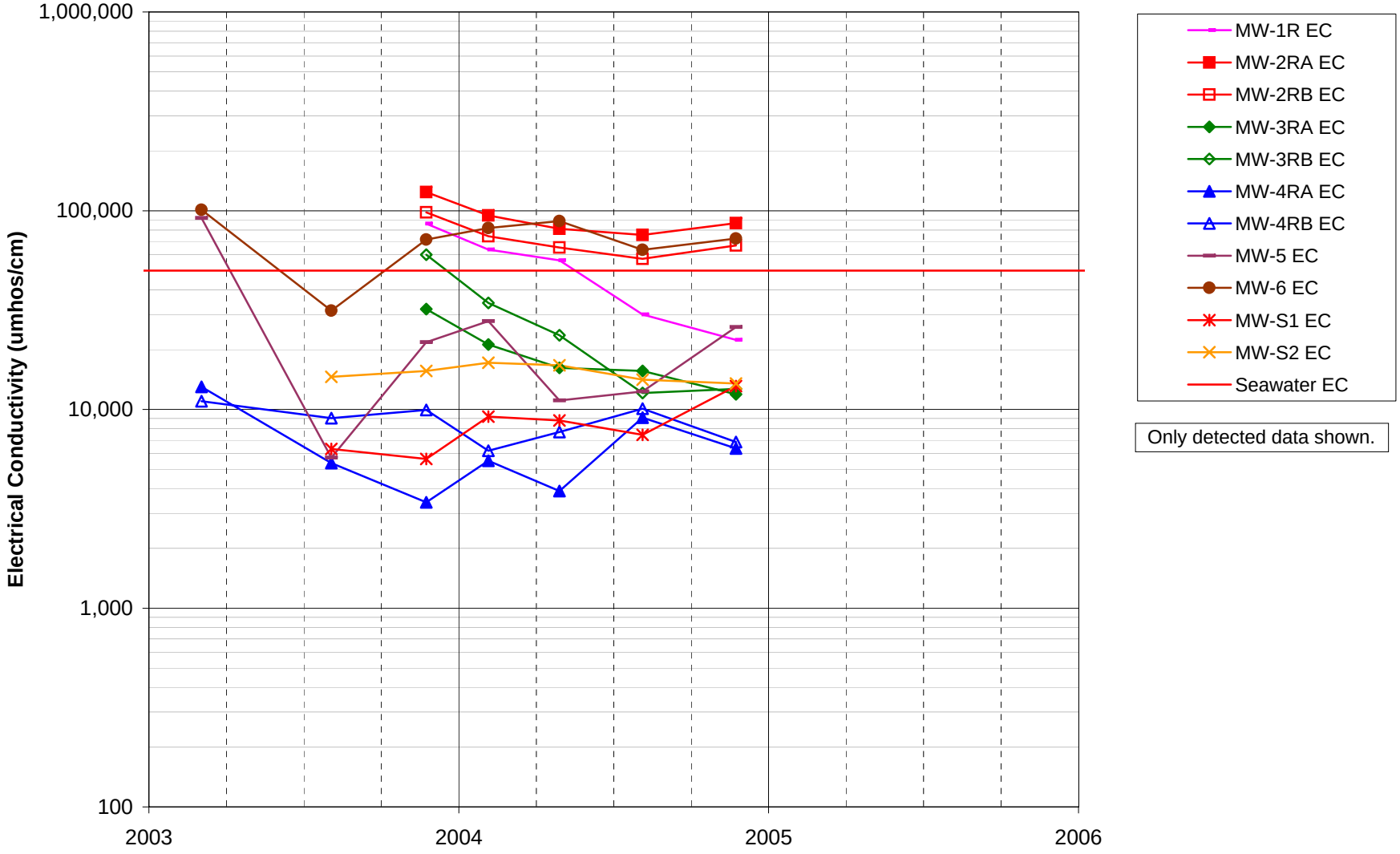


Figure 6-17
Groundwater - Ammonia
Post Onsite Discharge Monitoring

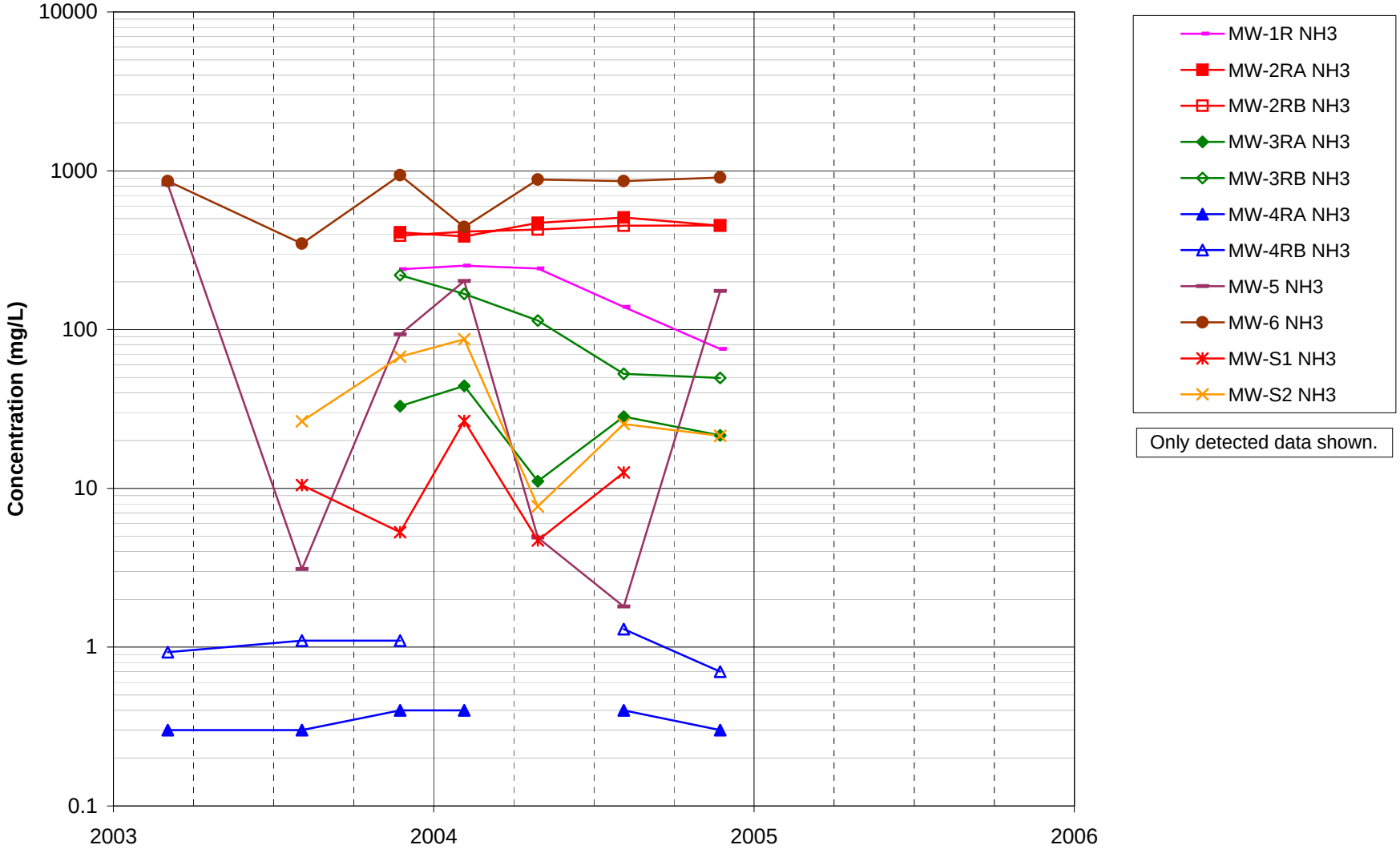


Figure 6-18
Groundwater - Metals
2006 EPA Integrated Assessment

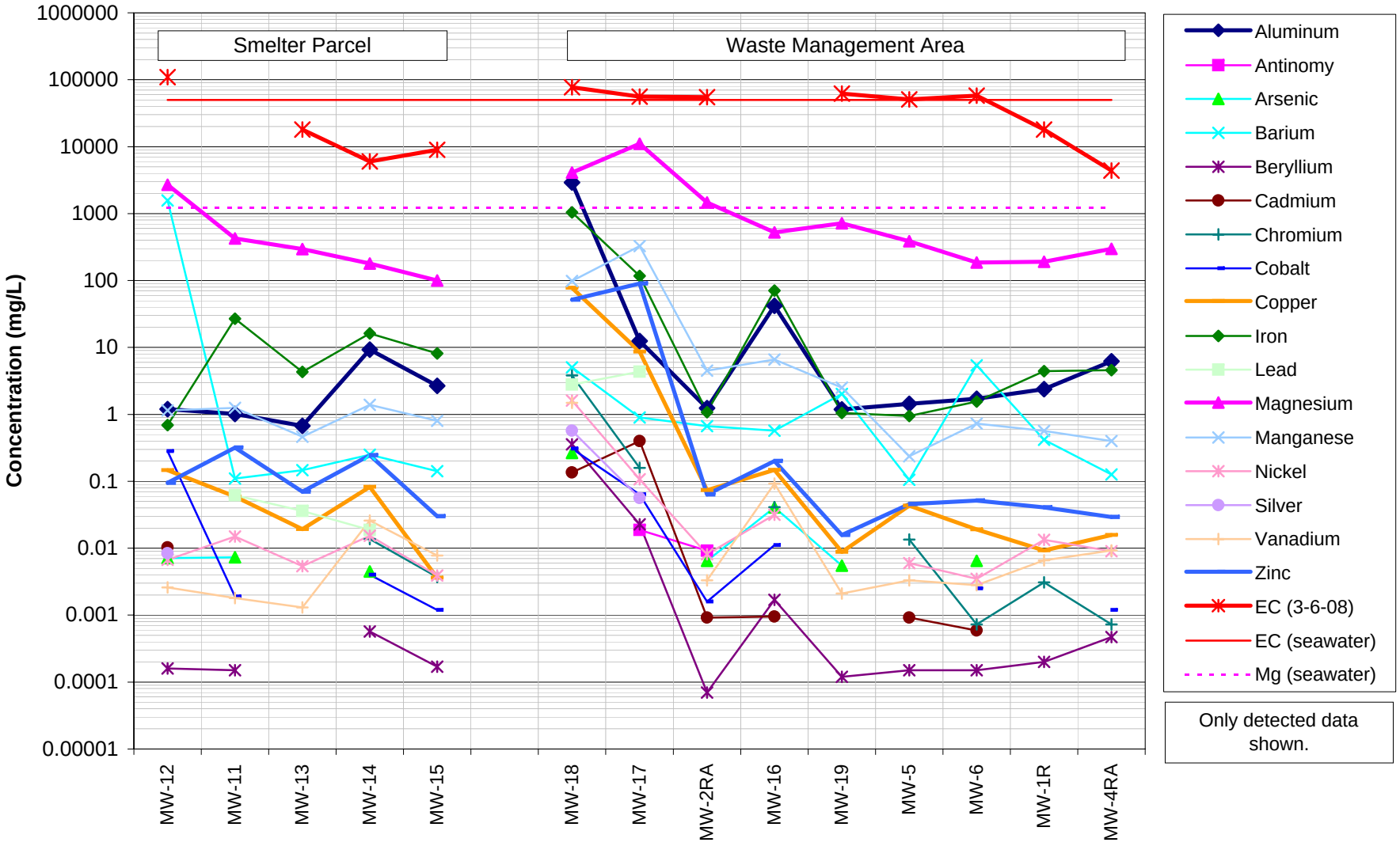
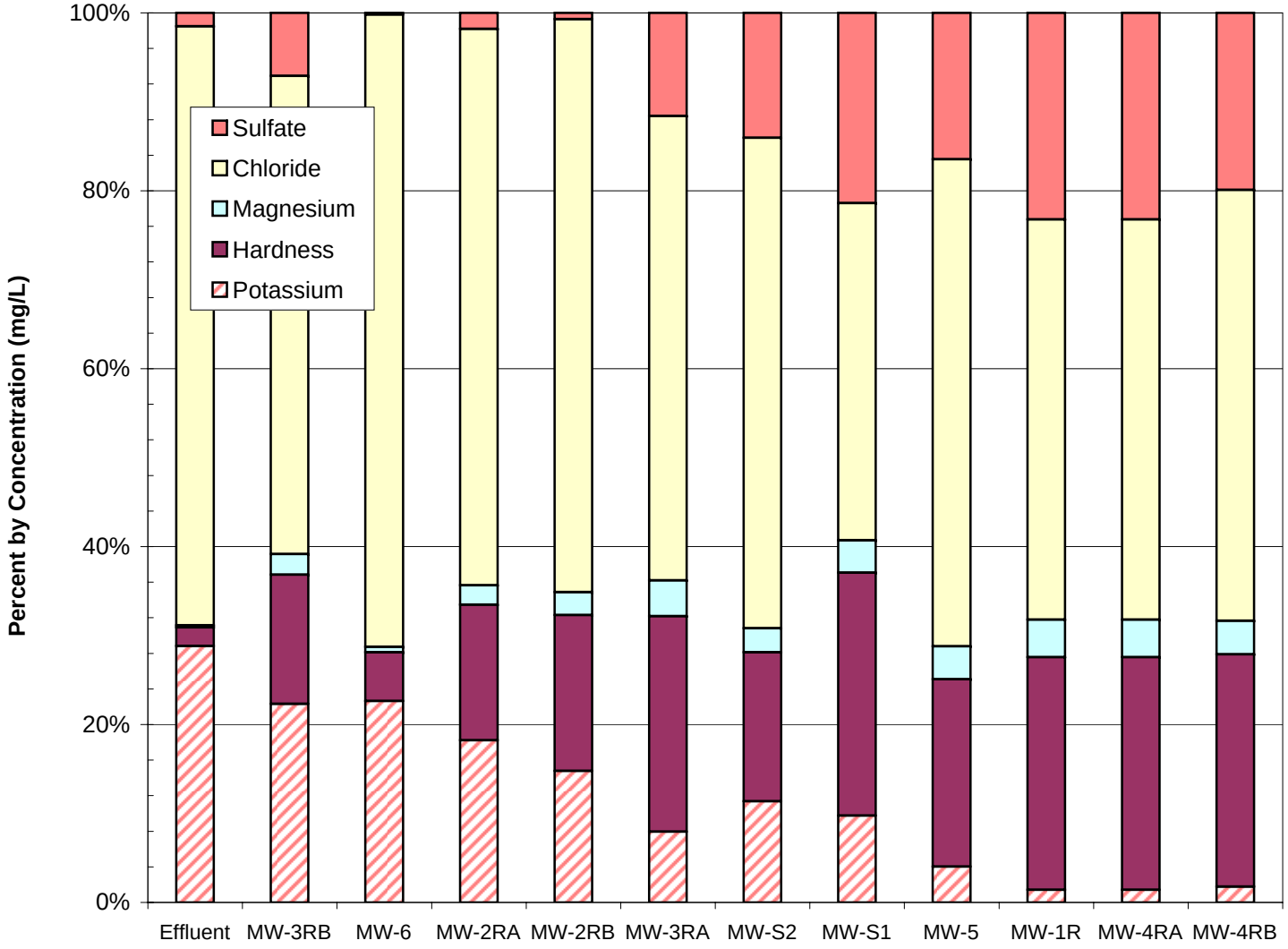


Figure 6-19
Groundwater - General Chemistry
August 6, 2004



TDS (mg/L)
60,700 -- Effluent (8-19-98)
52,600 -- MW-6
74,900 -- MW-2RA
55,000 -- MW-2RB
9,140 -- MW-3RB
12,500 -- MW-3RA
11,500 -- MW-S2
6,710 -- MW-S1
9,980 -- MW-5
24,200 -- MW-1R
8,010 -- MW-4RA
8,490 -- MW-4RB

Ammonia (mg/L)
460 -- Effluent (8-19-98)
861 -- MW-6
508 -- MW-2RA
451 -- MW-2RB
52.6 -- MW-3RB
28.3 -- MW-3RA
25.4 -- MW-S2
12.6 -- MW-S1
1.8 -- MW-5
139 -- MW-1R
0.4 -- MW-4RA
1.3 -- MW-4RB

Appendix A
Metal Recycling Process Description

APPENDIX A

Metal Recycling Process Description

Halaco Operations

Halaco Engineering Company operated a secondary metal smelter at the site from 1965 to 2004, recovering aluminum and magnesium for reuse or resale. Halaco also reports that it recovered zinc until the 1970s. The site includes an 11-acre parcel containing the former smelter and an adjacent 26-acre area where wastes were deposited and managed.

During its 40 years of operation, Halaco acquired metal from a variety of suppliers in a variety of forms, including aluminum cans, aluminum and magnesium dross, car parts, aircraft wheels, machine shop borings, and a radioactive magnesium-thorium alloy. Halaco reports that it processed magnesium-thorium scrap for a limited period, from 1965 to about 1977. Other metals found in aluminum and magnesium alloys include copper, silver, zinc, lead, chromium, titanium, tin, manganese, and nickel. The raw materials were received at the facility or at a railroad spur about one-half mile north of Halaco along Perkins Road, melted in Halaco's natural-gas-fired rotary furnaces, and then cast into various shapes and sizes (e.g., sows, pigs, ingots, and anodes). Sodium chloride, potassium chloride, and magnesium chloride salts (known as "fluxes") were added to improve the recovery of aluminum and magnesium. The molten material in the furnace would stratify, and the recoverable metal was directly cast into large metal blocks or, at times, mixed with small amounts of beryllium, manganese, and possibly other alloying agents to produce alloys meeting product specifications. Some scrap raw materials were washed onsite to remove dirt and other impurities before they were placed in the furnace.

The residual material ("dross") from the furnaces was placed in large, rotating horizontal drums ("washers") located next to the Oxnard Industrial Drain (OID) and sprayed with water to break up the dross, dissolve the salts, and separate the fine oxides and dirt from the recoverable metals. Water was reportedly drawn from the OID and Halaco's settling ponds. A slurry of water, salt, metal particles, and other solids was discharged from the washers into a shaker located in a sump. Larger solids were recovered and separated into magnetic and non-magnetic materials, then sold, disposed of, or returned to the smelter area for use as feedstock.

The remaining slurry was pumped to onsite settling ponds until about September 2002, when Halaco began processing its waste using a filter press. Halaco reports that all operations ceased in September 2004. Halaco stored and used large quantities of diesel fuel and oil in its vehicles and equipment, and used petroleum-based solvents for cleaning.

Halaco operated equipment to reduce air pollution from exhaust gases generated during smelting. Halaco initially operated venturi-type scrubbers, which were later replaced by baghouse filters. Lime and ammonia were used to raise the pH and remove particulate matter. The equipment generated solid and/or liquid waste.

Waste Disposal

During its 40 years of operation, Halaco produced large quantities of solid and liquid waste. The majority of the waste was generated during the smelting process ("process waste"). Other waste was generated by the air pollution control equipment, and from used oil and spent solvent.

From 1965 to about 1970, Halaco discharged much or all of its process waste to a settling pond in or adjacent to the OID, and used waste solids as fill in the smelter area. Correspondence indicates that Halaco considered discharging waste to the sewer in 1965, 1970, and 1979 but it is not known whether discharges occurred.

After the Los Angeles Regional Water Quality Control Board (RWQCB) issued Waste Discharge Requirements in September 1970, Halaco began pumping its wastewater across the OID into unlined earthen settling ponds in the waste management unit (WMU) on the east side of the OID. Beginning in or before 1980, Halaco began moving some of the waste solids from the WMU to the area immediately to the north (the "waste disposal area" [WDA]).

Discharge to the WMU ended in late 2002, when Halaco began using a filter press and discharged wastewater to the City of Oxnard (City) sewer in accordance with an industrial waste discharge permit. Discharges to the sewer ceased in or before June 2003, after the City expressed concern about ammonia in its collection system and exceeded performance goals for metals in its effluent. Halaco reports that wastewater was recycled onsite after discharge to the sewer stopped. Records indicate that an estimated 6,700 tons (or more) of "filter cake" or other waste were shipped offsite for disposal. "Filter cake" left onsite when Halaco ceased operations was later moved to the WMU.

More than 700,000 cubic yards of waste solids remain onsite. The bulk of the solids are in the WMU, which covers about 15 acres and rises up to 40 feet above grade.

Used oil and spent solvent were reportedly disposed of onsite before 2000. Oil and/or solvent wastes were reportedly poured on metal before placement in the furnaces, and mixed with air pollution control equipment waste and put in Halaco's washers. Slurry from the washers was discharged to the onsite settling ponds, as described above.

Appendix B
Historical Aerial Photographs

Contents

B.1 1982 Aerial Photographic Analysis Report
B.2 1991 Aerial Photographic Analysis Report
B.3 Undated Aerial Photograph of Site Operations

Appendix B.1
1982 Aerial Photographic Analysis Report

TS-AMD-82043
May 1982

PHOTOGRAPHIC ANALYSIS OF A WASTE DISPOSAL SITE

Ventura County, California

by

D. R. Williams
Environmental Programs
Lockheed Engineering and Management Services Company, Inc.
Las Vegas, Nevada 89114

Contract No. 68-03-3049

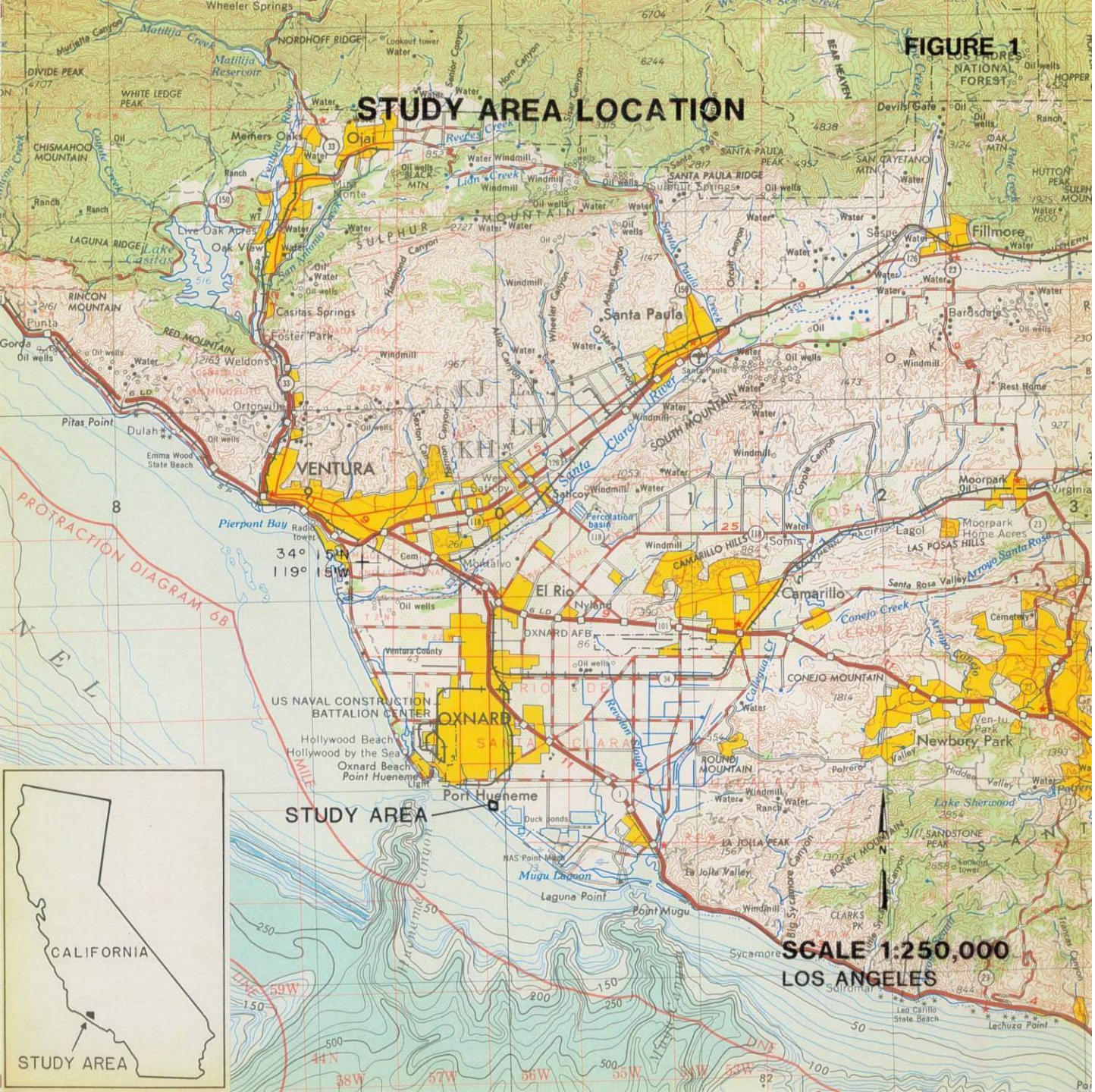
Project Officer

C. E. Lake
Advanced Monitoring Systems Division
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada 89114

ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89114

FIGURE 1

STUDY AREA LOCATION



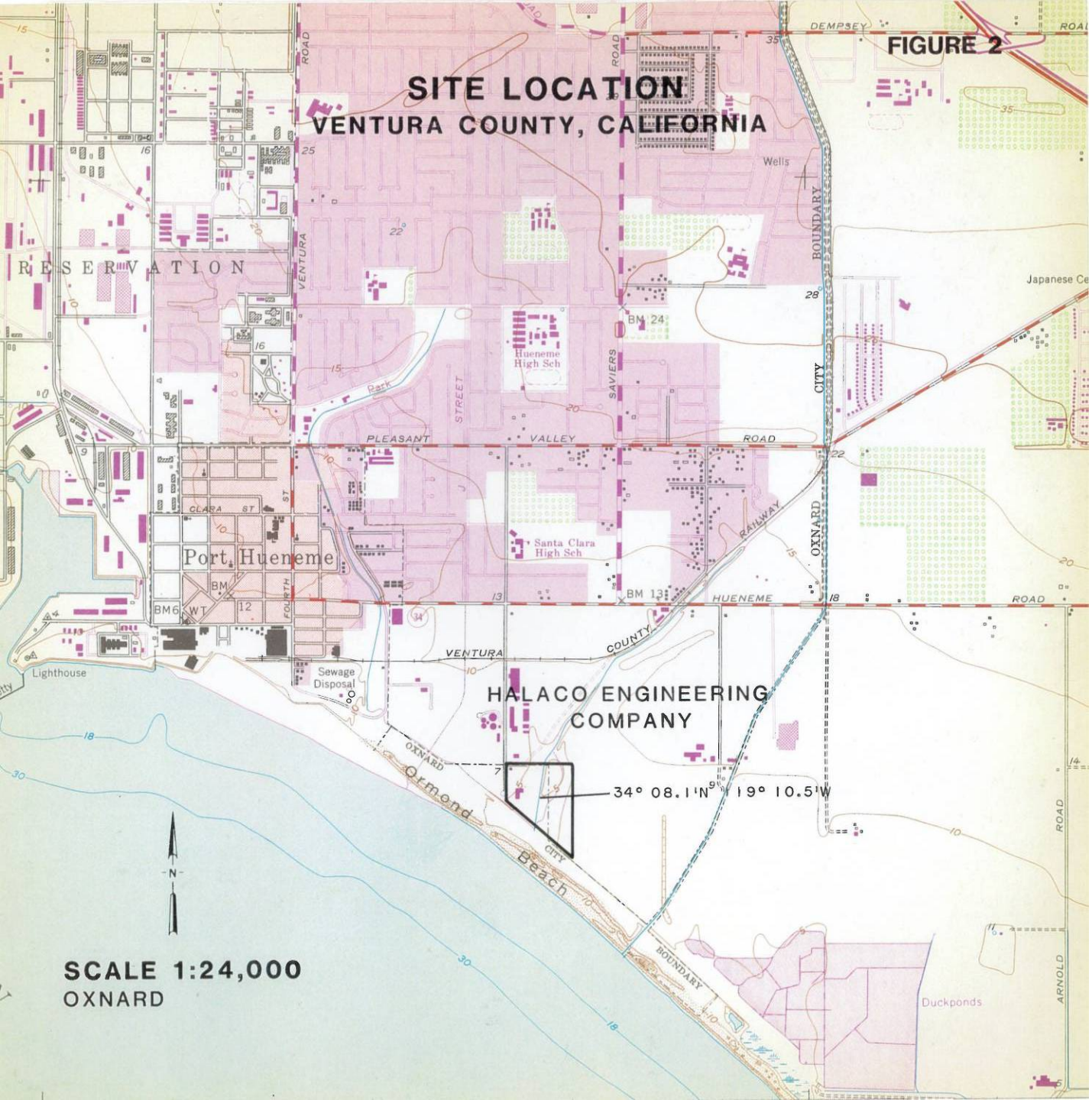


FIGURE 2
SITE LOCATION
VENTURA COUNTY, CALIFORNIA
RESERVATION
Port Hueneme
Hueneme High Sch
Santa Clara High Sch
Wells
Japanese Ce
Lighthouse
Sewage Disposal
HALACO ENGINEERING COMPANY
34° 08.1'N 119° 10.5'W
Ormond Beach
Duckponds
PLEASANT VALLEY ROAD
HUENEME ROAD
VENTURA COUNTY
OXNARD CITY BOUNDARY
SAVIERS ROAD
VENTURA ROAD
DEMPSEY ROAD
ARNOLD ROAD
RAILWAY
CLARA ST
FOURTH ST
N
SCALE 1:24,000
OXNARD

1929

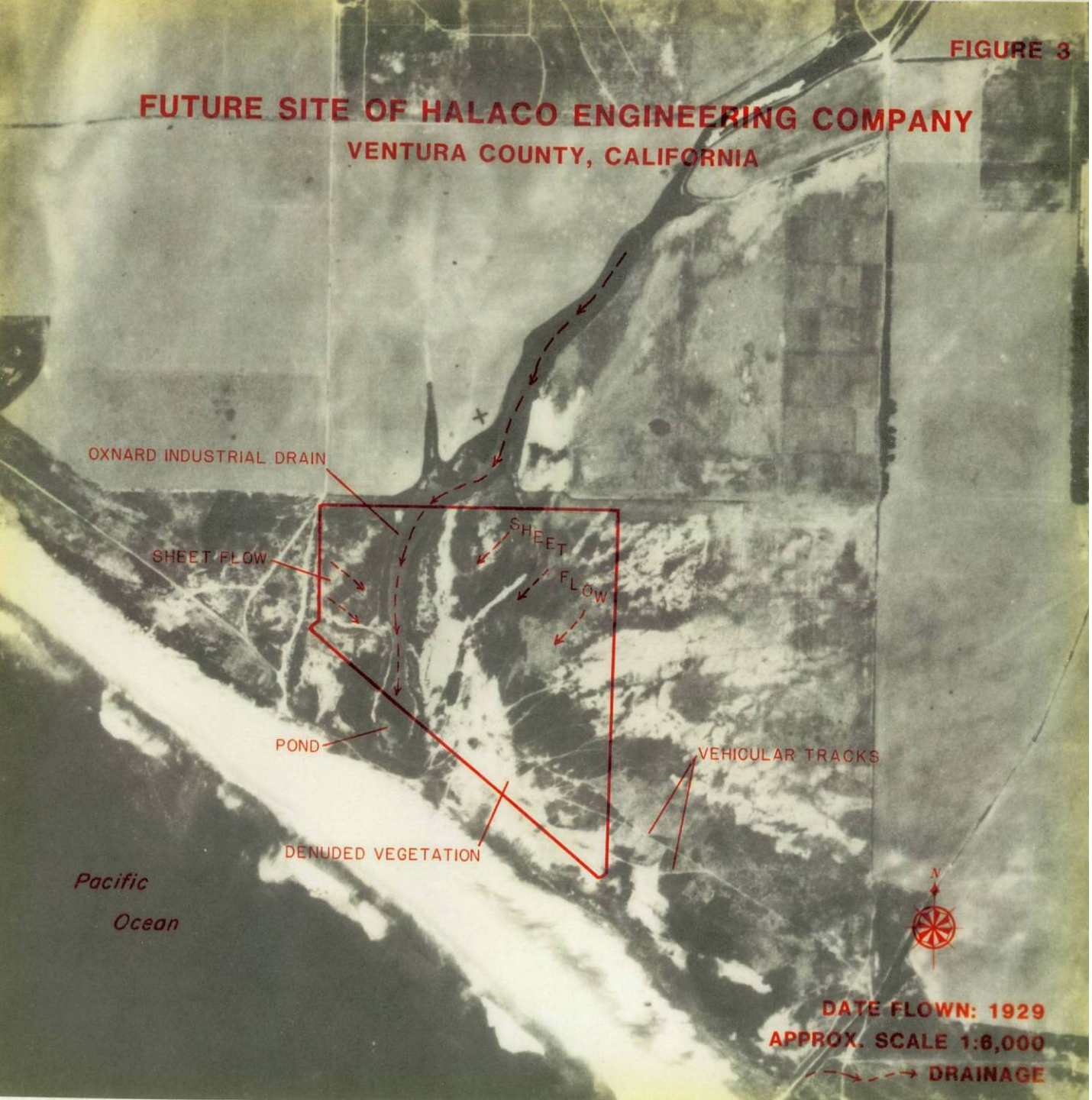
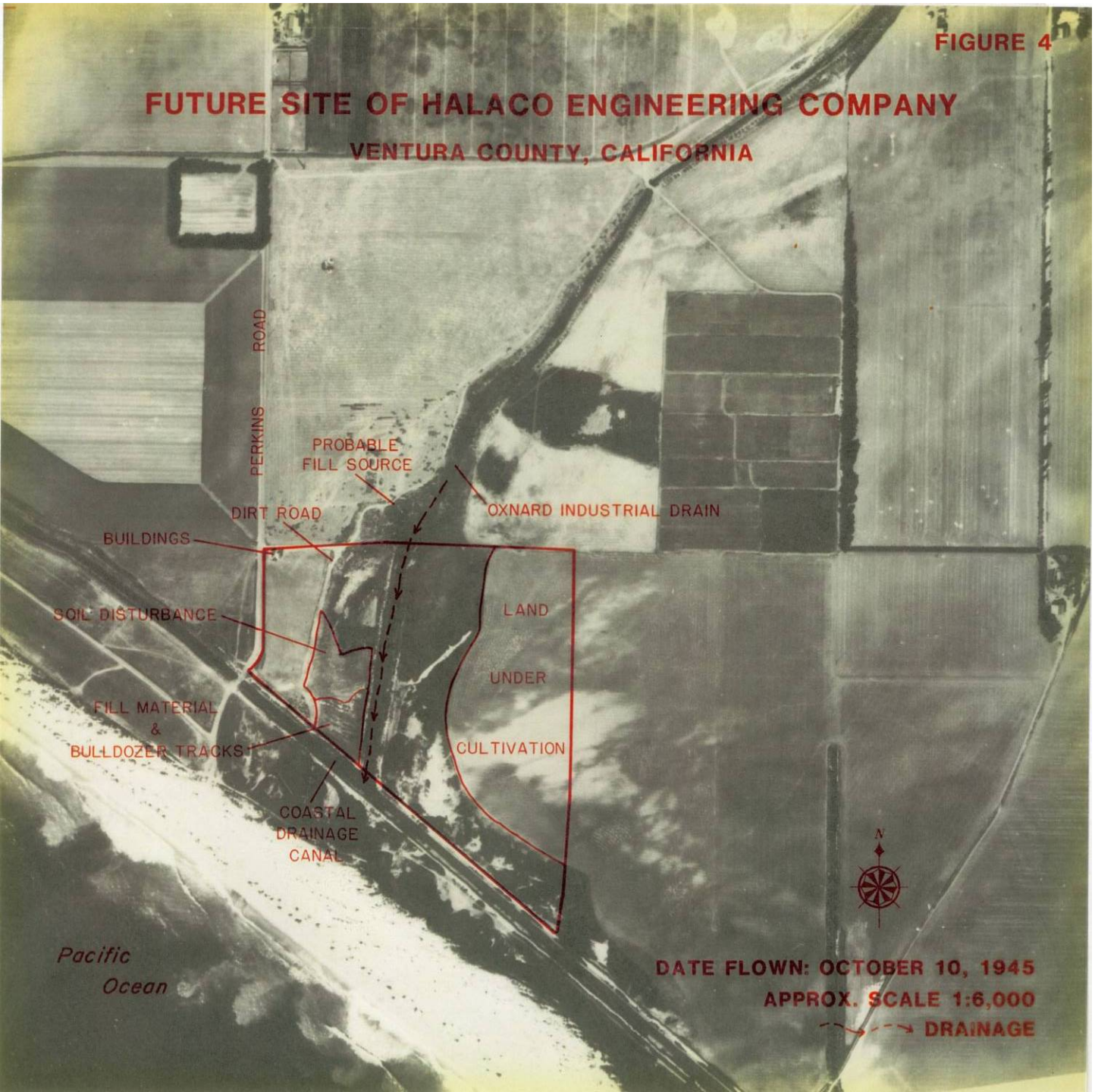


FIGURE 3
FUTURE SITE OF HALACO ENGINEERING COMPANY
VENTURA COUNTY, CALIFORNIA
OXNARD INDUSTRIAL DRAIN
SHEET FLOW
SHEET FLOW
POND
VEHICULAR TRACKS
DENUDED VEGETATION
Pacific
Ocean
N
DATE FLOWN: 1929
APPROX. SCALE 1:6,000
DRAINAGE



October 10, 1945

May 4, 1951

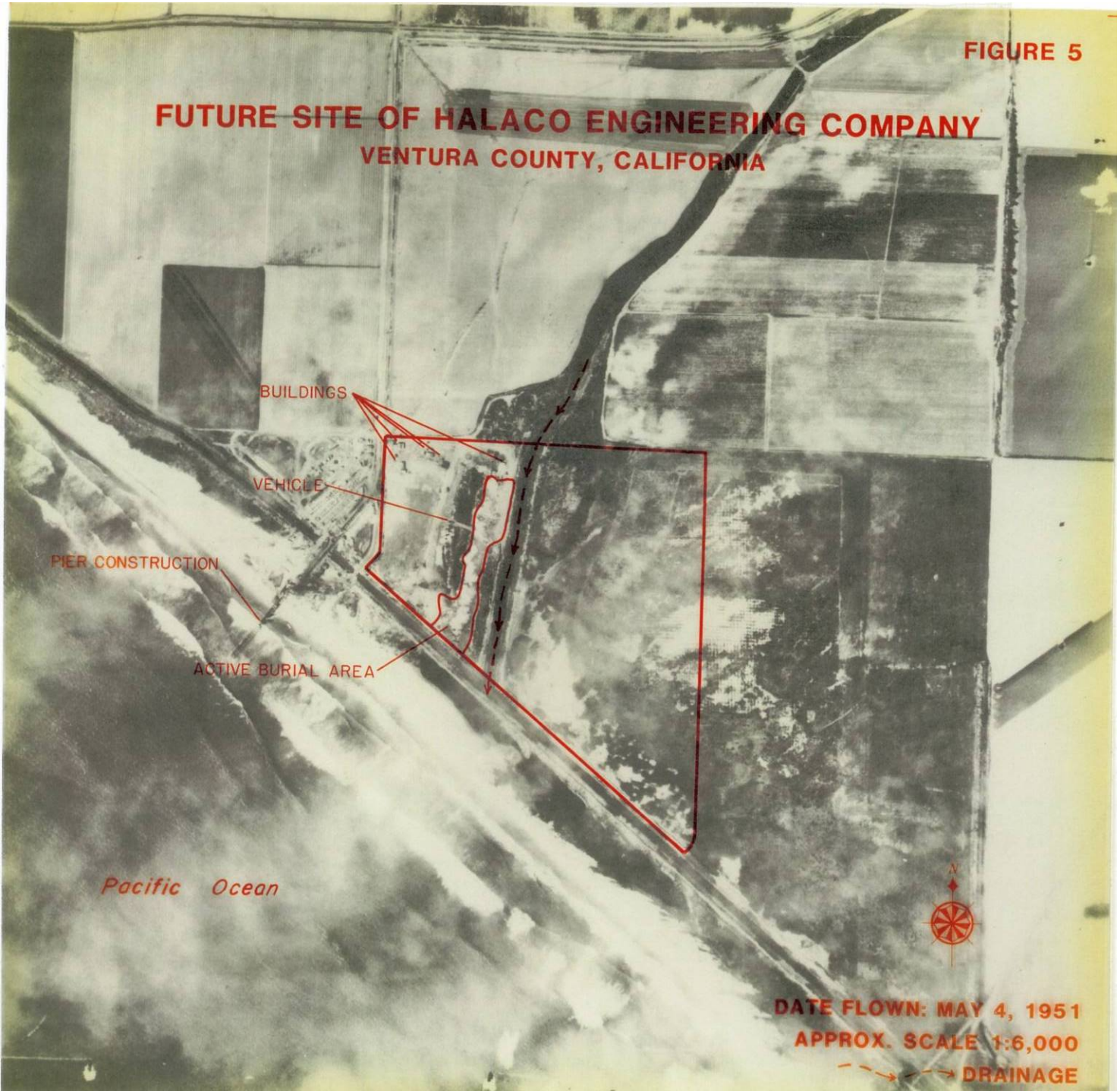
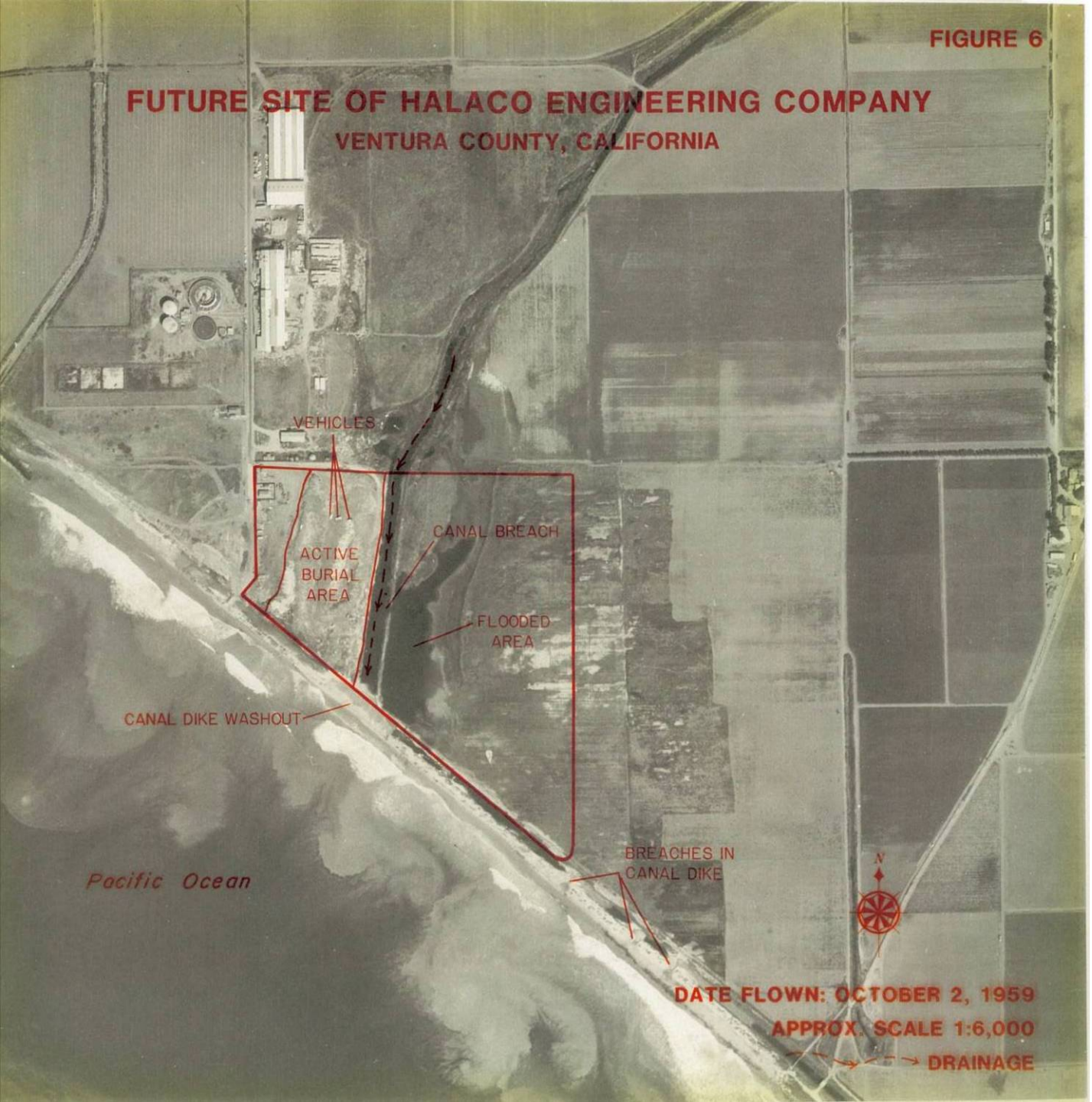
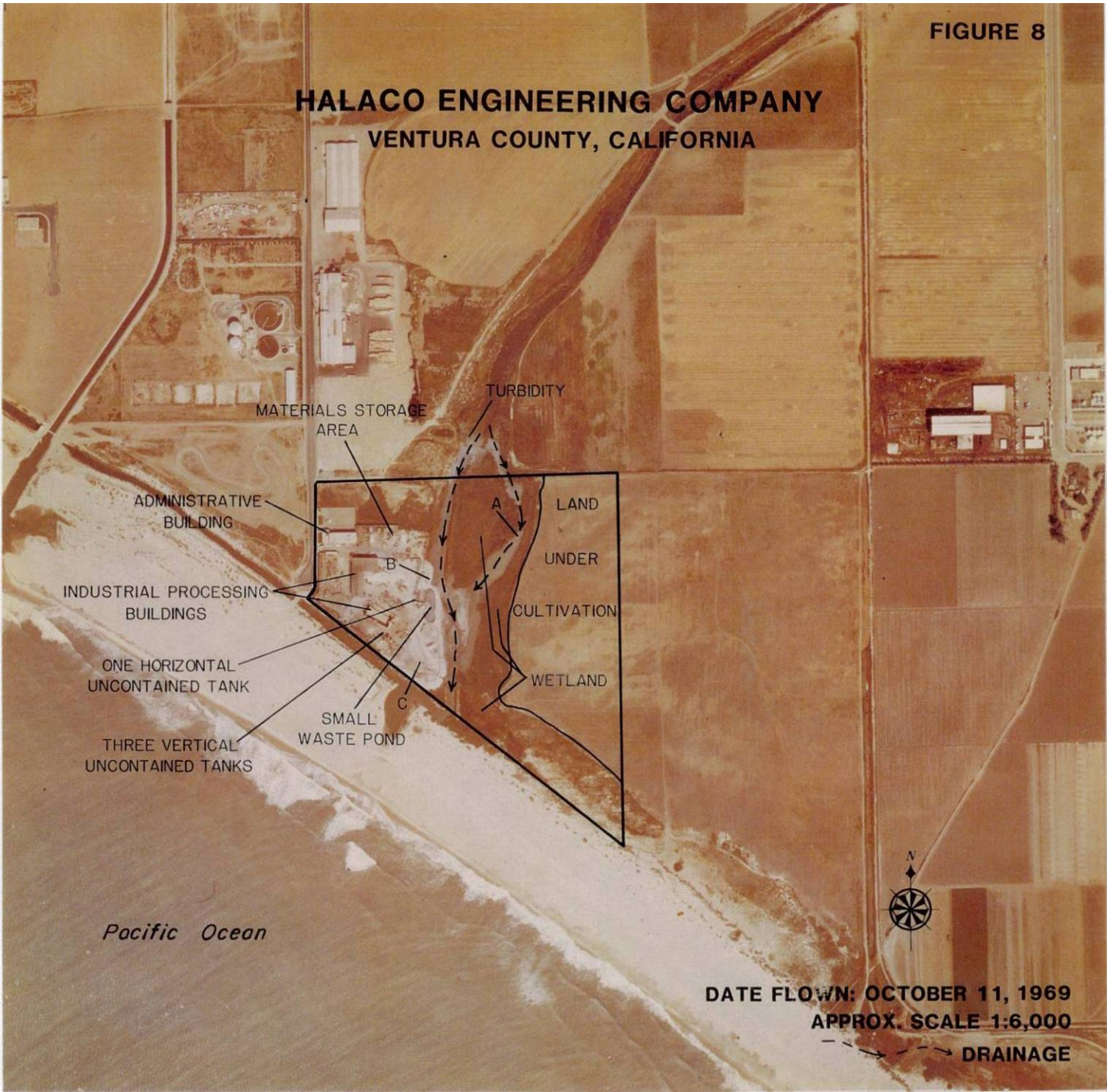


FIGURE 5
FUTURE SITE OF HALACO ENGINEERING COMPANY
VENTURA COUNTY, CALIFORNIA
BUILDINGS
VEHICLE
PIER CONSTRUCTION
ACTIVE BURIAL AREA
Pacific Ocean
N
DATE FLOWN: MAY 4, 1951
APPROX. SCALE 1:6,000
DRAINAGE

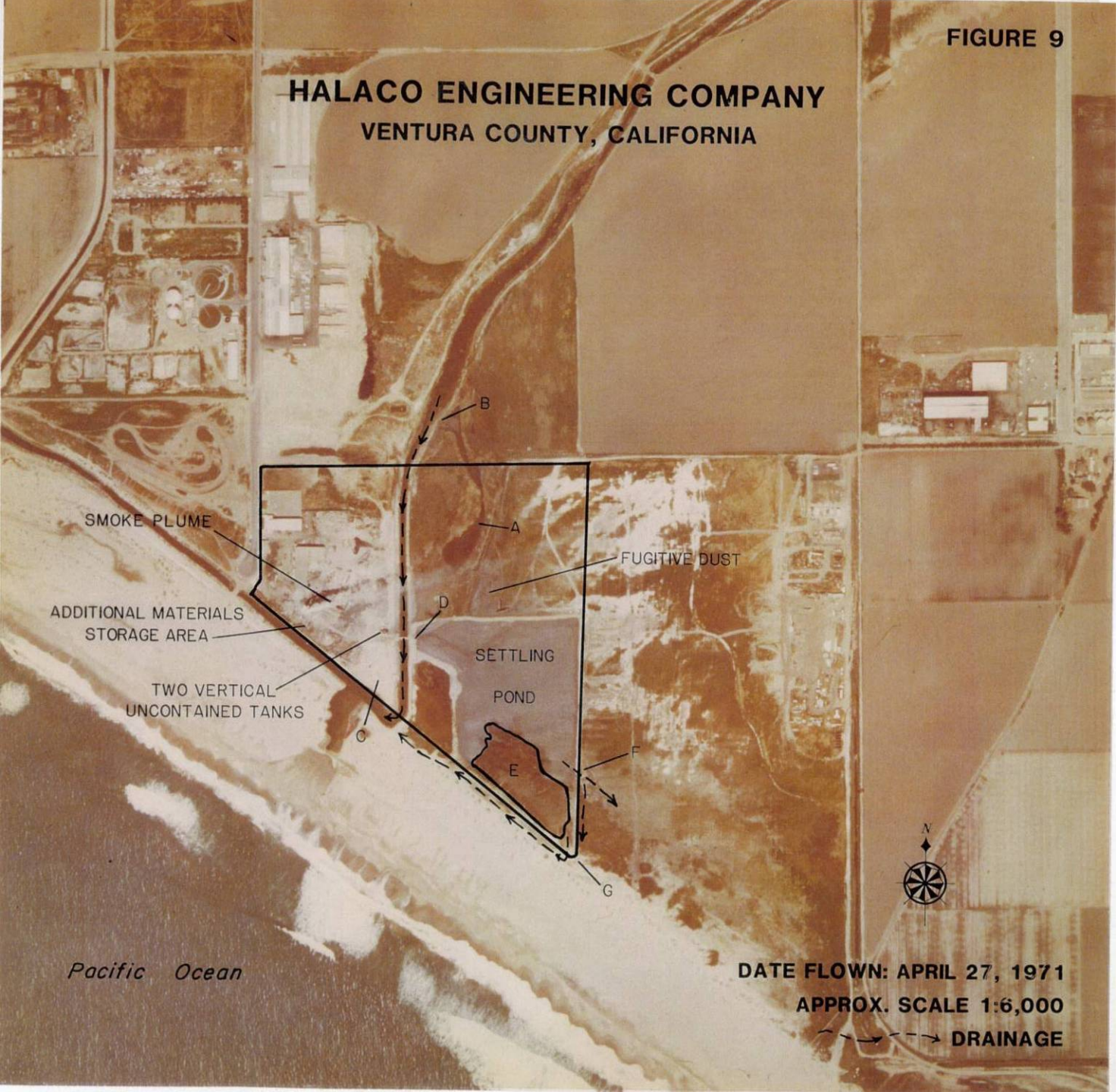


October 2, 1959

September 20, 1965



October 11, 1969



April 27, 1971

March 26, 1972

August 23, 1973

FIGURE 12
HALACO ENGINEERING COMPANY
VENTURA COUNTY, CALIFORNIA
STANDING WATER
ONE VERTICAL CONTAINED TANK
FOUR VERTICAL UNCONTAINED TANKS
ADDITIONAL WASTE MATERIAL
A
B
STANDING WATER
N
DATE FLOWN: MARCH 4, 1974
APPROX. SCALE 1:6,000
DRAINAGE

March 4, 1974

October 7, 1975

FIGURE 14
HALACO ENGINEERING COMPANY
VENTURA COUNTY, CALIFORNIA
ONE HORIZONTAL UNCONTAINED TANK
ADDITIONAL WASTE MATERIAL
POSSIBLE SEEPAGE
STANDING WATER
N
DATE FLOWN: MAY 16, 1978
APPROX. SCALE 1:6,000
DRAINAGE

May 16, 1978

FIGURE 15
HALACO ENGINEERING COMPANY
VENTURA COUNTY, CALIFORNIA
BULLDOZER TRACKS
ADDITIONAL WASTE MATERIAL
DRUM STORAGE
STANDING WATER
ONE HORIZONTAL CONTAINED TANK
WASTEWATER OUTFALL
WATER TREATMENT EQUIPMENT
FIVE VERTICAL UNCONTAINED TANKS
FORMER FILL AREA
Ocean
N
DATE FLOWN: JUNE 22, 1981
APPROX. SCALE 1:6

June 22, 1981

Appendix B.2
1991 Aerial Photographic Analysis Report

TS-PIC-91730
February 1991

AERIAL PHOTOGRAPHIC ANALYSIS OF THE MALACO ENGINEERING FACILITY

Oxnard, California

by

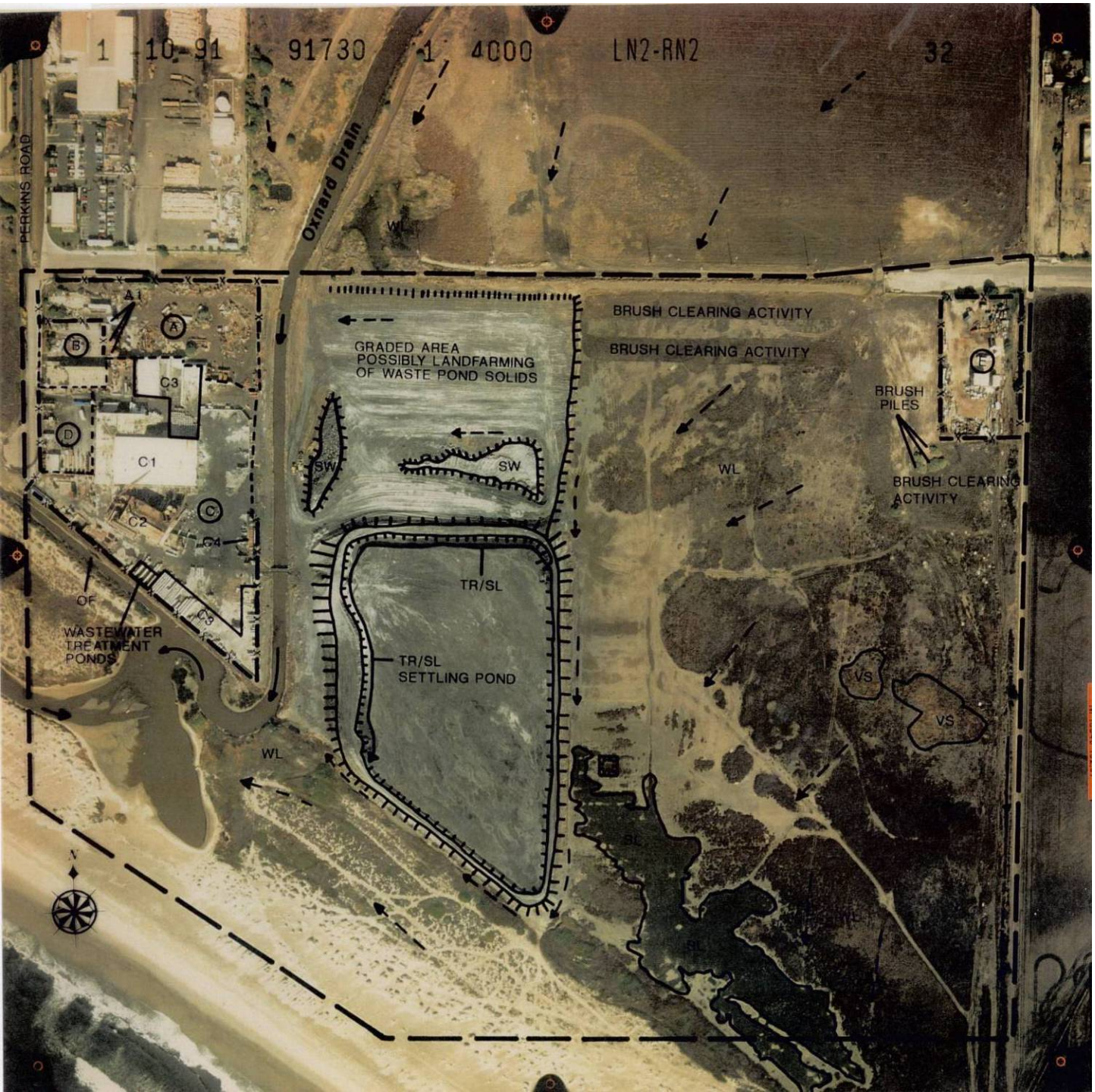
A. B. Divers
Environmental Programs
Lockheed Engineering and Sciences Company
Las Vegas, Nevada 89193-3478

Contract No. 68-C0-0050

Project Officer

P. A. Arberg
Advanced Monitoring Systems Division
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada 89193-3478

ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89193-3478



January 10, 1991

Appendix B.3
Undated Aerial Photograph of Site Operations

Undated Aerial Photograph

Appendix C
Location Maps, Cross Sections, Boring Logs, and Groundwater Monitoring Well Logs

Contents

C.1 1985 Site Investigation Cross Sections (Levine-Fricke, 1985)
C.2 MW-1R through MW-6 (Padre Associates, 2003a and 2003b)
C.3 MW-11 through MW-19 (Weston Solutions, 2007)
C.4 CM-4 (USGS, 1995)

Appendix C.1
1985 Site Investigation Cross Sections
(Levine-Fricke, 1985)

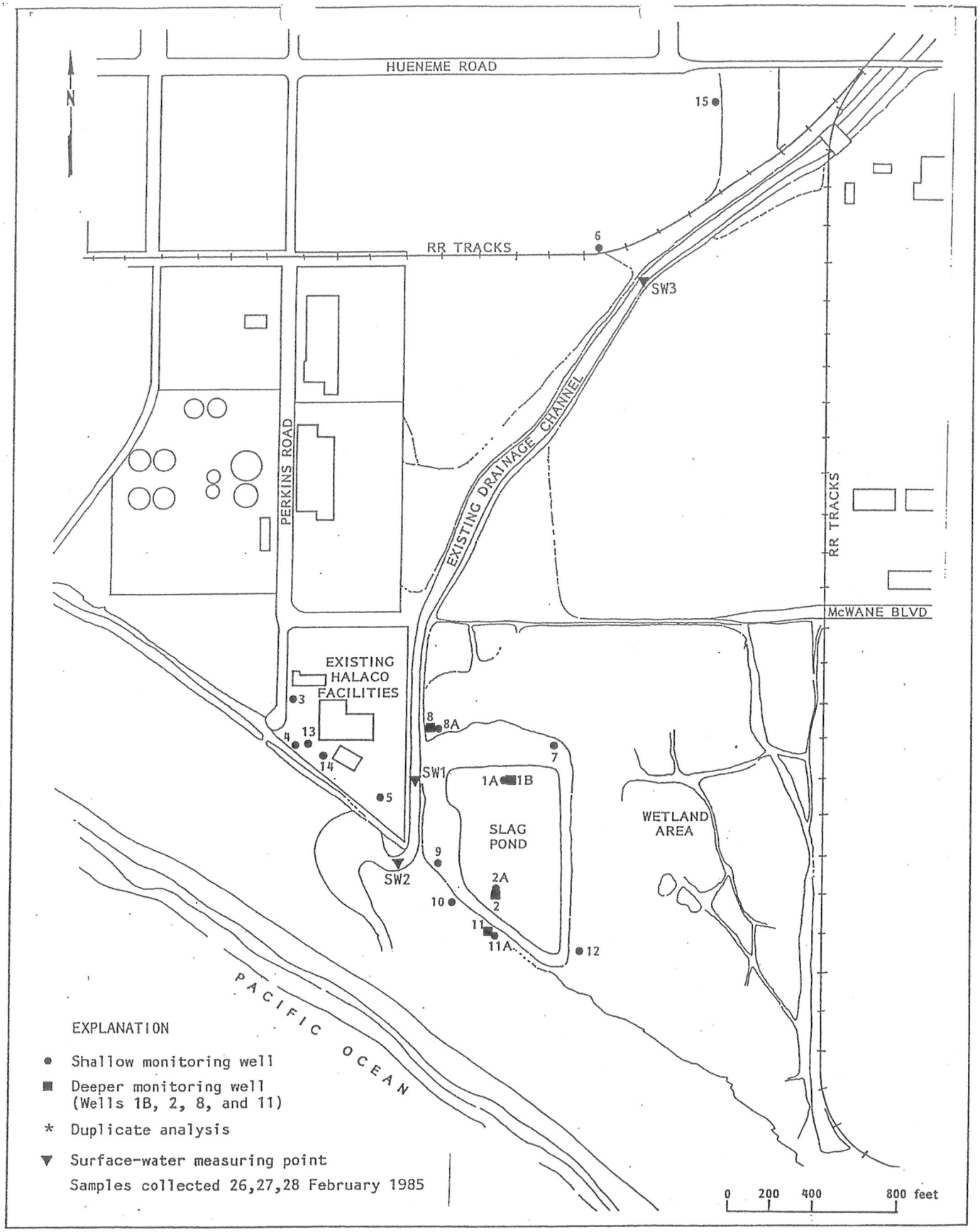


Figure 1 : SITE PHYSIOGRAPHY AND LOCATION OF MONITORING WELLS

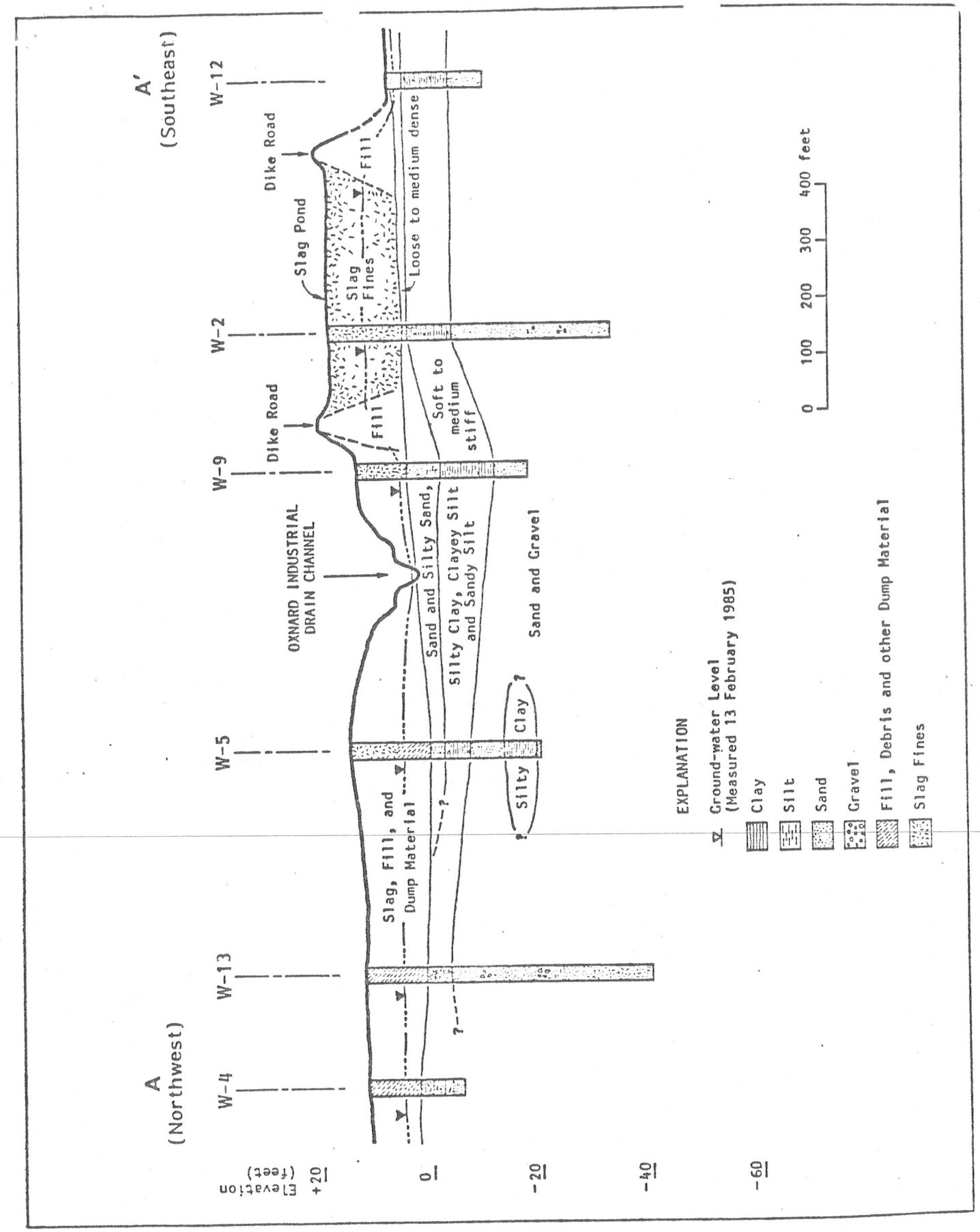


Figure 4: GENERALIZED GEOLOGIC CROSS SECTION A-A'

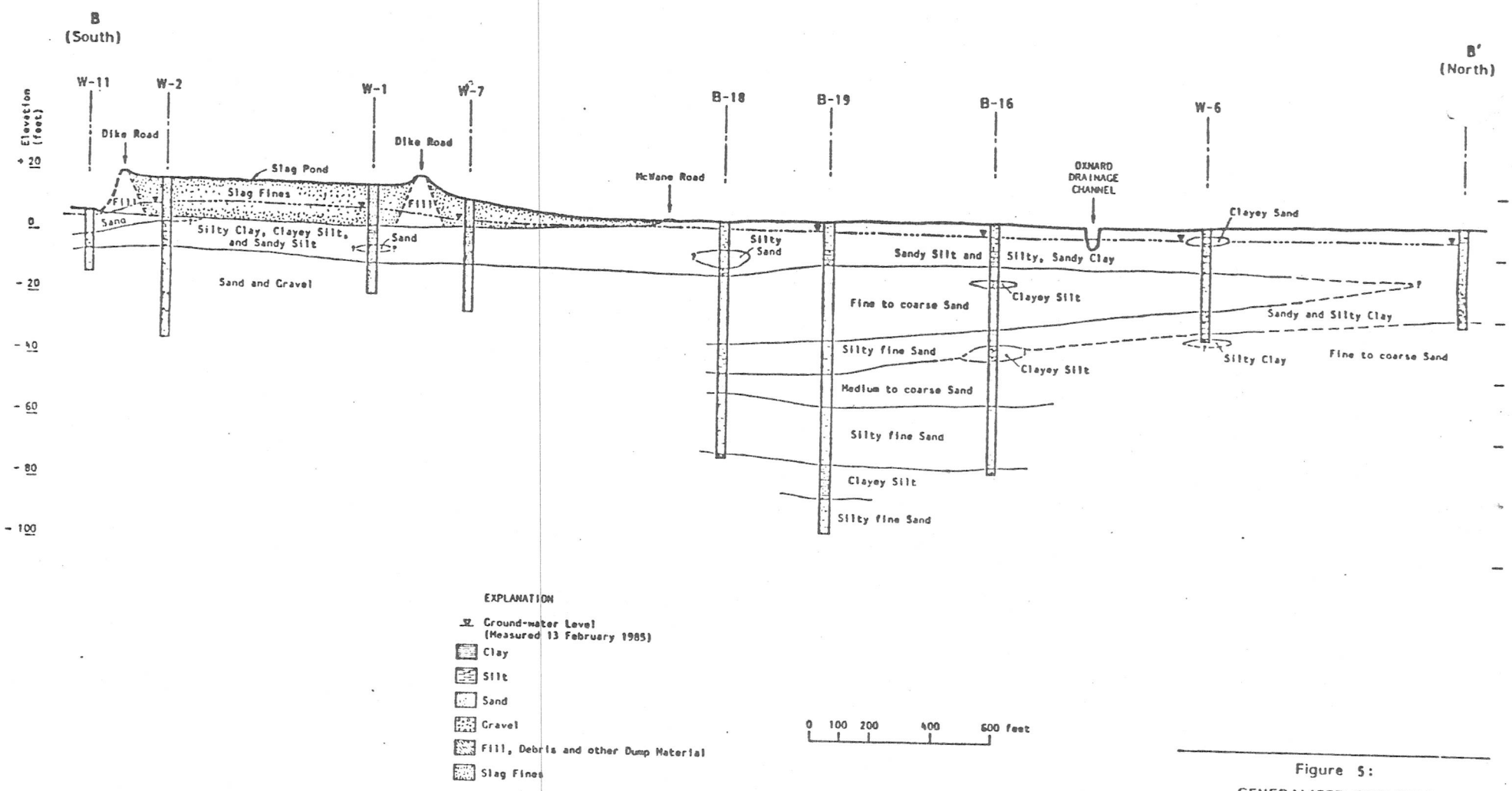


Figure 5:

GENERALIZED GEOLOGIC CROSS SECTION B-B'

Project No. 1448

LEVINE•FRICKE CONSULT AND

N

Appendix C.2
MW-1R through MW-6
(Padre Associates, 2003a and 2003b)

LOG OF BORING MW-1R

(Page 1 of 1)

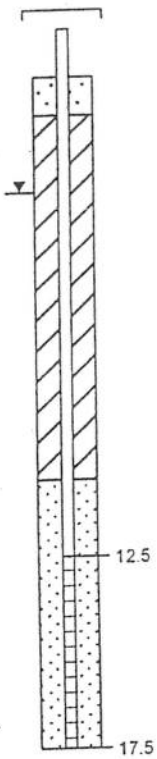
Halaco Engineering Co.
6200 Perkins Road
Oxnard, CA 93033

Project Number	: 0201-0594	Drilling Method	: LAR-Hollow Stem Auger
Project Name	: Halaco Engineering Company	Boring Total Depth	: 17.5 Feet
Logged By	: James T. Tolar	Drilling Date	: 11/6/03
Checked By	: Jerome K. Summerlin	Backfilled With	: 2" Monitoring Well
Driller	: West Hazmat Drilling	Water Depth	: 3 Feet

Depth in Feet	Surf. Elev. 5	USCS	GRAPHIC	Blow Count	Samples	DESCRIPTION
0	5	SP				QUATERNARY DUNE SAND and BEACH SAND (Qds/Qbs) SAND (SP), light brown, gray, damp to saturated, fine to medium grained sand
		ML		20		SILT with Sand (ML), light olive brown, very moist, fine to medium grained sand
5	0	CL		15 11 14		QUATERNARY ESTUINE DEPOSITS (Qe) Silty CLAY to CLAY (CL), light olive brown, light brown, damp to moist, intervals mottled, minor caliche
10	-5			9 15		
15	-10	SP		21 22 24		QUATERNARY BEACH SAND (Qbs) SAND (SP), dark gray, wet, fine grained sand, micaceous
20	-15					
25	-20					
30						

Total depth = 17.5 ft.
Groundwater encountered at 2.5 ft. and at 12.5 ft.

Well: MW-1R
Elev.: 7.87



Well Construction Information

NOTES
Well Monument set in concrete rises approximately 3 feet above ground surface and is affixed with an external lock.

2" locking well cap
Blank casing - sch 40 PVC 2" diameter
Slotted casing - sch 40 PVC - 0.020" screen slots.
2" diameter flush threaded
End cap - flush threaded

Concrete seal - quickcrete/concrete
Bentonite seal - hydrated bentonite chips
Gravel pack - No. 3 Monterey Sand

General notes:

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

12-10-2003 c:\mtech5\halaco\mw-1.bor

Boring log for MW-2RA – unavailable at this time

LOG OF BORING MW-2RB

(Page 1 of 1)

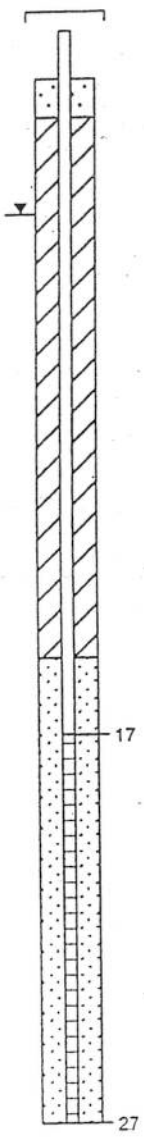
Halaco Engineering Co.
6200 Perkins Road
Oxnard, CA 93033

Project Number	: 0201-0594	Drilling Method	: LAR-Hollow Stem Auger
Project Name	: Halaco Engineering Company	Boring Total Depth	: 27 Feet
Logged By	: James T. Tolar	Drilling Date	: 11/6/03
Checked By	: Jerome K. Summerlin	Backfilled With	: 2" Monitoring Well
Driller	: West Hazmat Drilling	Water Depth	: 3 Feet

Depth in Feet	Surf. Elev. 5	USCS	GRAPHIC	Blow Count	Samples	DESCRIPTION
0	5	AF		13		ARTIFICIAL FILL (AF) Silty Sand (SM) and SILT (ML), olive brown, damp to moist, fine to medium grained sand, metal fragments, slag
		SM/ML		15		QUATERNARY DEPOSITS (Qd) Silty SAND (SM) to SILT (ML), olive brown, dark gray, light olive brown, moist to saturated, fine to medium grained sand, organics, 6-inch interval of saturated sand at 3 feet
5	0			8		
		CL		12		CLAY to Silty CLAY (CL), olive brown, damp to moist, micaceous
				15		
		SM/ML		15		Silty SAND (SM) to SILT (ML), olive brown, gray, dark brown, moist to saturated, fine grained sand
10	-5			15		CLAY to Silty CLAY (CL), olive brown, gray, damp to moist, micaceous, intervals of silt
				15		
		CL		13		
15	-10			13		Dark gray, organic rich
				14		
		SP		20		QUATERNARY BEACH SAND (Qbs) SAND (SP), gray brown, wet, fine grained sand
20	-15			21		
				22		
25	-20			23		
30						

Total depth = 27 ft.
Groundwater encountered at 3 ft. and at 17.5 ft.

Well: MW-2RB
Elev.: 7.25



Well Construction Information

NOTES
Well Monument set in concrete rises approximately 3 feet above ground surface and is affixed with an external lock.

2" locking well cap
Blank casing - sch 40 PVC 2" diameter
Slotted casing - sch 40 PVC - 0.020" screen slots,
2" diameter flush threaded
End cap - flush threaded

Concrete seal - quickcrete/concrete
Bentonite seal - hydrated bentonite chips
Gravel pack - No. 3 Monterey Sand

General notes:

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

12-10-2003 c:\mtech5\halaco\mw-2b.bor

LOG OF BORING MW-3RA

(Page 1 of 1)

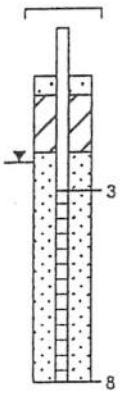
Halaco Engineering Co.
6200 Perkins Road
Oxnard, CA 93033

Project Number	: 0201-0594	Drilling Method	: LAR - Hollow Stem Auger
Project Name	: Halaco Engineering Company	Boring Total Depth	: 8 Feet
Logged By	: James T. Tolar	Drilling Date	: 11/5/03
Checked By	: Jerome K. Summerlin	Backfilled With	: 2" Monitoring Well
Driller	: West Hazmat Drilling	Water Depth	: 2 Feet

Depth in Feet	Surf. Elev. 5	USCS	GRAPHIC	Blow Count	Samples	DESCRIPTION
0	5	SP		19, 21, 22, 23, 15		QUATERNARY DUNE SAND and BEACH SAND (Qds/Qbs) SAND (SP), light brown, gray, damp to wet, fine to medium grained sand Saturated at 1.5 feet Wet, shell fragments, minor coarse grained sand and gravel
5	0	OL		19		QUATERNARY ESTUINE DEPOSITS (Qe) SILT (OL), dark gray to black, wet, micaceous, plastic, organic odor
10	-5	CL		23		Silty CLAY to CLAY (CL), light olive brown to light brown, damp to moist, micaceous
15	-10	SP		27, 30, 22, 24, 24		QUATERNARY BEACH SAND (Qbs) SAND (SP), dark gray, wet, fine grained sand, micaceous
20	-15					
25	-20					
30						

Total depth = 8 ft.
Groundwater encountered at 2 ft.

Well: MW-3RA
Elev.: 7.34



Well Construction Information

NOTES

Well Monument set in concrete rises approximately 3 feet above ground surface and is affixed with an external lock.

2" locking well cap
Blank casing - sch 40 PVC 2" diameter
Slotted casing - sch 40 PVC - 0.020" screen slots,
2" diameter flush threaded
End cap - flush threaded

Concrete seal - quickcrete/concrete
Bentonite seal - hydrated bentonite chips
Gravel pack - No. 3 Monterey Sand

General notes:

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

12-10-2003 c:\mtech5\halaco\mw-3a.bor

LOG OF BORING MW-3RB

(Page 1 of 1)

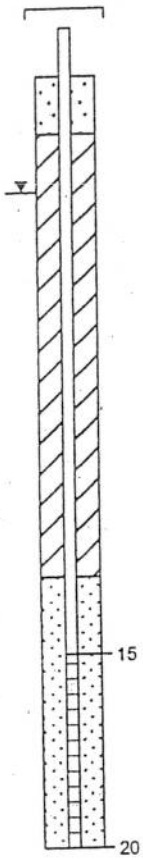
Halaco Engineering Co.
6200 Perkins Road
Oxnard, CA 93033

Project Number	: 0201-0594	Drilling Method	: LAR-Hollow Stem Auger
Project Name	: Halaco Engineering Company	Boring Total Depth	: 20 Feet
Logged By	: James T. Tolar	Drilling Date	: 11/5/03
Checked By	: Jerome K. Summerlin	Backfilled With	: 2" Monitoring Well
Driller	: West Hazmat Drilling	Water Depth	: 2 Feet

Depth in Feet	Surf. Elev. 5	USCS	GRAPHIC	Blow Count	Samples	DESCRIPTION
0	5	SP		19, 21, 22, 23, 15		QUATERNARY DUNE SAND and BEACH SAND (Qds/Qbs) SAND (SP), light brown, gray, damp to wet, fine to medium grained sand Saturated at 1.5 feet Wet, shell fragments, minor coarse grained sand and gravel
5	0	OL		19		QUATERNARY ESTUINE DEPOSITS (Qe) SILT (OL), dark gray to black, wet, micaceous, plastic, organic odor
10	-5	CL		23		Silty CLAY to CLAY (CL), light olive brown to light brown, damp to moist, micaceous
15	-10	SP		27, 30, 22, 24, 24		QUATERNARY BEACH SAND (Qbs) SAND (SP), dark gray, wet, fine grained sand, micaceous
20	-15					
25	-20					
30						

Total depth = 20 ft.
Groundwater encountered at 2 ft. and 11 ft.

Well: MW-3RB
Elev.: 7.40



Well Construction Information

NOTES
Well Monument set in concrete rises approximately 3 feet above ground surface and is affixed with an external lock.

2" locking well cap
Blank casing - sch 40 PVC 2" diameter
Slotted casing - sch 40 PVC - 0.020" screen slots,
2" diameter flush threaded
End cap - flush threaded

Concrete seal - quickcrete/concrete
Bentonite seal - hydrated bentonite chips
Gravel pack - No. 3 Monterey Sand

General notes:

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

12-10-2003 c:\mlech5\halaco\mw-3b.bor

LOG OF BORING MW-4RA

(Page 1 of 1)

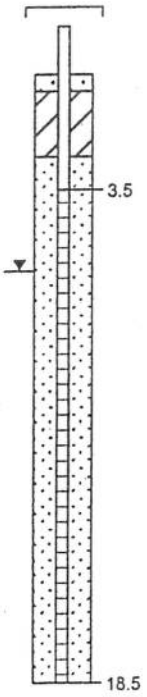
Halaco Engineering Co.
6200 Perkins Road
Oxnard, CA 93033

Project Number	: 0201-0594	Drilling Method	: Hollow Stem Auger
Project Name	: Halaco Engineering Company	Boring Total Depth	: 20 Feet
Logged By	: James T. Tolar	Drilling Date	: 2/20/03
Checked By	: Jerome K. Summerlin	Backfilled With	: 2" Monitoring Well
Driller	: Cascade Drilling	Water Depth	: 5 Feet

Depth in Feet	Surf. Elev. 7.1	USCS	GRAPHIC	Blow Count	Samples	DESCRIPTION
0	7	AF				ARTIFICIAL FILL (AF) Base Materials
		SM/CL		9, 37, 31		QUATERNARY ALLUVIUM (Qal) Silty SAND (SM) to sandy CLAY (CL), grayish brown, moist, well graded sand, gravel, roots, organic debris
5	2	SP/SM		28, 21, 10		SAND with silt (SP) and silty SAND (SM), dark yellowish brown, wet, fine grained to well graded sand, micaceous
10	-3	ML		15, 12		SILT with sand (ML), dark gray, wet, very fine grained sand, micaceous, roots, intervals of silty clay with peat debris at 11 feet
15	-8	SP		17, 26		SAND with silt (SP), dark gray, wet, fine grained sand, micaceous
		CL		10, 19		Silty CLAY (CL), brownish gray, soft, damp to moist, micaceous
20	-13	SP				SAND (SP), grayish brown, wet, fine to medium grained sand
25	-18					
30	-23					
35						

Total depth = 20 ft.
Groundwater encountered at 5 ft.

Well: MW-4RA
Elev.: 7.98



Well Construction Information

NOTES

Well Monument set in concrete rises approximately 2 feet above ground surface and is affixed with an external lock.

2" locking well cap
Blank casing - sch 40 PVC 2" diameter
Slotted casing - sch 40 PVC - 0 020" screen slots,
2" diameter flush threaded
End cap - flush threaded

Concrete seal - quickcrete/concrete
Bentonite seal - hydrated bentonite chips
Gravel pack - No. 3 Monterey Sand

General notes:

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

12-10-2003 c:\mtech5\halaco\mw-4a.bor

LOG OF BORING MW-4RB

(Page 1 of 1)

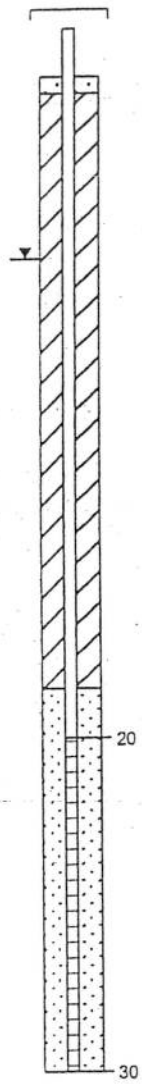
Halaco Engineering Co.
6200 Perkins Road
Oxnard, CA 93033

Project Number	: 0201-0594	Drilling Method	: Hollow Stem Auger
Project Name	: Halaco Engineering Company	Boring Total Depth	: 30 Feet
Logged By	: James T. Tolar	Drilling Date	: 2/20/03
Checked By	: Jerome K. Summerlin	Backfilled With	: 2" Monitoring Well
Driller	: Cascade Drilling	Water Depth	: 5 Feet

Depth in Feet	Surf. Elev. 7.1	USCS	Blow Count	DESCRIPTION
0	7	AF	9	ARTIFICIAL FILL (AF) Base Materials
		SM/CL	37, 31	QUATERNARY ALLUVIUM (Qal) Silty SAND (SM) to sandy CLAY (CL), grayish brown, moist, well graded sand, gravel, roots, organic debris
5	2	SP/SM	28, 21, 10	SAND with silt (SP) and silty SAND (SM), dark yellowish brown, wet, fine grained to well graded sand, micaceous
10	-3	ML	15, 12	SILT with sand (ML), dark gray, wet, very fine grained sand, micaceous, roots, intervals of silty clay with peat debris at 11 feet
		SP	17, 26	SAND with silt (SP), dark gray, wet, fine grained sand, micaceous
15	-8	CL	10, 19	Silty CLAY (CL), brownish gray, soft, damp to moist, micaceous
20	-13	SP	15, 32, 33	SAND (SP), grayish brown, wet, fine to medium grained sand, minor well rounded gravel
25	-18		37, 31	Intervals of silty CLAY
30	-23		30	
35				

Total depth = 30 ft.
Groundwater encountered at 5 ft. and 19 ft.

Well: MW-4RB
Elev.: 8.75



Well Construction Information

NOTES
Well Monument set in concrete rises approximately 2.5 feet above ground surface and is affixed with an external lock

2" locking well cap
Blank casing - sch 40 PVC 2" diameter
Slotted casing - sch 40 PVC - 0.020" screen slots,
2" diameter flush threaded
End cap - flush threaded

Concrete seal - quickcrete/concrete
Bentonite seal - hydrated bentonite chips
Gravel pack - No. 3 Monterey Sand

General notes:

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

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LOG OF BORING MW-5

(Page 1 of 1)

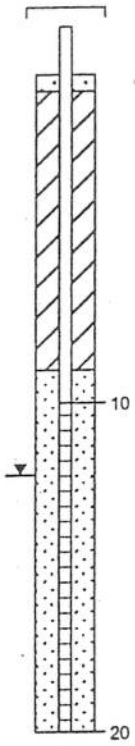
Halaco Engineering Co.
6200 Perkins Road
Oxnard, CA 93033

Project Number	: 0201-0594	Drilling Method	: Hollow Stem Auger
Project Name	: Halaco Engineering Company	Boring Total Depth	: 20 Feet
Logged By	: James T. Tolar	Drilling Date	: 2/20/03
Checked By	: Jerome K. Summerlin	Backfilled With	: 2" Monitoring Well
Driller	: Cascade Drilling	Water Depth	: 12.5 Feet

Depth in Feet	Surf. Elev. 16.05	USCS	GRAPHIC	Blow Count	Samples	DESCRIPTION
0	16	SM/ML		15, 49, 43		ARTIFICIAL FILL (AF) Silty SAND (SM) to Sandy SILT (ML), dark gray, moist, fine to medium grained sand, concrete fragments, ammonia odor
5	11			37		Percipitates, granular fragments
		SM		46, 42		Silty SAND (SM), light gray, damp, fine grained sand, abundant percipitates (white, blue)
10	6			33		Iron oxide staining, rock fragments with metallic luster
		SP		23, 21		QUATERNARY ALLUVIUM (Qal) SAND (SP), yellowish brown to dark brown with dark gray, very moist to wet, fine to medium grained sand, slight ammonia odor
15	1			12		
		CL		12, 11		Silty CLAY (CL), grayish brown, damp, very micaceous, roots, organics, slightly plastic
20	-4					
25	-9					
30	-14					
35						

Total depth = 20 ft.
Groundwater encountered at 12 ft.

Well: MW-5
Elev.: 17.55



Well Construction Information

NOTES

Well Monument set in concrete rises approximately 2 feet above ground surface and is affixed with an external lock.

2" locking well cap
Blank casing - sch 40 PVC 2" diameter
Slotted casing - sch 40 PVC - 0.020" screen slots,
2" diameter flush threaded
End cap - flush threaded

Concrete seal - quickcrete/concrete
Bentonite seal - hydrated bentonite chips
Gravel pack - No. 3 Monterey Sand

General notes:

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

12-10-2003 c:\mtech5\halaco\mw-5.bor

LOG OF BORING MW-6

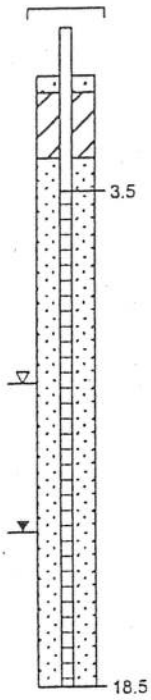
Halaco Engineering Co.
6200 Perkins Road
Oxnard, CA 93033

Project Number	: 0201-0594	Drilling Method	: Hollow Stem Auger
Project Name	: Halaco Engineering Company	Boring Total Depth	: 30 Feet
Logged By	: James T. Tolar	Drilling Date	: 2/20/03
Checked By	: Jerome K. Summerlin	Backfilled With	: 2" Monitoring Well
Driller	: Cascade Drilling	Water Depth	: 9.5 Feet

Depth in Feet	Surf. Elev. 12.05	USCS	GRAPHIC	Blow Count	Samples	DESCRIPTION
0	12	SM		18, 22, 28		ARTIFICIAL FILL (AF) Silty SAND (SM), dark brown to dark gray, damp to moist, fine grained sand, rock fragments, abundant white percipitates
						Dark yellow brown to light gray, abundant percipitates (white, pink, blue, brown), brick fragments
5	7			32, 38, 38		Dark gray, moist to wet, fine to meduium grained sand, strong ammonia odor
						Intervals cemented and vesicular, strong ammonia odor
10	2	ML		18, 14, 16		QUATERNARY ALLUVIUM (Qal) SILT (ML), dark grayish brown, dark gray, damp to moist, very micaceous, organics, organic odor, intervals with very fine grained sand, slightly plastic
						Organics, ammonia and sulpher odor
						Light greenish gray to dark gray, damp
15	-3	SP		19, 11		SAND (SP), dark gray, dark brown, very moist to wet, fine grained sand, slight ammonia odor, intervals of silt and clay
		CL		13		Silty CLAY (CL), dark greenish gray, grayish brown, damp, very micaceous, shell fragments, slightly plastic
20	-8	SP		15, 12, 21		SAND (SP), brownish gray to dark gray, wet, fine to medium grained sand, minor well rounded gravel
						Intervals of Silty CLAY at 21 ft.
25	-13			25, 28, 28		
30	-18					
35						

Total depth = 30 ft.
Groundwater encountered at 15 ft.

Well: MW-6
Elev.: 12.95



Well Construction Information

NOTES

Well Monument set in concrete rises approximately 2 feet above ground surface and is affixed with an external lock.

2" locking well cap
Blank casing - sch 40 PVC 2" diameter
Slotted casing - sch 40 PVC - 0.020" screen slots,
2" diameter flush threaded
End cap - flush threaded

Concrete seal - quickcrete/concrete
Bentonite seal - hydrated bentonite chips
Gravel pack - No. 3 Monterey Sand

General notes:

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

12-10-2003 c:\mtech5\halaco\mw-6.bor

Appendix C.3
MW-11 through MW-19
(Weston Solutions, 2007)

MW-11

Geologic Log

BOREHOLE No. SSN 8
Sheet 1 of 1

PROJECT No. 2767-062-317 DATE 06/19/06
CLIENT USACE
LOCATION Holaco - Smelting Area
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model Push-Probe (Geoprobe 5400)
Driller Tom Farther - WESTON
Drilling method Push Hole dia. 2"

Boring completion data Sand / Bentonite / Concrete

	First			
Depth to water	8.5' bgs			
Time	1415			
Date	06/19/06			

Time	PID/FID HNu/OVA (ppm)	Blows/6 in. or Pressure (psi)	Recovery (ft/ft)	Sample Number	Depth (ft bgs)	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
1338	0.0	–	1	8/1	1			ML		- dk. brown to black silty-sand w/ 10% subangular gravel and 20% fine sand. No odor, low moisture, moderate plasticity RAD = 2408
					2					
					3					
1340	0.0	–	1	8/4	4			ML		- same as above RAD = 2340
					5					
					6					
					7					
1403	0.0	–	0.75	8/8	8			ML		- dk gray silty-sand w/ 5% subangular gravel up to 1/8" diam. No odor. High Plasticity. Low Moisture RAD = 2249
					9		Screened			
					10					
					11					
					12					
					13					

Total Depth = 13' bgs

No RAD or PID spikes

MW-12

Geologic Log

WESTON SOLUTIONS

BOREHOLE No. SSN9
Sheet 1 of 1

PROJECT No. 12767.002.317 DATE 06/19/06
CLIENT USACE
LOCATION Hakalo Engineering - Smelter Area
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model ~~Cr~~ Push-Probe (Geoprobe 5400)
Driller Tom "Further" - WESTON
Drilling method Push Hole dia. 2"

Boring completion data ~~06/19/06~~ Sand / Bentonite

Depth to water	8.5' bgs			
Time	1610			
Date	06/19/06			

Time	PID/FID HNu/OVA (ppm)	Blows/6 in. or Pressure (psi)	Recovery (ft/ft)	Sample Number	Depth (bgs)	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
1559	0.0	-	1	9/1	1			CL		- lt. gray to lt. brown clayey-silt w/ ~10% sand. No odor. Low Moisture. High Plasticity RAD = 31.30 kC/m
					2					
					3					
1601	0.0	-	.75	9/4	4			ML		- Lt. brown silty-sand. No odor. Low Moisture. Mod. Plasticity RAD = 30.05 kC/m
					5					
					6					
					7					
1608	0.0	-	.75	9/8	8			ML		- Lt. gray to lt. brown clayey-silt w/ 10% sand. No odor. Low Moisture. High Plasticity RAD = 24.49 kC/m
					9		screened H_2O			
					10					
					11					
					12					
					13					Total Depth = 13' bgs
					14					

MW-13

WESTON SOLUTIONS

Geologic Log

BOREHOLE No. SSN1D
Sheet 1 of 1

PROJECT No. 02767.062.317 DATE 06/19/06
CLIENT USACE
LOCATION Hakco - Smelting Area
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model Push-Probe (Geoprobe 5400)
Driller Tom Fortner - WESTON
Drilling method Push Hole dia. 2"

Boring completion data Sand/Bentonite/Concrete

	First			
Depth to water	7' bgs			
Time	1730			
Date	6/19/06			

Time	PID/FID HNu/OVA (ppm)	~~Blows/6 in. or Pressure (psi)~~ RAD kc/m	Recovery (ft/ft)	Sample Number	Depth	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
1714	0.0	18.90	0.75	10/1	1			SM		- light to dark brown silty-sand w/ ~20% subangular gravels. Slight odor. Low moisture. Low plasticity. Small percentage of organics and glass
					2					
					3		screened			
1720		17.50		10/4						
~~1724~~	0.0	~~19.12~~	1	~~14/8~~	4			SM		- same as above except ~~wet and color varies from dk. brown to black~~ w/ ~30% sand
					5					
					6					
					7					
1724	0.0	19.12	1	10/8	8			SM		- same as above except wet and color varies from dk. brown to black
					9					
					10					
					11			SM		- same w/ greater percentage of fines and color varies to greys toward depth
					12					
					13					Total Depth = 13' bgs
					14					

MW-14

WESTON SOLUTIONS

Geologic Log

BOREHOLE No. SSN11.
Sheet 1 of 1

PROJECT No. 12767.062.317 DATE 6/21/06
CLIENT USACE
LOCATION Holaco - #1 Smelter Area
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model Geoprobe 5400
Driller Tom Fortner - Weston
Drilling method Push-Probe Hole dia. 2"
Boring completion data Sand / Betonite / Concrete

Depth to water	First = 1'	Static = 3"		
Time	1248	1310		
Date	6/21/06	6/21/06		

Time	PID/FID HNu/OVA (ppm)	Blows/6 in. or Pressure (psi)	Recovery (ft/ft)	Sample Number	Depth	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
1248	0.2	–	0.5	11/1	1			ML		dk. brown to olive green clayey-silt. High moisture. Moderate plasticity. No odor. RAD = 24.59 kc/m
					2					
					3					
1252	0.4	–	1	11/4	4			SM		light brown to gray, well-sorted, sandy-silt. Micaceous. Saturated. No odor. RAD = 23.9 kc/m
					5					
					6					
					7		screened			
1255	0.4	–	1	11/8	8			ML		same as above except w/ greater percentage of fines of moderate plasticity. RAD = 23.36 kc/m
					9					
					10					
					11			SM		light brown to gray, well-sorted, micaceous, sandy-silt. Saturated. No odor
					12					
					13					

Total Depth = 13' bgs

No RAD or PID spikes

MW-15

Geologic Log

WESTON

BOREHOLE No. SSN12.
Sheet 1 of 1

PROJECT No. 12767.062.317 DATE 6/21/06
CLIENT USACE
LOCATION Habco - #1 Smelter - (MW-15)
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model Geoprobe 5400
Driller Tom Fortner - Weston
Drilling method Push-Probe Hole dia. 2"
Boring completion data Sand / Bentonite / Concrete

	First
Depth to water	10' bgs
Time	1505
Date	6/21/06

Time	PID/FID HNu/OVA (ppm)	Blows/6 in. or Pressure (psi)	Recovery (ft/ft)	Sample Number	Depth	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
1448	0.0	–	0.75	12/1	1			ML		Light to dark brown silty-sands. Low moisture. No odor. Mod. Plasticity. RAD = 24.97 kC/m
					2					
					3					
1450	0.0	–	0.75	12/4	4			ML		Same as above ~~ex~~ except w/ slightly greater percentage of fines. RAD = 24.38 kC/m
					5					
					6					
					7					
1500	0.0	–	1	12/8	8			CL		Dark gray to olive green silty-clay w/ ~10% micaceous fine sand. No odor. Moderate moisture. Moderate plasticity. RAD = 24.87
					9					
					10					
					11		Screened			
					12					
					13			ML		dark gray, well-sorted, fine sands. No odor. ~~moderate moisture~~ Moist. Micaceous
					14					
					15					
					16					
					17					
					18					Total Depth = 17' bgs
					19					No RAD or PID spikes

Geologic Log

WESTON SOLUTIONS

BOREHOLE No. ~~MW-7~~ MW-16
Sheet 1 of 1

PROJECT No. 12767.062.317 DATE 6/20/06
CLIENT USACE
LOCATION #2 WMU - SE of Pile
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model GeoProbe
Driller Tom Fortner - WESTON
Drilling method Push Hole dia. 2"

Boring completion data Sand / Bentonite / Concrete

	First	Static		
Depth to water	15.5' bgs	5' bgs		
Time	1000	1030		
Date	6/20/06	6/20/06		

Time	PID/FID HNu/OVA (ppm)	Blows/6 in. or Pressure (psi)	Recovery (ft/ft)	Sample Number	Depth	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
					1					
					2					Light brown clayey-silt. Low moisture, No odor. High plasticity.
					3					
					4				ML	
					5					
					6					
					7					
					8				ML	Same as above except more green, mod. moisture, slight odor, and small % fine sands
					9					
					10					
					11		Screened			Same except mostly olive-green
					12				ML	
					13					
					14					
					15			BPR		
					16				SP	Light green to brown fine sand. Well sorted. No odor. Moderate moisture
					17					
					18					Total Depth = 17' bgs
					19					No PID or RAD spikes

(MW-17)

WESTON SOLUTIONS

Geologic Log

BOREHOLE No. SW4-1
Sheet 1 of 2

PROJECT No. 12767.062.317 DATE 6/22/06
CLIENT USACE
LOCATION Velsco - #2 (WMU Area)
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model Geoprobe 5400
Driller Tom Fortner - Weston
Drilling method Push
Hole dia. 2"

Boring completion data ~~None~~ Sand, Bentonite, Grout

	First			
Depth to water	~~N/A~~	27.5 bgs		
Time	~~X~~	1620		
Date	~~X~~	6/22/06		

Time	PID/FID HNu/OVA (ppm)	RAD ~~Blows/6 in. or Pressure (psi)~~ kc/m	Recovery (ft/ft)	Sample Number	Depth (ft. bgs)	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
					1					
					2					
					3					
					4					
1545	0.3	6.21	1	1/5	5			ML		- Light to dk. grey, poorly consolidated, sandy-silt. No odor. Low moisture.
					6					
					7					
					8					
					9					
1557	4.0	6.25	1	1/10	10			ML		- Same as above except w/ miss. gravel-size clasts up to 1" diam.
					11					
					12					
					13					
					14					
1600	2.8	6.36	1	1/15	15			ML		- Same as above except color varies from dk. grey to black and moderate moisture.
					16					
					17					
					18		Screened			
					19			ML		
1609	6.5	6.47	1	1/20	20					- Same as above except color varies from dk. grey to dk. blue w/ strong sulfur odor.

(MW-17)

WESTON SOLUTIONS

Geologic Log

BOREHOLE No. SW4-1
Sheet 2 of 2

PROJECT No. 12747-062-317 DATE 6/22/06
CLIENT USACE
LOCATION Hakaco - #2 WMU Area
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model Geoprobe 5400
Driller Tom Fortner - Weston
Drilling method Push Hole dia. 2"

Boring completion data Sand, Bentonite, Grout

Depth to water				
Time				
Date				

Time	PID/FID HNu/OVA (ppm)	Blows/6 in. or Pressure (psi)	Recovery (ft/ft)	Sample Number	Depth	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
					~~20~~		screened			
					21					(20'-23' bgs) - same as above
					22			ML		
					23					
					24					(23'-27.5' bgs) - Dk. brown clay w/small percentage micaceous fine sand. No odor High moisture. Moderate plasticity.
					25			CL		
					26					
					27					
					28			SP		- Greenish-grey, well-sorted, micaceous sand. No odor. Moist.
					29					
					30					Total Depth = 28' bgs

(MW-18)

WESTON

Geologic Log

BOREHOLE No. SWS-6
Sheet 1 of 2

PROJECT No. 17767.062.317 DATE 6/26/06
CLIENT USACE
LOCATION Halaco - Area #2 (WMU)
LOGGED BY Brian P. Reilly

Drilling Co. EPA
Drill rig model Geoprobe 5400
Driller Tom Fortner - Weston
Drilling method Push Hole dia. 2"

Boring completion data Sand, Bentonite, Grout

	First	Static		
Depth to water	28' bgs	24' bgs		
Time	1600	1630		
Date	6/26/06	6/26/06		

Time	PID/FID HNu/OVA (ppm)	RAD ~~Blows/6 in. or Pressure (psi)~~ kc/m	Recovery (ft/ft)	Sample Number	Depth (ft. bgs)	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
					1			ML		Poorly consolidated sandy-silt w/low moisture, no odor, and light-grey
					2					
					3			CL		Light to dk. grey, well consolidated, silty-clay w/mod. moisture, high plasticity, no odor
					4					
1414	12.2	6.17	1	6/5	5					same as above
					6			CL		
					7					
					8					
					9					
1429	0.9	6.34	1	6/10	10					Dark grey clayey-silt w/mod. moisture, low plasticity, no odor.
					11					
					12					
					13					
					14			ML		
1434	6.24	6.24	1	6/15	15					same as above
					16					
					17					
					18					
1450	1.1	6.25	1	6/20	19					same as above
					20					

(MW-18)

Geologic Log

BOREHOLE No. SW5-6
Sheet 2 of 2

PROJECT No. 12767.062.317 DATE 6/26/06
CLIENT USACE
LOCATION Halaco - Area #2 (WMU)
LOGGED BY Brian P. Reilly

Drilling Co. EPA
Drill rig model Geoprobe 5400
Driller Tom Fortner - Weston
Drilling method Push Hole dia. 2"

Boring completion data Sand, Bentonite, Grout

	First	Static		
Depth to water	28' bgs	24' bgs		
Time	1600	1630		
Date	6/26/06	6/26/06		

Time	PID/FID HNu/OVA (ppm)	~~Blows/6 in. or Pressure (psi)~~	Recovery (ft/ft)	Sample Number	Depth (ft. bgs)	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log	FIELD SOIL DESCRIPTION
					~~20~~					
					21					
					22					Same as above except varying to dk. blue in color and moderate ammonia odor.
					23			ML		
					24					
					25					
					26					
					27					
					28			CL		Med. brown to olive green, mod. well consolidated, silty-clay w/ med. to low plasticity, mod. moisture, and moderate to strong ammonia odor.
					29			SP		Med. brown, well-sorted, fine sand w/ strong ammonia and sulfur odor. Micaceous. Saturated
					30		screened			
					31			CL		Med. brown to olive green, med. well consolidated, silty clay w/ mod. moisture, no odor, ~~and~~ ~20% fine micaceous sand, and med. plasticity.
					32					
					33					Total Depth = 32' bgs
					34					note: Screen was pushed to 33' bgs
					35					

MW-19

Geologic Log

WESTON SOLUTIONS

BOREHOLE No. SSN 33
Sheet 1 of 1

PROJECT No. 12767.062.317 DATE 6/21/06
CLIENT USACE
LOCATION #3 - Waste Disposal Area
LOGGED BY Brian P. Reilly

Drilling Co.
Drill rig model Geoprobe 5400
Driller Tom Fortner - Weston
Drilling method Push-Probe Hole dia. 2"

Boring completion data Sand / Bentonite / Concrete

	First	Static		
Depth to water	20' bgs	14' bgs		
Time	1100	1115		
Date	6/21/06	6/21/06		

Time	PID/FID HNu/OVA (ppm)	RAD ~~Blows/6 in. or Pressure (psi)~~ kc/m	Recovery (ft/ft)	Sample Number	Depth (ft bgs)	Sample Interval	Well Detail	Soil/Rock Symbol	Graphic Log
1014	0.6	12.88	1	33/1	1, 2			SM	
					3			SM	
1016	0.0	13.10	1	33/4	4, 5			ML	
					6				
1029	0.0	13.09	1	33/8	7, 8			ML	
					9, 10				
					11, 12			ML	
					13, 14				
					15			ML	
					16, 17				
					18, 19				
					20		Screened	ML	
					21, 22				
					23, 24				
					25				
					26, 27				

FIELD SOIL DESCRIPTION

- med. brown, fine-sandy-silt. Poorly consolidated. Dry. Slight odor. Around 5% subangular gravels. Poorly sorted.

- (2.5'-3.5') bgs - Light grey to yellowish-green silty-sand. Poorly consolidated. Low moisture.

- dk. brown to black clayey-silt w/ ~10% sub-angular gravels up to 1/8" diam. No odor. Low moisture. Low plasticity.

- same as above except w/ short layers of grey clayey-silts w/ strong ammonia odor.

- (10'-13' bgs) - same as above except color varies from grey to dk. blue.

- (13'-17' bgs) - same as above except olive green w/ mod. moisture and mod. plasticity.

- (17'-25' bgs) - same as above except color varies from browns to olive greens.

Total Depth = 25' bgs

Appendix C.4
CM-4 (USGS, 1995)

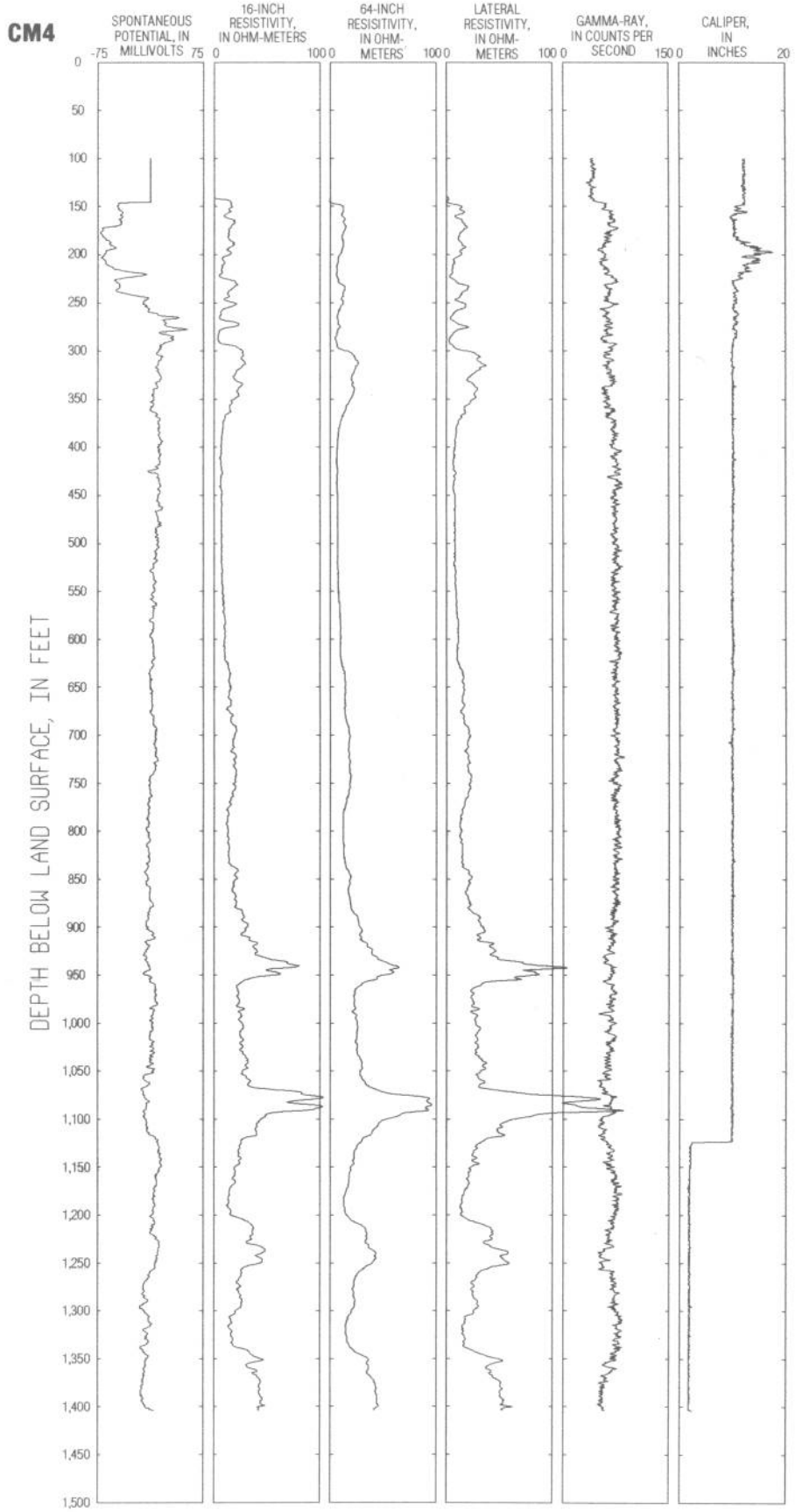


FIGURE 12. Geophysical logs, stratigraphic column, and well-construction diagram for multiple-well monitoring site CM4 (1N/22W-28G1, 2, 3, 4, 5).

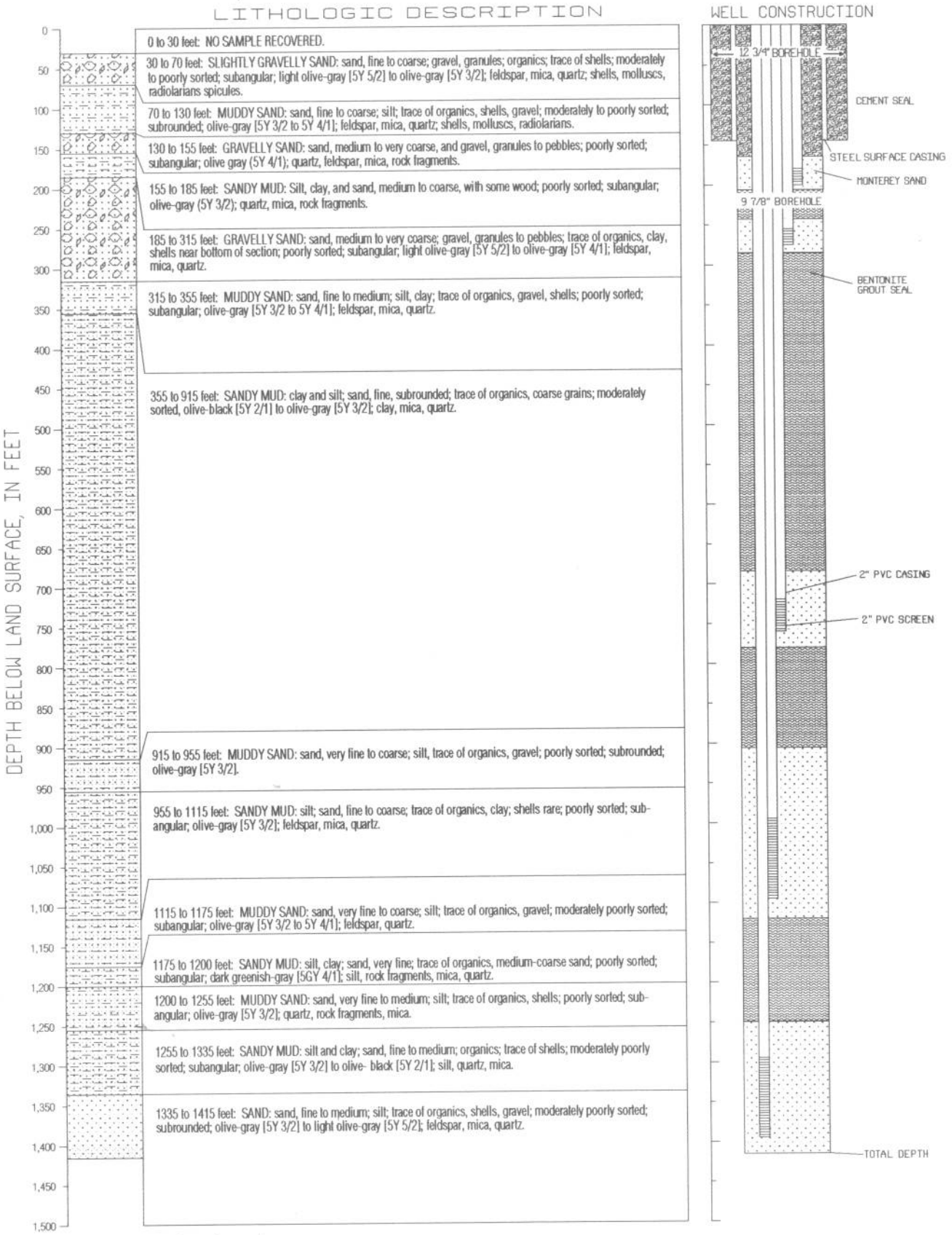


FIGURE 12. *Continued.*

Appendix D
Photographs of Monitoring Wells Before and After Wellhead Repairs

Contents

D.1 Well Inventory before Repairs (August 15, 2007)
D.2 Repaired Wells (October 9, 2008)

Appendix D.1
Well Inventory before Repairs (August 15, 2007)

MW-1
08/15/2007

MW-2
cluster
08/15/2007

MW-2
cluster
08/15/2007

MW-3
cluster
08/15/2007

MW-3
cluster
08/15/2007

MW-4
cluster
08/15/2007

MW-4
cluster
08/15/2007

MW-5
08/15/2007

MW-6
08/15/2007

MW-11
08/15/2007

MW-12
08/15/2007

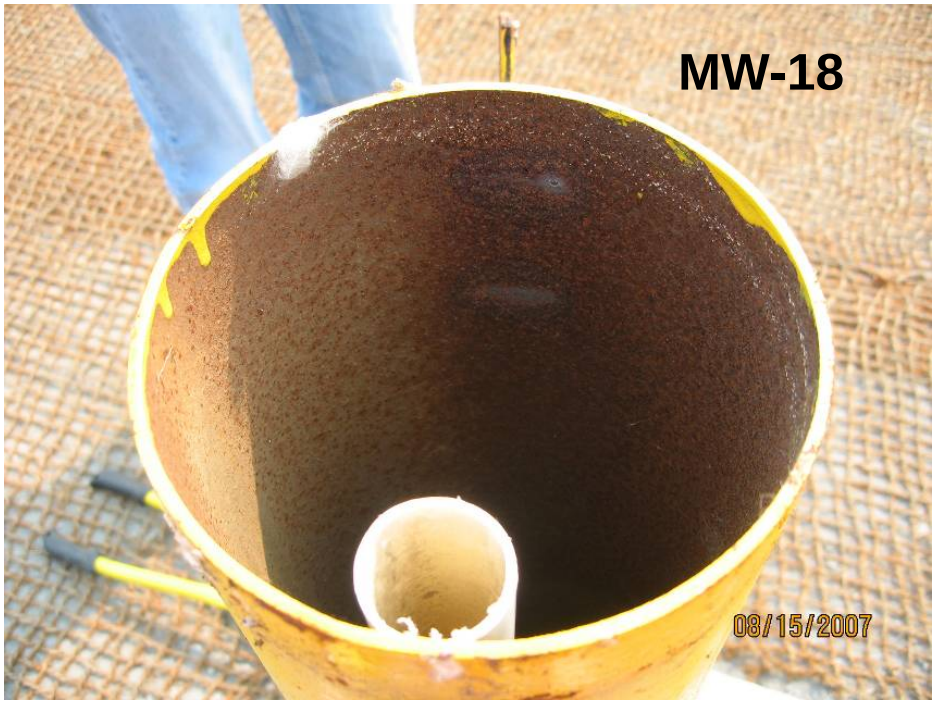
MW-13
08/15/2007

MW-14
08/15/2007

MW-15
08/15/2007

MW-16
10/09/2007

MW-17
08/15/2007


MW-18
08/15/2007

MW-19
08/15/2007

Appendix D.2
Repaired Wells (October 9, 2008)

MW-1
10/09/2007

MW-2
10/09/2007

MW-3
10/09/2007

MW-4
10/09/2007

MW-11
10/09/2007

MW-12
10/09/2007

MW-17
10/09/2007

MW-18
10/09/2007

Appendix E
Wellhead Survey Data

Contents

E.1 Site Well Locations
E.2 Offsite Well CM-4

Appendix E.1
Site Well Locations

SAGE Consultants, Inc.

LAT 34° 15' 06" N LONG 119° 02' 46" W ELEV 35.438m

January 2, 2008
JO: 523-V-1902

CH2MHILL Inc.
325 East Hillcrest Drive
Suite 125
THOUSAND OAKS CA 91360-5828

Attn.: Mark Wuttig, Project Manager

Subject: Survey Report for monitoring wells, HALACO Superfund Site, Perkins Road, Oxnard.

Reference: CH2MHILL Purchase Order 924324.

Dear Mr. Wuttig:

This report covers the recently completed location survey of seventeen monitoring wells, one control monument and three water level gauge stations at the subject site. Two of the water level gauge stations were furnished and installed by this facility. The third gauge is an appurtenance believed to be the property of the City of Oxnard.

Scope of Work

The original scope of work was modified to eliminate monitoring well "MW-16" which is submerged and inaccessible; X,Y location survey was defined as RTK measurements using dual frequency, survey grade GPS receivers. The X,Y,Z of the existing City of Oxnard gauge at the south end of Perkins Road was substituted for the reference mark on the bank of the Oxnard Industrial Drain (OID).

The horizontal datum for all survey work is the North American Datum of 1983 (NAD 83). The vertical datum is North American Vertical Datum of 1988 (NAVD 88), Mean Sea Level (MSL). Horizontal values are the results obtained from measurements using dual frequency, survey grade GPS receivers. Vertical measurements are the result of closed leveling circuits using differential leveling techniques. All reported measurements are in U.S. Survey Feet and/or degrees, minutes, seconds.

Equipment

Horizontal location of the monitoring wells was derived from RTK measurements on the center of the outer casing lid using TOPCON HIPER XT receivers meaning 10/1 second reading in a SEP of 0.10 feet. Data obtained on GPS receivers SN # 360-1094 and SN # 360-1135 GPS was recorded on a Tremble Recon data collector with Carlson Survey software. A copy of the raw data recovery is attached as Appendix A.

Vertical measurements were obtained by differential leveling techniques using a Leitz/Sokkisha automatic level SN #80662 and a plumbed level rod graduated in 0.01 feet increments. Monitoring Well elevations are on the north side of the outer steel casing and the north side of the free standing open PVC pipe inside the outer casing. Ground elevations are on the north side of the outer steel casing. A copy of the Level Notes is attached as Appendix B.

Control

City of Oxnard monument #1251 as shown on map filed in book 51 Record of Survey page 93 in the office of the City Surveyor was used as the control monument for this survey. The monument is described as "Set S. & W. 'CITY OF OXNARD 1251' in W. end of parking lot 0.1 KM s/o McWayne Blvd." The monument was recovered in good condition. The horizontal location used for this survey was the Latitude and Longitude obtained from a 2+ hour Static session with GPS receiver SN # 1135. A Copy of the Precise Orbit NGS OPUS Solution Report is attached as Appendix C.

Coordinate Transformation

Latitude/Longitude was transformed into the California Zone 5 datum from the NAD83 HARN reference via Geoid 03. A copy of the Interactive Conversion Report using Geographic Calculator 7,0,0,0 by Blue Marble Geographics is attached as Appendix D.

Deliverables

The Excel spread sheet identifying Point ID, North Latitude, West Longitude, Northing, and Easting horizontal locations together with outer casing, inner casing and ground elevation for each surveyed monitoring well has been previously forwarded via email. The data forwarded included reference X, Y, Z for the water gauges (Tide Gauge) furnished and installed as a part of this contract. A reference X, Y, Z for the City of Oxnard gauge west of the foot bridge at the south end of Perkins Road was also provided together with depths to bottom of channel at each gauge location. All reported elevations are on NAVD 88 datum. A copy of the spread sheet is attached as Appendix E.

The two water gauges (tide gauge) furnished and installed as apart of this project are set to read MSL directly without any conversion.

The City of Oxnard gauge west of the foot bridge is marked 1.52 feet lower than the elevation datum reported herein. Elevations read from the "8" mark on this gauge must be increased by 1.52 feet to be consistent with the surveyed elevations reported herein.

We appreciate the opportunity to provide this service. If you have questions regarding this report or require additional services, please call.

Respectfully submitted,

Sage Consultants, Inc.

Robert E. Littell

Robert Littell, P.E.

cc: addressee (2)

file (1)

encl: (4)

REGISTERED PROFESSIONAL ENGINEER
ROBERT E. LITTELL
No. 13395
Exp. 03-31-09
CIVIL
STATE OF CALIFORNIA

N:\PROJECTS\CH2MHILL\HALACO 1962

SAGE CONSULTANTS INC.
JO: 522-V-1902

HALACO MONTORING WELL SURVEY
6200 PERKINS ROAD, OXNARD CA

SHEET __1__ of ___1_
Date:__12/18/2007____

	Point ID	North Latitude *	West Longitude *	Northing**	Easting**	Elevation*** (BM #1251) Outer Casing	Inner Casing	Ground
	#1251 Cty Oxnard	34-08-21.50871	119-11-05.76691	1875190.4860	6203110.8580			16.29
	MW-1R	34-08-07.26433	119-10-46.32652	1873733.3773	6204734.2083	10.93	10.46	8.16
	MW-2R South B	34-08-13.83923	119-10-45.55851	1874397.1802	6204806.5590	10.64	9.81	7.91
	MW-2R North A	34-08-13.85882	119-10-45.54947	1874399.1506	6204807.3427	10.56	10.01	7.91
Packe	MW-3R East B	34-08-08.44117	119-10-48.72962	1873854.6647	6204533.6177	10.84	10.00	8.09
wells	MW-3R West A	34-08-08.45219	119-10-48.75659	1873855.8051	6204531.3631	10.95	9.93	8.22
	MW-4 East A	34-08-24.05361	119-10-49.45559	1875433.5094	6204491.1312	11.76	11.29	9.52
	MW-4 West B	24-08-24.06008	119-10-49.48660	1875434.1935	6204488.5323	11.29	10.51	9.56
	MW-5	34-08-13.34168	119-10-54.09709	1874355.3155	6204088.2910	20.43	20.20	18.76
	MW-6	34-08-17.05670	119-10-53.91087	1874730.6516	6204108.3578	16.32	16.14	14.87
	MW-11	34-08-18-57610	119-10-59.99224	1874890.2477	6203599.0265	13.82	13.57	13.69
	MW-12	34-08-16.54480	119-10-56.57039	1874681.5367	6203884.2164	16.33	14.81	14.15
	MW-13	34-08-23.22963	119-10-57.81228	1875358.4770	6203787.7860	10.06	9.85	9.86
Weston	MW-14	34-08-19.24504	119-11-02.80982	1874960.6547	6203363.0064	8.17	7.91	7.86
wells	MW-15	34-08-24.40882	119-11-01.50506	1875481.3220	6203479.0701	8.42	8.25	8.39
	MW-16	*submerged*						
	MW-17	34-08-14.71563	119-10-50.75890	1874490.8996	6204370.5019	47.00	45.82	42.49
	MW-18	34-08-16.91210	119-10-48.83814	1874711.0259	6204534.5503	45.87	45.83	41.81
	MW-19	34-08-19.02335	119-10-49.02560	1874924.6188	6204521.3005	17.73	17.37	17.64
						Elevation		
						Top	**Bot Chanel**	**Depth**
	Top East Gauge	34-08-11.78636	119-10-45.34325	1874189.4605	6204822.2176	10.43	6.02	4.4
	Post Mark East Gauge					10.54		
	Top North Gauge	34-08-24.50487	119-10-52.92583	1875482.5500	6204200.0000	10.40	6.61	3.8
	"8" Bridge Gauge	34-08-18.80420	119-11-03.69589	1874916.9714	6203288.0070	9.52	4.28	5.3

Appendix E

* ___ degrees, minutes, seconds (NAD 83)
** __ CA State Plane Coordinates System Zone 5, Survey feet
*** - MSL elevation, survey feet (NAVD 88)

Appendix E.2
Offsite Well CM-4

SAGE Consultants, Inc.

LAT 34° – 13' – 00" N LONG 119° – 02' – 40" W ELEV 55.438m

February 18, 2008
JO: 523-V-1902

CH2MHILL Inc.
325 East Hillcrest Drive
Suite 125
THOUSAND OAKS CA 91360-5828

Attn.: Mark Wuttig, Project Manager

Subject: Survey Report for monitoring wells CM4 1-5, HALACO Superfund Site, Perkins Road, Oxnard, CA..

Reference: CH2MHILL Purchase Order 924324 – Revision 1.

Dear Mr. Wuttig:

This report covers the recently completed location survey of subject wells.

Scope of Work

The original scope of work was modified to include five additional wells located on the City of Oxnard Waste Water Treatment Plant site.

The horizontal datum for all survey work is the North American Datum of 1983 (NAD 83). The vertical datum is North American Vertical Datum of 1988 (NAVD 88), Mean Sea Level (MSL). Horizontal values are the results obtained from dual frequency, survey grade GPS receivers. Vertical measurements are the result of closed leveling circuits using differential leveling techniques. All reported measurements are in U.S. Survey Feet and/or degrees, minutes, seconds.

Equipment, Control, and Coordinate Transformation are outlined in the survey report for the original Purchase Order 924324

Deliverables

The Excel spread sheet identifying Point ID, North Latitude, West Longitude, SPC CA Zone V Northing, and Easting horizontal locations together with outer casing, inner casing and ground elevation for each surveyed monitoring well is attached. All reported elevations are on NAVD 88 datum.

We appreciate the opportunity to provide this service. If you have questions regarding this report or require additional services, please call.

Respectfully submitted,

Sage Consultants, Inc.

Robert E Littell

Robert Littell, P.E.

REGISTERED PROFESSIONAL ENGINEER
ROBERT E. LITTELL
No. 13395
Exp. 03-31-09
CIVIL
STATE OF CALIFORNIA

cc: addressee (2); file (1)

encl: (1)

SAGE CONSULTANTS INC.
JO: 522-V-1902

HALACO MONTORING WELL SURVEY
6200 PERKINS ROAD, OXNARD CA

Date: 2/15/2008

					Elevation***		
Point ID	Latitude *	Longitude *	Northing**	Easting**	outer Casing	Well Casing	Ground
CM4 - 1	34-08-26.5395	119-11-12.6553	1875707.747	6202544.201	12.07	11.03	6.51
CM4 - 2	34-08-26.5390	119-11-12.6490	1875707.687	6202544.731	12.07	11.22	9.51
CM4 - 3	34-08-26.5416	119-11-12.6500	1875707.955	6202544.645	12.07	11.20	9.51
CM4 - 4	34--08-26.5363	119-11-12.6520	1875707.415	6202544.476	12.07	10.97	9.51
CM5 - 5	34-08-26.5426	119-11-12.6541	1875708.057	6202544.306	12.07	11.04	9.51

* ___ degrees, minutes, seconds seconds (NAD 1983)
** __ CA State Plane Coordinates System Zone 5, Survey feet
*** - MSL elevation, survey feet (NAVD 1988)

Appendix F
Tidal Monitoring Station Details

Contents

F.1 Santa Barbara Station
F.2 Santa Monica Station

Appendix F.1
Santa Barbara Station

Apr 20 2008 10:02 ELEVATIONS ON STATION DATUM
National Ocean Service (NOAA)

Station: 9411340 T.M.: 0 W
Name: SANTA BARBARA, PACIFIC OCEAN, CA Units: Feet
Status: Accepted Epoch: 1983-2001

Datum	Value	Description
MHHW	8.59	Mean Higher-High Water
MHW	7.83	Mean High Water
DTL	5.89	Mean Diurnal Tide Level
MTL	6.00	Mean Tide Level
MSL	5.98	Mean Sea Level
MLW	4.18	Mean Low Water
MLLW	3.20	Mean Lower-Low Water
GT	5.39	Great Diurnal Range
MN	3.65	Mean Range of Tide
DHQ	0.75	Mean Diurnal High Water Inequality
DLQ	0.98	Mean Diurnal Low Water Inequality
HWI	5.52	Greenwich High Water Interval (in Hours)
LWI	11.57	Greenwich Low Water Interval (in Hours)
NAVD	3.29	North American Vertical Datum
Maximum	10.55	Highest Water Level on Station Datum
Max Date	19920119	Date Of Highest Water Level
Max Time	16:24	Time Of Highest Water Level
Minimum	0.27	Lowest Water Level on Station Datum
Min Date	19331217	Date Of Lowest Water Level
Min Time	00:00	Time Of Lowest Water Level

To refer Water Level Heights to a Tidal Datum, apply the desired Datum Value.

Click HERE for further station information including New Epoch products.

Appendix F.2
Santa Monica Station

Apr 20 2008 10:04 ELEVATIONS ON STATION DATUM
National Ocean Service (NOAA)

Station: 9410840 T.M.: 0 W
Name: SANTA MONICA, PACIFIC OCEAN, CA Units: Feet
Status: Accepted Epoch: 1983-2001

Datum	Value	Description
MHHW	7.87	Mean Higher-High Water
MHW	7.13	Mean High Water
DTL	5.16	Mean Diurnal Tide Level
MTL	5.25	Mean Tide Level
MSL	5.23	Mean Sea Level
MLW	3.37	Mean Low Water
MLLW	2.44	Mean Lower-Low Water
GT	5.43	Great Diurnal Range
MN	3.76	Mean Range of Tide
DHQ	0.74	Mean Diurnal High Water Inequality
DLQ	0.93	Mean Diurnal Low Water Inequality
HWI	5.19	Greenwich High Water Interval (in Hours)
LWI	11.26	Greenwich Low Water Interval (in Hours)
NAVD	2.63	North American Vertical Datum
Maximum	10.94	Highest Water Level on Station Datum
Max Date	19821130	Date Of Highest Water Level
Max Time	07:54	Time Of Highest Water Level
Minimum	-0.40	Lowest Water Level on Station Datum
Min Date	19331217	Date Of Lowest Water Level
Min Time	15:42	Time Of Lowest Water Level

To refer Water Level Heights to a Tidal Datum, apply the desired Datum Value.

Click HERE for further station information including New Epoch products.

To refer Water Level Heights to either
NGVD (National Geodetic Vertical Datum of 1929) or
NAVD (North American Vertical Datum of 1988), apply the values located at:
National Geodetic Survey

Appendix G
Oxnard Drainage District No. 3 Map

office of John Orr

PACIFIC

ROAD

Bridge 3

Bridge 2

#2

SUMP where now empties into open ditch

CONTRACT NOs. 1, 2 & 3

AS CONSTRUCTED
MAP OF
OXNARD DRAINAGE
DISTRICT No. 3
VENTURA COUNTY, CALIFORNIA
Showing
CANALS AND PIPE LINES
JULY 1937 SCALE 1" = 1000'
Revised MAY 1938
JULY 1938
JUNE 1939
OCT. 1939
DEC. 1939

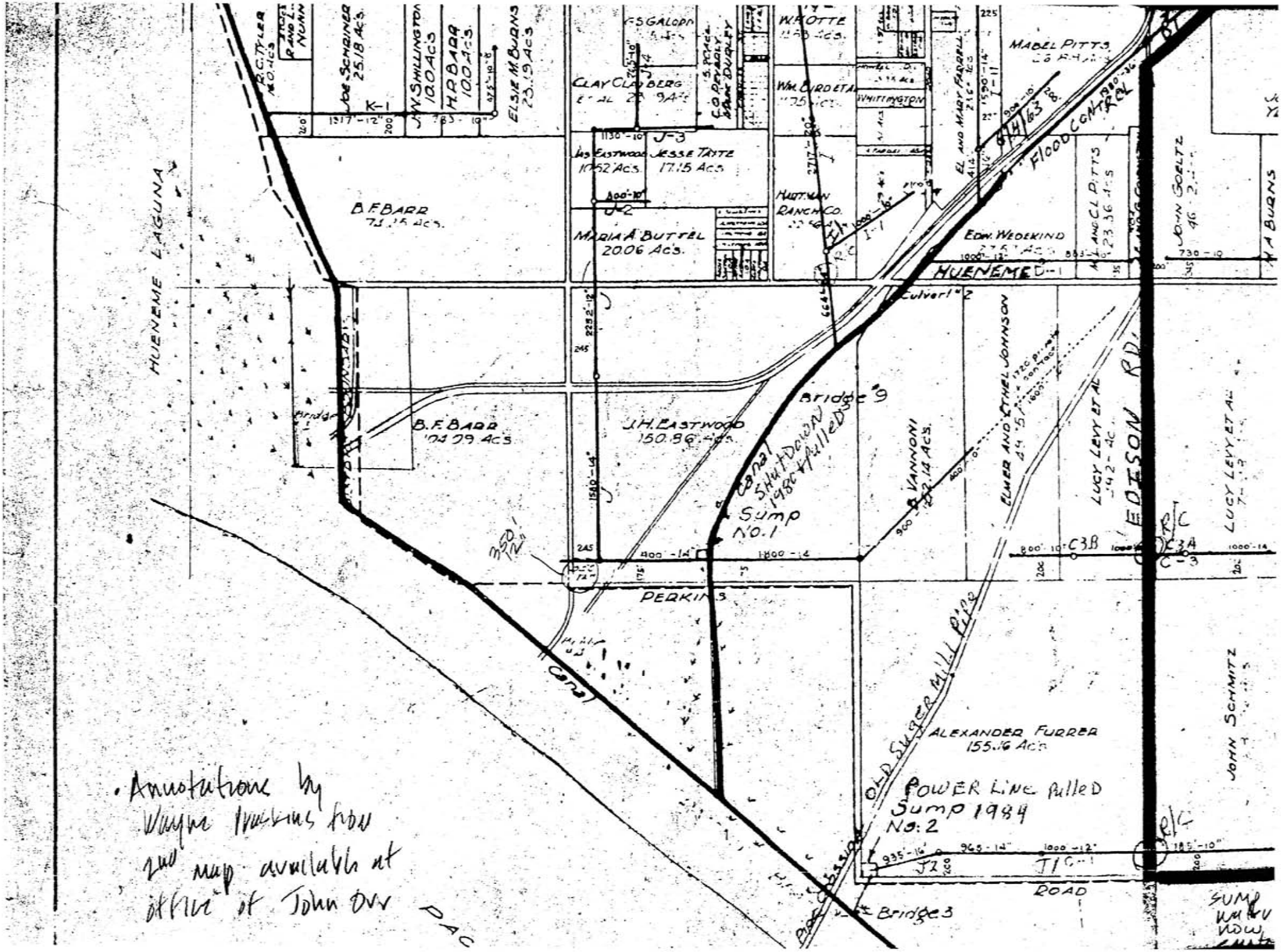
G. G. Bennett
DISTRICT ENGINEER R.E. 2269

Jas. C. Parsons
ASSISTANT ENGINEER

0 200 400 1000 2000 3000 4000
SCALE IN FEET

ROAD CROSSING - R/C
NOT FOUND - N/F
STREET MANHOLES - S
LEGEND
INDICATES MANHOLE
MAIN CANAL

RETURN USED


HUENEME LAGUNA
B.F. BARR 75.15 ACS.
B.F. BARR 104.09 ACS.
MARIA A. BUTTEL 20.06 ACS.
J.H. EASTWOOD 150.86 ACS.
JESSE TAYTE 17.15 ACS.
CLAY CLAUBERG
ELSIE M. BURNS 23.19 ACS.
J.N. SHILLINGTON 10.0 ACS.
H.P. BARR 10.0 ACS.
JOE SCHRINER 25.18 ACS.
HUTTMAN RANCH CO.
WM. CURDETA
WHITTINGTON
EL AND MARY FARRELL
MABEL PITTS
FLOOD CONTROL
EDW. WEDEKIND
HUENEME
Culvert #2
Bridge #9
Canal Shut Down 1980 Pulled Sump No. 1
VANNONI
ELMER AND ETHEL JOHNSON
LUCY LEVY ET AL
EDISON RD.
PERKINS
Canal
ALEXANDER FURRER 155.16 ACS.
OLD SUGAR MILL RD.
POWER LINE Pulled Sump 1984 No. 2
ROAD
Bridge 3
JOHN SCHMITZ
JOHN GOELTZ
PAC
Annotations by Wayne Hawkins from 2nd map available at office of John Orr

Appendix H
Historical Surface Water and Groundwater Chemistry Data

Contents

H.1 Halaco Industrial Wastewater Discharge Permit Application (1979, 2001)
H.2 Halaco Surface Water and Groundwater Monitoring (1981 to 2004)
H.3 Halaco Surface Water and Groundwater Monitoring (2002 to 2004)
H.4 EPA NEIC Site Inspection (1980)
H.5 EPA Ecology & Environment, Inc. Site Inspection (1991)
H.6 RWQCB Site Inspection (1998, 1999)
H.7 EPA Site-wide Integrated Assessment (2006)
H.8 EPA Southeast Smelter Investigation (2007)

Appendix H.1
Halaco Industrial Wastewater Discharge Permit Application (1979, 2001)

Halaco Inc. 6200 Perkins Road, Oxnard, Calif. 93030 • (805) 488-3684 • (213) 889-3820
Magnesium • Aluminum • Zinc

June 21, 1979

Ventura Regional
County Sanitation District
P. O. Box AB
Ventura, California 93001

Attention: Ronald J. Calkins
Associate Sanitary Engineer

Re: Wastewater Discharge Permit Application

Dear Mr. Calkins:

Please find enclosed our completed application, pages 1 through 4.

Should you have any questions or comments, please do not hesitate to call.

Many thanks!

Sincerely,

HALACO INC.

C. W. Haack

C. W. HAACK
President

m

Enclosure

256284 H 415-03

Fruit Growers Laboratory, Inc.

P. O. BOX 272 — 853 CORPORATION STREET
SANTA PAULA, CALIFORNIA 93060
(805) 525-2146 Phone (805) 659-0910

March 28, 1979
Lab. No. 41719

Halaco Engineering Company
6200 Perkins Road
Oxnard, Calif. 93030

Gentlemen:

The analysis of a liquid sample received on March 26, 1979 has been completed. The sample was collected from a pond by J. D. Gable in the presence of our fieldman Everett Baca on the same day. Mr. Fine indicated by telephone, types of analysis desired. The results are as follows:

DATA

	3/26/79 Sample
Suspended Solids, mg/l	196
pH	8.9
Oil & Grease, mg/l	4
COD, mg/l	144
Copper, mg/l	0.15
Nickel, mg/l	less than 0.1
Silver, mg/l	less than 0.05
Zinc, mg/l	0.3
Ammonium-N, mg/l	116
Chloride, mg/l	27200
Magnesium, mg/l	1520
Sodium, mg/l	9500
Potassium, mg/l	9900

If there are questions, please call.

Very truly yours,
FRUIT GROWERS LABORATORY, INC.

Ming Y. Wang

Ming Y. Wang

MYW:jl
cc: 1

Fruit Growers Laboratory, Inc.

P. O. BOX 272 — 853 CORPORATION STREET
SANTA PAULA, CALIFORNIA 93060
(805) 525-2146 Phone (805) 659-0910

June 7, 1979
Lab. No. 42368

Halaco Engineering Company
6200 Perkins Road
Oxnard, CA 93030

Attention: Mr. Les Fine

Gentlemen:

The analysis of a waste water sample collected by Bob Fisher and our staff member Everett Baca at 8:10 a.m. on June 6, 1979 has been completed. The results are as follows:

DATA

	Effluent Sample
Iron	2.5 mg/1
Phenol	0.7 mg/1

If there are questions, please call or write.

Very truly yours,
FRUIT GROWERS LABORATORY, INC.

Ming Y. Wang

MYW:drh
cc: 1

1-20-79
(Mbg)

Fruit Growers Laboratory, Inc.

P. O. BOX 272 — 853 CORPORATION STREET
SANTA PAULA, CALIFORNIA 93060
(805) 525-2146 Phone (805) 659-0910

February 20, 1979
Lab. No. 41461

Halaco Engineering Co.
6200 Perkins Road
Oxnard, California 93030

Attention: Les Fine

Gentlemen:

The analyses of two solids and two liquid samples received on February 14, 1979 have been completed. The samples were collected by J. D. Gable in the presence of our fieldman Everett Baca on the same day. The results are as follows:

DATA

	Effluent	
	~~Solids~~ mg/kg	Liquid (with suspension) mg/liter
Cyanide (CN) *		less than 0.05
Mercury (Hg)	~~less than 0.1~~	less than 0.001
Cadmium (Cd)	~~0.16~~	less than 0.01
Chromium (Cr)**	~~less than 0.05~~	less than 0.05
Lead (Pb)	~~0.9~~	less than 0.05
Boron (B)	~~1.6~~	0.1
Arsenic (As)	~~less than 0.5~~	less than 0.05
Selenium (Se)	~~less than 0.1~~	less than 0.01

*by distillation **hexavalent

The specific gravity of effluent liquid (with suspension) is 1.1 gm/ml and that of pond liquid is 1.05 gm/ml. Dividing valves of mg/liter by specific gravity equals ppm (w/w).

The detection limits for solid samples are higher than that for liquid samples because of the dilution that was necessary for the solid samples.

256284 H 415-03

mg/kg is same as ppm (w/w).

Cyanide was not determined on solid samples because we do not have standard procedures for it.

If there are questions, please call or write.

Very truly yours
FRUIT GROWERS LABORATORY, INC.

Ming Y. Wang

MYW:dlc
cc: 1

RECEIVED

01 NOV -9 2:13

CITY OF OXNARD

TECHNICAL SERVICES PROGRAM

SOURCE CONTROL

6001 PERKINS ROAD, OXNARD, CA 93033

INDUSTRIAL WASTEWATER DISCHARGE PERMIT APPLICATION

(INDUSTRIAL USER BASELINE MONITORING REPORT)

All businesses in the City of Oxnard are required to complete an industrial wastewater discharge permit application. Use current operating parameters. PLEASE ANSWER ALL QUESTIONS.

GENERAL INSTRUCTIONS

1. PLEASE COMPLETE THE ATTACHED FORM AND RETURN IT BY _____ TO THE FOLLOWING ADDRESS:

   CITY OF OXNARD
   TECHNICAL SERVICES PROGRAM
   SOURCE CONTROL
   6001 PERKINS ROAD
   OXNARD, CA 93033

2. IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT THE TECHNICAL SERVICES PROGRAM - SOURCE CONTROL AT (805) 271-2220.

656956-01

ENVIRONMENTAL

ACCREDITED IN ACCORDANCE WITH nelac

ANALYTICAL CHEMISTS

August 16, 2001

Halaco
6200 Perkins
Oxnard, CA 93033

Description : Sample 4F
Project : Sample 4F

Lab ID : SP 106707-06
Customer ID : 2-15300

Sampled On : July 26, 2001-
Sampled By :
Received On : July 26, 2001-11:25
Matrix : Non Potable Water

Sample Results - Inorganic

Constituent	Results	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
Irrigation Suit P:4,5								
Total Hardness	15600	12♦	mg/L					
Calcium	1450	5♦	mg/L		200.7	08/01/01:A203	200.7	08/07/2001:A01
Magnesium	2920	5♦	mg/L		200.7	08/01/01:A203	200.7	08/07/2001:A01
Potassium	8500	200♦	mg/L		200.7	08/01/01:A203	200.7	08/09/2001:B01
Sodium	1360	5♦	mg/L		200.7	08/01/01:A203	200.7	08/07/2001:A01
Total Cations	589	--♦	meq/L					
Boron	0.15	0.05	mg/L		200.7	08/01/01:A203	200.7	08/01/2001:B02
Copper	ND	10	ug/L		200.7	08/01/01:A203	200.7	08/01/2001:B02
Iron	ND	50	ug/L		200.7	08/01/01:A203	200.7	08/01/2001:B02
Manganese	ND	100♦	ug/L		200.7	08/01/01:A203	200.7	08/07/2001:A01
Zinc	ND	20	ug/L		200.7	08/01/01:A203	200.7	08/01/2001:B02
Gypsum Requirement	0.0	--♦	mg/L					
SAR	4.7	0.1♦	mg/L					
Total Alkalinity	1500	10	mg/L		2320B	07/30/01:A202	2320B	07/30/2001:A02
Hydroxide	360	10	mg/L		2320B	07/30/01:A202	2320B	07/30/2001:A02
Carbonate	270	10	mg/L		2320B	07/30/01:A202	2320B	07/30/2001:A02
Bicarbonate	ND	10	mg/L		2320B	07/30/01:A202	2320B	07/30/2001:A02
Sulfate	300	100♦	mg/L		300.0	07/26/01:A21[illegible]	300.0	07/26/2001:A04
Chloride	17800	200♦	mg/L		300.0	07/26/01:A215	300.0	07/26/2001:A04
Nitrate	ND	40♦	mg/L		300.0	07/26/01:A2[illegible] 13:00	300.0	07/26/2001:A04 19:13
Fluoride	ND	10♦	mg/L		300.0	07/26/01:A215	300.0	07/26/2001:A04
Total Anions	538	--	meq/L					
pH	9.7	--	units		4500-H B	07/26/01:B246	4500-H B	07/26/2001:B01 19:28
E. C.	64100	1	umhos/cm		2510B	07/27/01:A212	2510B	07/27/2001:A[illegible]
TDS by Summation	33000	--♦	mg/L					

ND=Non-Detect. PQL=Practical Quantitation Limit. ♦ PQL adjusted for dilutions, concentrations, dry weight reporting, or limited sample.
Containers: (P) Plastic Preservatives: (4) H2SO4 pH < 2, (5) HNO3 pH < 2

FGL ENVIRONMENTAL

KW:cl

Kurt Wilkinson, B.S.
QA Director

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656956-01

Capco Analytical Services INC. (CAS)
1536 Eastman Avenue, Suite B
Ventura CA 93003
(805) 644-1095

Client: Halaco Engineering
Sample ID: Clear Liquid
Date Received: 5/30/01

Sample Matrix: Water
CAS LAB NO: 01106901
Analyst: AS & EN

METALS ANALYSIS SUMMARY

METALS	RESULT	UNITS	PQL	METHOD	DIL FACTOR	ANALYZED
Arsenic	BQL	mg/L	0.02	206.2	1	5/31/01
Cadmium	BQL	mg/L	0.03	200.7	1	5/31/01
Chromium	BQL	mg/L	0.04	200.7	1	5/31/01
Copper	0.08	mg/L	0.03	200.7	1	5/31/01
Lead	BQL	mg/L	0.09	200.7	1	5/31/01
Mercury	BQL	mg/L	0.0005	245.1	1	6/01/01
Nickel	BQL	mg/L	0.08	200.7	1	5/31/01
Silver	BQL	mg/L	0.06	200.7	1	5/31/01
Zinc	0.14	mg/L	0.06	200.7	1	5/31/01

PQL: Practical Quantitation Limit
BQL: Below Practical Quantitation Limit

Principal Analyst

CAPCO Analytical Services, Inc.

656956-01

Capco Analytical Services INC. (CAS)
1536 Eastman Avenue, Suite B
Ventura CA 93003
(805) 644-1095

Client: Halaco Engineering
Lab ID: 011069
Analyst: ZS

Sample Matrix: Water
Date Received: 5/30/01
Date Sampled: 5/30/01

pH RESULTS
EPA METHOD 150.1

CAS Lab #	Sample ID	RESULTS pH (S.U.)	Date Analyzed
01106901	Clear Liquid	9.9	5/30/01

PQL: Practical Quantitation Limit
BQL: Below Practical Quantitation Limit

Principal Analyst

CAPCO Analytical Services, Inc.

656956-01

Appendix H.2
Halaco Surface Water and Groundwater Monitoring (1981 to 2004)

OID Surface Water Samples

Halaco OID Surface Water Monitoring Chemistry Data, 1981 to 2004
Halaco Site, Oxnard, California

			Electrical Conductivity (umhos/cm)		Magnesium (mg/L)		Aluminum (mg/L)		Copper (mg/L)		Zinc (mg/L)		Oil & Grease (mg/L)		pH		
Year		Date	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	Comment
1981	1	1/14/81	2,600	4,600	60	75	<0.2	<0.2	<0.02	<0.02	0.05	0.05	3.2	10.9	7.85	7.95	Buena Engineers
	2																Data not avialable
	3	5/26/81	3,000	3,000	125	125	<0.2	<0.2	<0.02	<0.02	<0.01	<0.01	25.2	29.7	7.8	7.7	Buena Engineers
	4	7/24/81	3,900	4,250	95	95	<0.2	<0.2	<0.02	<0.02	<0.05	<0.05	5.1	1.5	7.5	7.8	Buena Engineers
	5	9/29/81	3,500	3,600	85	85	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	1	<1	7.9	7.8	Buena Engineers
	6	11/4/81	2,100	2,100	37.5	37.5	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	1.7	1.2	7.75	7.8	Buena Engineers
1982	1	1/18/82	3,350	3,850	116	121	<0.2	<0.2	<0.02	<0.02	0.03	0.06	6.1	4.4	7.65	7.94	Buena Engineers
	2	3/25/82	3,400	3,800	100	100	<0.2	<0.2	0.06	0.04	0.03	0.02	4.3	3.1	7.9	8.1	Buena Engineers
	3	5/20/82	2,800	2,800	90	92	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	4.4	2.1	8.15	7.9	Buena Engineers
	4	8/6/82	2,700	2,900	90	85	<0.2	<0.2	0.03	0.03	0.03	0.04	11.7	11.3	7.8	8.1	Buena Engineers
	5	9/30/82	2,600	2,600	80	80	<0.2	<0.2	0.04	<0.02	<0.02	<0.02	3.8	7.4	8.4	8.3	Buena Engineers
	6	11/15/82	3,000	3,200	95	95	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	0.5	1.1	8	7.8	Buena Engineers
1983	1	1/28/83	8,000	8,900	142	275	<0.2	<0.2	<0.02	0.03	0.02	0.05	1.6	<1	7.8	7.7	Buena Engineers
	2	3/24/83	890	760	13.5	10	<0.2	0.2	<0.02	<0.02	<0.02	<0.02	1.9	1.9	7	7	Buena Engineers
	3	5/31/83	3,280	3,400	75	80	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	1.8	2.4	7	7.52	Buena Engineers
	4	7/21/83	3,000	2,800	61	56.5	<0.1	<0.1	0.02	0.02	0.02	<0.02	1.8	1.4	7.8	8.2	Buena Engineers
	5	9/23/83	2,600	3,000	67.5	70	<0.2	<0.2	<0.02	<0.02	<0.02	0.02	0.6	4.4	8.45	8.45	Buena Engineers
	6	11/28/83	8,400	6,300	124	102	<0.1	<0.1	<0.02	<0.02	<0.02	<0.02	0.8	0.8	7.75	7.65	Buena Engineers
1984	1	1/23/84	3,600	3,800	60	60	<0.1	<0.1	<0.02	<0.02	0.02	0.02	8.4	3.8	7.95	8	Buena Engineers
	2	3/30/84	2,800	3,200	32	31	<0.1	<0.1	<0.02	<0.02	<0.02	0.02	4.3	3.7	8.1	8.3	Buena Engineers
	3	5/30/84	3,200	4,000	70	79	<0.2	<0.2	<0.05	<0.05	<0.02	<0.02	2.5	5.2	8.05	7.9	Buena Engineers
	4	7/25/84	3,650	9,250	72.5	115	<0.2	1	0.02	0.04	0.03	0.07	1.4	1.2	7.8	7.7	Buena Engineers
	5	9/28/84	2,900	2,900	95	75	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	3.6	1.9	7.9	7.7	Buena Engineers
	6	11/30/84	2,800	2,600	120	80	<0.2	<0.2	<0.02	<0.02	<0.01	<0.01	2.7	1.5	7.8	8.1	Buena Engineers
1985	1	1/31/85	5,450	5,600	120	140	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	1.1	1.4	7.7	7.9	Buena Engineers
	2	4/2/85	2,800	2,800	62.5	62.5	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	1.2	1.8	7.15	7.3	Buena Engineers
	3	6/14/85	2,850	2,975	50	50	<0.2	<0.2	<0.02	0.02	<0.02	0.02	2.7	5	7.73	7.55	Buena Engineers
	4	7/19/85	3,420	4,000	100	110	<0.2	<0.2	<0.02	0.02	0.08	0.13	1.4	0.7	7.5	7.8	Buena Engineers
	5	9/23/85	3,100	3,900	65	60	<0.2	<0.2	<0.02	<0.02	0.02	0.03	6.5	4	7.7	8	Buena Engineers
	6	11/20/85	3,020	3,190	100	100	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	0.85	0.3	8.1	8.1	Buena Engineers
1986	1	1/27/86	3,400	3,300	120	120	<0.2	<0.2	<0.02	<0.02	0.03	<0.02	8.7	6.3	7.9	8.1	Buena Engineers
	2	4/3/86	3,500	3,700	119	125	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	3.8	6.4	7.6	7.5	Buena Engineers
	3	6/11/86	3,300	3,400	60	70	<0.2	<0.2	0.03	<0.02	<0.02	<0.02	5.2	3.8	6.95	7.11	Buena Engineers
	4	6/17/86	2,950	3,800	80	80	<0.2	<0.2	0.02	0.03	<0.02	0.02	1	0.4	8.2	8.2	Buena Engineers
	5	9/29/86	5,160	5,200	80	64	<0.2	<0.2	<0.02	<0.02	<0.02	0.03	<1	<1	7.75	7.75	Buena Engineers
	6	12/17/86	3,600	4,100	150	140	<0.2	<0.2	<0.2	<0.2	<0.02	<0.02	2.9	14.2	8.3	8.1	Buena Engineers
1987	1	1/23/87	3,600	3,800	175	175	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	5.8	11.5	7.8	7.4	Buena Engineers
	2	3/31/87	2,850	3,290	120	110	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	1.89	<1	8.03	8.1	Buena Engineers
	3	5/29/87	4,050	3,180	87.5	75	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	<1	4.3	7.8	7.5	Buena Engineers
	4	7/16/87	3,600	3,550	110	100	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02	2.6	2.6	8.25	8.2	Buena Engineers
	5	9/29/87	3,900	3,300	135	118	0.7	2	<0.02	<0.02	<0.02	0.56	<1	<1	7.8	7.8	Buena Engineers
	6	11/19/87	4,700	4,110	170	158	<0.2	<0.2	<0.01	<0.01	<0.01	<0.01	4.4	6.6	8	7.75	Buena Engineers
1988	1	1/13/88	4,140	4,185	119	106	0.45	0.4	<0.01	<0.01	0.08	<0.01	<1	<1	7.7	7.1	Buena Engineers
	2	3/26/88	5,850	5,070	198	173	<0.1	<0.1	<0.02	<0.02	<0.02	0.05	<1	<1	7.9	7.7	Buena Engineers
	3	5/11/88	4,110	2,570	159	102	0.3	0.2	<0.02	<0.02	<0.02	<0.02	<1	<1	8.3	8.2	Buena Engineers
	4	7/28/88	6,370	9,190	121	149	<0.02	<0.02	0.09	<0.02	0.29	0.28	4.1	4.1	7.9	7.6	Buena Engineers
	5	10/4/88	4,130	5,100	141	155	0.46	0.5	0.02	0.03	0.06	0.08	<1	8.7	7.96	8.05	Buena Engineers
	6	12/2/88	9,570	9,450	250	247	<0.02	<0.02	<0.02	<0.02	<0.02	0.07	3	0.25	7.4	7.5	Buena Engineers

Halaco OID Surface Water Monitoring Chemistry Data, 1981 to 2004
Halaco Site, Oxnard, California

			Electrical Conductivity (umhos/cm)		Magnesium (mg/L)		Aluminum (mg/L)		Copper (mg/L)		Zinc (mg/L)		Oil & Grease (mg/L)		pH		
Year		Date	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	Comment
1989	1	1/31/89	7,970	6,180	164	223	<0.02	<0.02	0.91	0.91	<0.02	<0.02	<0.05	1.2	8.2	8.2	Buena Engineers
	2	4/3/89	11,310	14,600	266	240	5.3	0.43	0.07	0.02	<0.02	<0.02	51	8.3	8.6	8.7	Buena Engineers
	3	6/1/89	1,851	9,830	360	307	0.14	81.9	<0.01	1.2	0.02	2.1	19	25.1	8.2	8.2	Buena Engineers
	4	8/9/89	4,700	13,200	226	506	<0.05	3.38	<0.05	<0.05	<0.05	<0.05	27.2	10.4	8.5	8.4	Buena Engineers
	5	9/29/89	15,510	15,850	611	613	159	160	<0.02	<0.02	<0.02	<0.02	8.2	18	7.61	7.87	Buena Engineers
	6	11/17/89	25,600	31,700	409	418	2.38	2.04	<0.05	<0.05	<0.05	<0.05	5.43	6.67	8.22	8.13	Buena Engineers
1990	1	1/24/90	20,300	20,600	451	581	0.72	1.14	<0.02	<0.02	<0.02	<0.02	11.4	29	8.2	8.27	Buena Engineers
	2	4/19/90	5,800	9,600	180	240	0.24	10	0.02	0.03	0.02	0.11	11	15	9.2	8.9	Buena Engineers
	3	5/10/90			210	260	0.62	0.77	0.21	0.23	0.07	0.04	0.88	1.7	8.7	8.8	Buena Engineers
	4	7/27/90	15,500	15,000	330	360	0.94	1.3	<0.1	<0.1	<0.1	<0.1	5.3	5	8.3	8.5	Buena Engineers
	5	10/1/90	8,500	10,400	260	540	<1	<1	<0.1	<0.1	<0.1	<0.1	<1	<1	8.6	8.6	Buena Engineers
	6																Data not avialable
1991	1	1/31/91	3,320	2,070	790	470	<1	<1	<0.1	<0.1	<0.1	<0.1	1	3	8	8.1	Buena Engineers
	2	3/13/91	2,730	7,780	2	7	1	1	<0.1	<0.1	0.12	0.1	1	<1	7.6	7.5	Buena Engineers
	3	5/13/91	23,000	20,000									<1	1	8.5	8.5	Buena Engineers
	4	7/23/91	8,600	10,000	250	290	<1	<1	<0.1	<0.1	<0.1	<0.1	<1	2	8.7	8.7	Buena Engineers
	5	9/16/91	13,000	10,000	300	200	<1	<1	<0.1	<0.1	<0.1	0.2	1.5	1	9.2	8.9	Buena Engineers
	6	11/18/91															Data not avialable
1992	1	1/28/92	14,000	19,000	360	500	<1	<1	<0.1	<0.1	<0.1	<0.1	3	1	8.4	8.4	Earth Systems
	2	3/20/92	3,000	4,900	50	70	3	1	<0.1	0.1	0.5	0.5	24	3.3	8	7.9	Earth Systems
	3	5/20/92	7,600	8,100	100	100	<1	<1	<0.1	<0.1	<0.1	<0.1	<1	2.5	8.2	8.3	Earth Systems
	4	7/13/92	19,000	25,000	410	480	5	5	<0.1	<0.1	<0.1	<0.1	2.5	2.6	8.8	8.8	Earth Systems
	5	9/18/92	9,600	10,000	150	150	<1	<1	<0.1	<0.1	<0.1	<0.1	<1	<1	8.6	8.7	Earth Systems
	6	11/30/92															Data not avialable
1993	1	1/25/93	3,900	8,500	150	220	1.2	1	<0.1	<0.1	<0.1	<0.1	<1	14	8.1	8.1	Earth Systems
	2	4/1/93	3,400	3,400	100	110	<1	<1	<0.1	<0.1	<0.1	<0.1	3.3	2.5	8.2	8	Earth Systems
	3	5/14/93	3,200	3,600	130	120	<1	<1	<0.1	<0.1	<0.1	<0.1	<1.28	<1.2	8.3	8.4	Earth Systems
	4	7/12/93	5,300	5,800	1,500	1,800	<1	<1	<0.1	<0.1	<0.1	0.1	<1	<1	8.8	8.7	Earth Systems
	5	10/25/93	3,600	5,000	94	110	<0.5	<0.5	<0.1	<0.1	<0.05	0.084	3	<1	8.9	8.7	Earth Systems
	6	11/23/93	3,000	3,200	97	100	<0.5	<0.5	<0.1	<0.1	<0.05	<0.05	3.8	5.8	8.5	8.6	Earth Systems
1994	1	1/31/94	5,600	1,200	180	310	<0.5	0.64	<0.1	<0.1	<0.05	<0.05	2.3	1.8	8	8.4	Earth Systems
	2	3/31/94	12,000	12,000	310	280	0.91	0.97	<0.1	<0.1	<0.05	<0.05	<1.2	<1.2	8.3	8.3	Earth Systems
	3	5/9/94	5,000	4,400	190	140	<0.5	<0.5	<0.1	<0.1	<0.05	<0.05	<1.1	2.9	8	8.1	Earth Systems
	4	7/6/94	4,700	4,000	180	140	0.64	0.91	<0.1	<0.1	<0.4	<0.4	4.8	1.5	8.4	8.1	Earth Systems
	5	9/22/94	3,800	4,100	110	130	<0.5	<0.5	<0.05	<0.05	<0.05	<0.05	2.4	<1.03	8.4	8.5	Earth Systems
	6	11/28/94					<0.5	<0.5	<0.1	<0.1	<0.05	<0.05					Earth Systems
1995	1	1/19/95	3,000	3,700	130	150	<0.5	<0.5	<0.1	<0.1	<0.05	<0.05	1.8	<1.17	8	7.9	Earth Systems
	2	3/30/95	2,800	3,500	120	110	0.71	0.4	<0.1	<0.1	<0.06	<0.06	1.1	1	8	8	Earth Systems
	3	5/3/95	2,600	2,800	110	120	<0.3	<0.3	<0.1	<0.1	<0.06	0.2	<1.14	<1	7.9	8.3	Earth Systems
	4	7/20/95	3,100	3,500	120	130	<0.3	<0.3	<0.1	<0.1	<0.06	<0.06	3	3.6	7.8	8	Earth Systems
	5	9/21/95	3,600	3,000	100	110	<0.3	<0.3	<0.1	<0.1	<0.06	<0.06	1.9	1.9	7.5	7.5	Earth Systems
	6	11/16/95	3,300	3,400	93	97	<0.3	<0.3	<0.1	<0.1	<0.06	<0.06	1.3	4	7.5	7.6	Earth Systems
1996	1	1/4/96	6,500	6,000	170	140	<0.3	0.37	<0.03	<0.03	<0.06	<0.06	3.3	<1.2	7.8	7.9	Earth Systems
	2	3/28/96	2,800	2,800	120	130	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	<1.12	<1.11	7.6	7.8	Earth Systems
	3	5/3/96	3,700	4,200	160	140	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	1.2	1.6	7.3	7.4	Earth Systems
	4	7/31/96	7,700	8,200	150	190	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	2.2	2.4	7.5	7.6	Earth Systems
	5																Data not avialable
	6	11/26/96	14,000	16,000	280	310	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	2.4	1.1	7.8	7.8	Earth Systems

Halaco OID Surface Water Monitoring Chemistry Data, 1981 to 2004
Halaco Site, Oxnard, California

			Electrical Conductivity (umhos/cm)		Magnesium (mg/L)		Aluminum (mg/L)		Copper (mg/L)		Zinc (mg/L)		Oil & Grease (mg/L)		pH		
Year		Date	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	OID 1 North	OID 2 South	Comment
1997	1	1/30/97	3,700	4,400	130	120	<0.3	<0.3	<0.03	0.11	<0.06	0.13	1.6	2.3	7.8	7.8	Earth Systems
	2																Data not avialable
	3																Data not avialable
	4	6/30/97	3,400	3,800	140	140	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	1.8	2.6	7.7	7.7	Earth Systems
	5	8/28/97	8,300	7,700	230	210	<0.3	<0.03	<0.03	<0.03	<0.06	<0.06	2.6	<1	8	8.2	Earth Systems
	6	11/25/97	3,700	7,400	120	180	<0.3	1.7	<0.03	<0.03	<0.06	<0.06	<1	<1	7.9	7.8	Earth Systems
1998	1	1/28/98	15,000	15,000	300	350	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	2	2.8	7.8	7.8	Earth Systems
	2	4/30/98	4,100	6,600	130	250	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	2.1	2.1	7.5	7.7	Earth Systems
	3	6/1/98	5,200	4,500	180	150	<0.3	<0.3	0.15	0.073	0.093	<0.06	1.4	2.9	8	7.8	Earth Systems
	4	7/2/98	3,900	4,400	120	130	1.2	<0.3	<0.03	<0.03	<0.06	<0.06	2.6	2.8	7.9	7.8	Earth Systems
	5	8/21/98	4,500	4,600	170	170	<0.3	0.34	<0.03	<0.03	<0.06	<0.06	2.3	2.6	7.9	8	Earth Systems
	6	10/12/98	3,600	3,700	110	110	1.1	2.5	<0.03	0.05	<0.06	<0.06	<1	<1	8	8.1	Earth Systems
	7	11/12/98	2,800	3,600	110	130	<0.3	0.5	<0.03	<0.03	<0.06	<0.06	<1	1.2	7.9	8	Earth Systems
1999	1	1/13/99	5,340	5,060	140	120	0.48	<0.3	<0.03	<0.03	<0.06	<0.06	2.1	1.2	8.1	8.2	Earth Systems
	2	3/24/99	8,460	17,800	210	410	<0.3	0.3	0.04	<0.03	0.06	<0.06	1.4	1.4	8	8.1	Earth Systems
	3	5/17/99	14,100	17,200	390	530	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	<1	<1	8	8	Earth Systems
	4	7/13/99	8,780	9,750	200	240	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	<1	<1	7.8	7.9	Earth Systems
	5	8/13/99	3,810	3,760	150	160	<0.3	<0.3	<0.03	<0.03	0.07	<0.06	1.6	1	7.8	7.8	Earth Systems
	6	10/4/99	3,920	3,710	120	140	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	9.8	11	8.2	8.2	Earth Systems
	7	11/10/99	41,500	43,000	1,300	1,100	0.37	<0.3	<0.03	<0.03	<0.06	<0.06	1.1	1.1	7.9	7.9	Earth Systems
2000	1	1/19/00	21,000	26,900	470	360	<0.3	<0.3	<0.03	<0.03	<0.06	<0.06	2.8	3.9	8	8	Earth Systems
	2	3/10/00	6,780	7,470	210	210	0.9	<0.3	<0.03	<0.03	<0.06	<0.06	1.6	2.2	7.9	7.9	Earth Systems
	3	5/19/00	10,000	11,400	8.3	8.7	<0.3	<0.3	0.14	0.04	<0.06	<0.06	16	11	8.1	8.2	Earth Systems
	4	7/21/00	8,150	9,160	210	240	1.3	0.4	0.1	0.08	0.15	<0.06	2.1	4.6			Earth Systems
	5	9/29/00	4,180	4,424	110	110	<0.3	<0.3			<0.06	<0.06	8.6	9.6	7.8	7.8	Earth Systems
	6	11/3/00	10,500	15,150	250	350	0.34	2.9	0.07	0.12	<0.06	0.09	<1	4.3	7.8	7.8	Earth Systems
2001	1	1/25/01	2,870	3,800	63	64	0.8	0.5	0.23	0.07	0.43	0.51	2.4	1.8	8.4	8.1	Earth Systems
	2	3/30/01	18,000	18,900	330	260	1	0.8	0.12	<0.03	<0.06	<0.06	1.8	2.3	8.1	8.2	Earth Systems
	3																Data not avialable
	4																Data not avialable
	5	9/1/01	2,040	2,570	66	80	ND	ND	ND	ND	ND	ND	7	ND	8.2	8.3	Halaco
	6	11/19/01	15,400	18,900	698	515	0.3	0.3	ND	ND	ND	0.04	ND	ND	8.6	8.5	Halaco
2002	1	1/21/02	2,940	6,370	112	164	ND	ND	ND	ND	ND	0.02	ND	ND	8.9	8.7	Halaco
	2	3/29/02	2,940	3,480	107	115	ND	ND	ND	ND	ND	ND	ND	ND	8.5	8.7	Halaco
	3	5/24/02	14,800	13,400	358	310	ND	ND	ND	ND	0.02	ND	ND	ND	8.6	8.3	Halaco
	4	7/3/02	3,470	3,930	120	128	ND	0.2	0.01	ND	ND	ND	ND	ND	8	8	Halaco
	5	9/11/02	3,490	5,340	109	121	ND	ND	ND	ND	ND	ND	ND	ND	7.6	7.6	Halaco
	6	11/27/02	8,690	21,000					ND	0.06	0.07	0.23	1.1	ND	8.1	8.1	Halaco/Brash Industries
2003	1	1/10/03	2,980	4,290	108	149	0.2	0.1	ND	ND	0.03	0.03	ND	ND	8.4	8.4	Halaco/Brash Industries
	2	1/31/03	6,270	6,510	150	130	ND	ND	0.14	0.17	ND	ND	4.8	5.1	7.6	7.7	Halaco/Brash Industries
	3	3/13/03	3,370	6,080	122	162	0.1	ND	0.01	ND	0.04	0.04	ND	ND	8.3	8.4	Halaco/Brash Industries
	4	5/9/03	3,870	3,790	124	126	0.1	0.3	ND	ND	0.07	0.06	ND	ND	8.3	8.2	Halaco/Brash Industries
	5	6/13/03	4,950	5,820	120	130	ND	ND	ND	ND	ND	0.08	ND	ND	7.8	7.9	Halaco/Brash Industries
	6	8/5/03	2,400	2,590	91	97	0.046	0.218	0.014	0.17	0.054	0.049	ND	ND	7.6	7.6	Halaco/Brash Industries
	7	10/27/03	42,300	49,600	682	889	0.059	1.71	0.003	0.016	0.008	0.031	19	20	7.8	8	Halaco/Brash Industries
	8	11/25/03	67,000	70,500	1,330	1,270	0.4	ND	ND	ND	ND	ND	ND	ND	7.85	7.42	Halaco/Brash Industries

Halaco OID Surface Water Monitoring Chemistry Data, 1981 to 2004
Halaco Site, Oxnard, California

			Electrical Conductivity (umhos/cm)		Magnesium (mg/L)		Aluminum (mg/L)		Copper (mg/L)		Zinc (mg/L)		Oil & Grease (mg/L)		pH		
Year		**Date**	**OID 1 North**	**OID 2 South**	**OID 1 North**	**OID 2 South**	**OID 1 North**	**OID 2 South**	**OID 1 North**	**OID 2 South**	**OID 1 North**	**OID 2 South**	**OID 1 North**	**OID 2 South**	**OID 1 North**	**OID 2 South**	**Comment**
2004	1	2/6/04	37,900	42,000	963	959	0.136	0.073	0.005	0.005	0.024	0.049	ND	ND	7.95	8.08	Halaco/Brash Industries
	2	3/15/04	10,200	8,900	168	206	0.226	0.103	0.024	0.019	0.053	0.013	ND	ND	7.75	7.98	Halaco/Brash Industries
	3	4/30/04	5,450	3,480	163	131	0.107	0.058	0.012	0.008	0.016	0.019	ND	1.12	7.21	6.89	Halaco/Brash Industries
	4	6/14/04	5,530	8,270	123	164	0.181	0.065	0.012	0.006	0.024	0.01	ND	ND	7.59	7.8	Halaco/Brash Industries
	5	8/6/04	3,930	4,200	132	141	0.038	0.048	0.061	0.055	0.008	0.006	ND	ND			Halaco/Brash Industries
	6	11/24/04	24,100	25,800	485	521	0.146	0.049	0.007	0.006	0.017	0.009	ND	ND	7.11	7.03	Halaco/Brash Industries

Note:
< = Not detected at less than the indicated detection limit.

Old Well Groundwater and Wastewater Disposal Pond Samples

Halaco Groundwater and Wastewater Disposal Pond Monitoring Chemistry Data, 1981 to 2003

Halaco Site, Oxnard, California

		Electrical Conductivity (umhos/cm)					Magnesium (mg/L)					Aluminum (mg/L)					Copper (mg/L)					Zinc (mg/L)					Oil & Grease (mg/L)					pH					
Year	**Date**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**Pond**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**Pond**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**Pond**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**Pond**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**Pond**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**Pond**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**Pond**	**Comment**
1981	1/14/81	92,000	52,000	72,000		200,000	900	220	350		930	<0.2	<0.2	<0.2		1,500	0.12	0.06	0.02		0.3	0.08	0.05	0.08		0.2	11.7	10.7	9.3		6.1	8.4	8.4	8.7		8.1	Buena Engineers
	9/29/81	950	19,200	78,500		85,000	30	480	320		33,330	<0.2	<0.2	<0.2		670	<0.02	<0.02	<0.02		56.7	0.07	0.3	<0.02		183	1.5	4	7.8		84	7.6	7.3	8.85		9.5	Buena Engineers
1982	3/25/82		26,000			4,450		700			140		<0.2			<0.2		0.08			0.02		0.12			0.04		5.5			3.5		7.25			7.55	Buena Engineers
	9/30/82		26,000		74,000	265,000		500		530	2,500		<0.2		<0.2	4,200		<0.02		<0.02	5		<0.02		0.04	5		5.8		8.7	1.6		7.8		7.5	9.4	Buena Engineers
1983	1/28/83	5,750			67,000	88,000	60			1,100	4,500	<0.2			<0.2	20,000	0.02			0.14	320	0.05			<0.02	200	1.2			1	1	7.8			7.4	7.8	Buena Engineers
	9/23/83	52,000	72,000	71,000	58,000	4,550	600	580	300	400	100	0.2	0.3	0.3	<0.2	17	<0.02	0.08	0.2	<0.02	0.6	<0.02	<0.02	<0.02	0.07	0.58	2	2.9	2.4	1.1	4.2	7.4	7.85	8.45	7.55	7.9	Buena Engineers
1984	3/30/84	68,000	76,000	71,000	37,500	56,000	520	400	590	420	280	0.2	0.3	0.3	<0.2	0.2	0.08	0.14	0.07	<0.02	<0.02	<0.02	<0.02	<0.02	0.07	<0.02	3	2.6	7.6	6.2	7.1	8.25	8.25	7.6	7.35	8.25	Buena Engineers
	9/28/84	27,000	52,000		52,000	52,000	500	700		525	650	<0.2	<0.2		<0.2	3,000	<0.02	<0.02		<0.02	35	0.04	0.02		0.06	16	0.5	0.4		0.71	2.6	7.1	7.2		7.25	9.8	Buena Engineers
1985	4/2/85	75,000	92,000	84,000	62,000	70,000	800	250	670	650	150	1.5	0.4	0.8	0.2	3	<0.02	<0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<1	<1	<1	<1	2	6.7	7.7	7.1	6.75	9.3	Buena Engineers
	9/23/85		77,000	92,000	68,000	134,000		500	150	400	2,000		<0.2	<0.2	<0.2	3.2		0.15	0.33	0.15	16		<0.02	0.21	0.28	0.37		3.4	5.4	4	3.2		6.6	8.1	6.8	9.3	Buena Engineers
1986	4/3/86		205,000	190,000	62,000	33,800		775	1,125	850	200		<0.2	<0.2	<0.2	0.8		0.04	0.03	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02		5.6	7.2	15.4	8.8		8.1	7.3	6.8	9	Buena Engineers
	9/29/86		111,000	100,000	64,000	130,000		400	500	500	1.6		<0.2	<0.2	0.4	74		<0.02	<0.02	0.06	<0.02		<0.02	<0.02	0.03	0.06		0.4	<1	<1	<1		8.1	7.55	7.6	10.3	Buena Engineers
1987	3/31/87			160,000	56,000	60,000			800	800	2,500			<0.2	0.4	74			0.07	0.17	0.04			<0.02	<0.02	<0.02			1.7	<1	<1			8.25	7.71	9.73	Buena Engineers
	9/29/87			118,000	64,000	238,000			829	784	1,090			9.7	24.5	3,970			<0.02	<0.02	27			<0.02	<0.02	18			<1	<1	<1			6.6	6.8	10.1	Buena Engineers
1988	3/26/88		78,500	61,500	33,800	46,700		235	965	650	11,100		19.6	8	3	212		0.78	0.13	0.05	2.15		0.9	0.18	0.1	9.5		<1	4.2	2.2	1.2		8.6	7.8	7.3	9.5	Buena Engineers
	10/4/88		23,100	44,900	80,800	5,770		442	820	476	155		1.17	8.89	5.48	10.1		0.06	0.06	0.07	0.05		0.14	0.14	0.13	0.13		<1	<1	<1	33.3		8.1	7.58	8.45	7.58	Buena Engineers
1989	4/3/89		65,300	81,600	72,500	133,500		358	508	585	2,832		82	187	240	22		0.84	0.59	0.85	81		<0.02	0.09	1.14	35		82	21	11	53		8.6	8	7.7	9.4	Buena Engineers
	9/29/89		89,600	82,300	30,900	71,500		777	869	790	1,823		212	212	212	212		0.93	0.11	0.31	<0.02		<1.05	0.11	0.3	<0.02		29	21	29	23		7.21	7.38	7.63	9.6	Buena Engineers
1990	4/19/90		82,200	79,400	43,100	64,200		710	1,000	1,300	1,300		42	29	7.7	5		0.79	0.47	0.07	140		0.52	0.41	0.09	190		16	13	9.9	59		7.3	7	7	8.5	Buena Engineers
	7/27/90		81,500	87,800	45,700	21,100		480	530	1,400	730		6.2	8.3	2.1	5.4		0.3	0.12	0.14	0.55		0.16	<0.1	<0.1	0.14		4.8	4.6	3.5	2.2		7.9	7.2	6.5	9.7	Buena Engineers
	10/1/90		82,700	88,900	48,600	23,000		1,400	780	1,700	720		7.1	2.7	6.7	250		0.36	<0.1	<0.1	<0.1		0.27	<0.1	<0.1	1.8		<1	<1	<1	<1		7.8	7.1	6.5	8.9	Buena Engineers
1991	3/13/91		83,800	88,700	38,400	311,400		540	620	280	240		12.5	2.5	<0.1	18,000		0.4	<0.1	0.1	590		0.3	<0.1	0.1	250		2	1	7	320		8	7.1	6.9	7.7	Buena Engineers
	9/16/91		91,000	100,000	45,000	84,000		400	400	300	400		9	1	2	30		0.3	<0.1	0.1	<0.1		0.3	0.2	0.2	<0.1		1.1	1.4	<1	<1		7.8	6.6	7.2	8.8	Buena Engineers
1992	3/20/92		110,000	97,000	23,000	110,000		850	550	200	800		3.5	1	1	1,200		0.1	0.1	0.2	10		0.5	0.5	1	<100		<1	<1	<1	1.5		8	7.1	7.6	9.1	Earth Systems
	9/18/92		120,000		40,000	20,000		1,000		400	2,000		5		2	45		0.1		<0.1	0.2		0.2		<0.1	5		<1		2.5	<1		7.3		7.9	9.9	Earth Systems
1993	4/1/93		110,000	98,000	100,000	130,000		1,200	720	1,400	1,600		1.9	21	2	7,400		<0.1	0.23	<0.1	55		<0.1	0.36	<0.1	24		<1	<1.33	<1.28	<1		8	7.4	7	9.1	Earth Systems
	10/25/93		120,000	110,000	150,000	42,000		1,300	450	1,600	1,800		4.4	0.63	2.6	180		<0.1	<0.1	<0.1	3.1		0.21	0.094	0.17	3.6		<1.16	2.4	2.7	12		7.9	7	6.7	9.8	Earth Systems
1994	3/31/94		120,000	110,000	140,000	94,000		1,500	770	2,200	34,000		0.52	0.58	0.52	4,100		0.16	<0.1	<0.1	95		0.17	0.12	0.17	120		<1.2	<1.2	<1.2	15		7.9	7.2	6.9	9.4	Earth Systems
	9/22/94		26,000	26,000	26,000	24,000		700	730	1,600	810		3	<2	<2	20		<0.5	<0.5	<0.5	0.097		<0.5	<0.5	<0.5	0.71		<1	5.6	<1	<1.25		7	6.8	7.8	9.6	Earth Systems
1995	3/30/95	66,000	130,000	120,000	110,000	45,000	1,400	1,200	540	630	17,000	5.6	0.73	<0.3	0.76	440	0.4	<0.1	<0.1	<0.1	7.4	0.26	<0.6	<0.6	<0.6	190	1.7	1	1.1	<1	1.4	7.1	7.8	7.3	7	9.6	Earth Systems
	9/21/95	28,000	15,000	28,000	30,000	20,000	1,700	350	650	840	600	4.2	1.2	<1	1.4	2,300	<0.4	<0.1	<0.4	<0.4	61	<0.2	0.06	<0.2	<0.2	14	1.9	1.3	1.07	<1	2.5	6.9	6.9	6.7	6.7	8.4	Earth Systems
1996	3/28/96	94,000	140,000	78,000	210,000	12,000	1,500	1,400	450	1,800	3,300	4.3	<0.9	<0.9	<2	92	<0.09	<0.09	<0.09	<0.2	0.67	<0.2	<0.2	<0.2	<0.3	36	<1.06	<1.08	<1.10	3.9	3.9	7.4	7.4	6.5	6.5	9.7	Earth Systems
	9/1/96																																				No sample, area flooded
1997	3/1/97																									330					4						No sample, area flooded
	11/25/97	77,000	140,000		190,000	130,000	1,600	1,200		1,900	47,000	1.7	0.42		6.8	0.58	<0.03	<0.03		<0.03	0.28	<0.06	<0.06		<0.06	42	1.3	<1		<1	27	7.9	7.6		6.8	9.2	Earth Systems
1998	4/30/98	78,000	120,000		160,000	95,000	1,400	930		1,900	1,400	<1.5	<3		3.5	1,800	<0.3	<0.3		<0.3	200	<0.3	<0.6		<0.6	330	2.2	2.7		2.5	4	7.8	7.9		6.6	8.4	Earth Systems
	10/12/98	85,000	130,000	190,000	250,000	93,000	1,600	1,200	1,200	2,800	2,700	360	1.8	<1.5	4.3	69	7.2	<0.06	<0.15	<0.15	<0.99	5.9	<0.12	<0.3	<0.3	18	1.1	<1	1	<1	1.5	7.8	8.1	7	6.7	9.2	Earth Systems
1999	3/24/99	71,000	118,000	254,000	189,000	86,100	2,000	1,700	3,300	1,300	2,400	46	<1.5	4.5	8.4	1.7	0.73	<0.06	<0.06	0.19	0.45	0.79	<0.12	<0.12	<0.24	0.17	1.3	42	14	1.3	50	7.3	8.1	6.8	6.4	9.4	Earth Systems
	10/4/99	70,000	42,600	196,000	231,000	75,000	7,100	630	1,200	1,700	1,200	<1.5	60	9.5	<0.3	<0.3	<0.15	2.8	<0.3	<0.03	<0.03	<0.3	1.7	<0.6	<0.06	<0.06	7.2	14	13	12	12	7	7.6	6.7	6.8	9.5	Earth Systems
2000	3/10/00	69,900	92,900	136,000	179,000	69,000	1,800	1,400	970	1,000	3,600	1.9	160	1	8.2	1,300	0.06	3.9	<0.03	<0.03	24	<0.06	0.97	<0.06	<0.06	1.6	2.1	2.4	2.2	2.5	43	7.6	8.1	7.1	6.7	9	Earth Systems
			MW-3	**MW-2**	**MW-1**	**Pond**		**MW-3**	**MW-2**	**MW-1**	**Pond**		**MW-3**	**MW-2**	**MW-1**	**Pond**		**MW-3**	**MW-2**	**MW-1**	**Pond**		**MW-3**	**MW-2**	**MW-1**	**Pond**		**MW-3**	**MW-2**	**MW-1**	**Pond**		**MW-2**	**MW-3**	**MW-1**	**Pond**	Wells Renumbered
	10/18/00		114,000	132,000	135,000	198,000		1,500	1,400	1,500	530		2.4	0.5	<0.3	710		0.14	0.1	0.05	120		0.09	0.18	<0.06	110		1.6	1.2	1.6	2		7.5	7.6	7.6	8	Earth Systems
2001	3/30/01		95,400	147,600	148,500	252,000		2,050	1,560	1,750	62,500		0.5	4.2	2.5	8,650		0.05	0.21	0.08	56		<0.06	0.18	0.12	140		1.5	4.9	6.3	9.2		7.3	7.9	7.9	9.3	Earth Systems
	9/1/01		61,800	85,200	85,000	63,800		1,940	1,420	1,890	33,100		8.9	1	2.6	3,150		0.15	0.05	0.33	17		0.11	0.04	0.05	66		ND	ND	15			7.1	7.9	7.3	10	Halaco/Brash
2002	3/29/02		63,000	79,500	74,700	49,300		1,400	1,090	1,070	6,170		1.8	0.9	2.8	154		0.03	0.04	0.12	0.15		ND	0.05	ND	6.72		ND	ND	ND	ND		7.2	7.6	7.5	9.3	Halaco/Brash
	9/11/02		61,700	82,500	85,700			1,290	833	1,150			0.6	1.1	1.7			0.02	0.1	0.05			ND	0.03	ND			ND	ND	3			7.4	7.4	6.9		Halaco/Brash
2003	3/13/03		61,700	78,200	18,200			1,600	2,060	266			0.7	3	1.8			0.02	0.17	0.09			0.04	0.22	0.12			ND	ND	ND			7	6.8	7.4		Halaco/Brash
																																					Old wells abandoned

Note:

< = Not detected at less than the indicated detection limit.

Appendix H.3
Halaco Surface Water and Groundwater Monitoring (2002 to 2004)

WDR Surface Water and Groundwater Samples

Sampling Results: May Quarterly Report - January through March 2002
Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
FGL Lab report SP200552; 01-02, FGL collected and received Jan 21, 2002

Parameter & Unit / Sample Location	Surface. Sta. #1 Upstream	Surface Sta. #2 Downstream
Sample ID	D	E
pH Units[1]	8.9	8.7
Temperature °F[1]	46.5	48.2
Al mg/l	ND	ND
Cu mg/l	ND	ND
Mg mg/l	112	164
Zn mg/l	ND	0.02
Cond umhos/cm[2]	2940	6370
O&G mg/l	ND	ND
Tide/Slack Water Time	9:00 AM	9:15 AM

*Slack water at high tide was 10:10 AM. Samples were collected between 9:00 AM - 9:15 AM.

	January	February	March
Waste discharged to pond. *Gallons*	<750,000 (estimate)	<750,000 (estimate)	650,000
Water pumped from pond to plant. *Gallons*	0	0	0
Residue removed from pond deposited in disposal site. *Cubic yards*	0	0	0

[1]Field testing performed using calibrated test equipment. The methodology is equivalent to EPA 150.1 for pH.

[2]Standard Methods Conductance test 2510B is equivalent EPA 120.1.

Sampling Results: May Quarterly Report - January through March 2002
Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
Lab SP 202757- 01-07. Samples collected and received **March 29, 2002.**

Sample Location	Well #1	Well #2	Well #3	Surface. Sta. #1	Surface Sta. #2	Discharge Outlet	Standing Water G	Standing Water H
Sample ID	Well A	Well B	Well C	D	E	F	G	H
Temp. °F[1]	62.8	64.7	63.6	60.8	59.7	117.6	60.9	Dry
pH[1] Units	7.5	7.6	7.2	8.5	8.7	9.3	7.1	Dry
Al mg/l	2.8	0.9	1.8	ND	ND	154	0.3	Dry
Cu mg/l	0.12	0.04	0.03	ND	ND	0.15	0.09	Dry
Mg mg/l	1070	1090	1400	107	115	6,170	3,110	Dry
Zn mg/l	ND	0.05	ND	ND	ND	6.72	ND	Dry
Cond[2] umhos/cm	74,700	79,500	63,000	2,940	3,480	49,300	156,000	Dry
O&G mg/l	ND	ND	ND	ND	ND	ND	ND	Dry
RadioIso[3] pCi/L	N/A	N/A	N/A	N/A	N/A	1.96+/- 1.38	N/A	N/A
Ground water Elevation	N/A	3' 3"	4' 5"	N/A	N/A	N/A	N/A	N/A
TDS mg/l	N/A	N/A	N/A	N/A	N/A	N/A	139,000	N/A
Tide*	9:45	10:40	10:15	9:25	9:10	11:10	10:55	N/A

*Slack water at high tide was 9:40 AM. Samples were collected between 9:10 AM - 11:10 AM.

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[1]Field testing performed using calibrated test equipment. The methodology is equivalent to EPA 150.1 for pH.

[2]Standard Methods Conductance test 2510B is equivalent to EPA 120.1

[3]Standard Method 7110C replaced EPA 900.0. EPA 900.0 is used for drinking water. Dissolved solid content of discharge effluent precluded usage of EPA 900.0 and accurate Gross Beta readings. Gross Alpha reading is well below natural occurring levels.

May, 2002 - Sampling Results Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
FGL Environmental Lab Results SP 2047984-01 & 2047984-02, Dated June 18, 2002

Sample Location	Sample Method	Surface. Sta. #1	Surface Sta. #2
Sample ID		D	E
Temp. °F	Field	75.2	72.1
pH Units	Field	8.6	8.3
Al mg/l	200.7	ND	ND
Cu mg/l	200.7	ND	ND
Mg mg/l	200.7	358	310
Zn mg/l	200.7	0.02	ND
Cond umhos/cm	2510B	14,800	13,400
O&G mg/l	1664	ND	ND
Tide*		0.9	0.9

*Heights are referred to mean lower low water, which is the chart datum of soundings.
Slack water at low tide was 2:23 PM.. Samples were collected at between 1:40-1:50 PM.

	April	May	June
Waste discharged to pond. Gallons	540,000	507,000	430,000
Water pumped from pond to plant. Gallons	0	0	0
Residue removed from pond deposited in disposal site. Cubic yards	0	0	0

July, 2002 - Sampling Results Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
FGL Environmental Lab Results SP 206600-01, Dated July 3, 2002

Sample Location	Sample Method	Surface. Sta. #1	Surface Sta. #2	Surface Sta "H"	Surface Sta "G"
Sample ID		D	E	Standing Water	Standing Water
Temp. °F	Field	73.4	72.5	76.7	75.2
pH Units	Field	8.0	8.0	8.0	7.5
Al mg/l	200.7	ND	0.2	0.2	0.6
Cu mg/l	200.7	0.01	ND	0.61	0.37
Mg mg/l	200.7	120	128	300	363
Zn mg/l	200.7	ND	ND	0.04	0.04
Cond umhos/cm	2510B	3,470	3930	61,800	60,900
O&G mg/l	1664	ND	ND	ND	ND
Tide*		1.2	1.2	1.2	1.2

*Heights are referred to mean lower low water, which is the chart datum of soundings.
Slack water at low tide was 10:30 AM.. Samples were collected at between 10:30-11:30 AM

	July	August	September
Waste discharged to pond. Gallons	550,000	540,000	40,000 to POTW
Water pumped from pond to plant. Gallons	0	0	0
Residue removed from pond deposited in disposal site. Cubic yards	0	0	0

Sampling Results: May Quarterly Report - July through September 2002
Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
Lab SP 209274- 01. Samples collected and received September 11, 2002

Sample Location	Well #1	Well #2	Well #3	Surface. Sta. #1	Surface Sta. #2	Discharge Outlet	Standing Water G	Standing Water H
Sample ID	Well A	Well B	Well C	D	E	F	G	H
Temp. °F[1]	71.4	73.4	72.4	68.0	67.4	No discharge	71.4	70.7
pH Units	6.9	7.4	7.4	7.6	7.6	No discharge	7.4	8.0
Al mg/l	1.7	1.1	0.6	ND	ND	No discharge	0.1	ND
Cu mg/l	0.05	0.10	0.02	ND	ND	No discharge	0.22	0.27
Mg mg/l	1150	833	1290	109	121	No discharge	3,650	267
Zn mg/l	ND	0.03	ND	ND	ND	No discharge	0.08	0.03
Cond[2] umhos/cm	85,700	82,500	61,700	3,490	5,340	No discharge	175,000	57,700
O&G mg/l	3	ND	ND	ND	ND	No discharge	ND	ND
RadioIso[3] pCi/L	N/A	N/A	N/A	N/A	N/A	No discharge	N/A	NA
Ground water Elevation	N/A	2' 3"	3' 3"	N/A	N/A	No discharge	N/A	N/A
TDS mg/l	N/A	N/A	N/A	N/A	N/A	No discharge	197,000	38,300
Tide*	9:10	9:30	10:10	8:00	8:30	No discharge	9:45	8:50

*Slack water at low tide was 6:46 AM. Samples were collected between 8:00 AM - 10:10 AM.

[1]Field testing performed using calibrated test equipment. The methodology is equivalent to EPA 150.1 for pH.

[2]Standard Methods Conductance test 2510B is equivalent to EPA 120.1

January, 2002 - Sampling Results Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
FGL Environmental Lab Results SP 211508-01, Dated November 8, 2002

Sample Location	Sample Method	Surface. Sta. #1	Surface Sta. #2	Surface Sta "G"	Surface Sta "H"
Sample ID		D	E	Standing Water	Standing Water
Temp. °F	Field	60.9	61.0	65.1	63.3
pH Units	Field	7.8	8.4	7.8	7.8
Al mg/l	200.7	6.4	8.2	2.5	1.8
Cu mg/l	200.7	0.02	0.03	0.05	0.06
Mg mg/l	200.7	18	9.0	49	109
Zn mg/l	200.7	0.14	0.17	0.11	0.10
Cond umhos/cm	2510B	658	277	3050	6710
O&G mg/l	1664	ND	ND	ND	ND
Tide*		6.1	6.1	6.1	6.1

*Heights are referred to mean lower low water, which is the chart datum of soundings.
Slack water at high tide was 10:46 AM.. Samples were collected at between 12:-12:35 PM

	October	November	December
No waste water has been discharged to the ponds since the installation of the filter press. Water discharged to the POTW. Gallons	1,255,00	828,000	840,000
Water pumped from pond to plant. Gallons	0	0	0
Residue removed from pond deposited in disposal site. Cubic yards	0	0	0

Sampling Results: May Quarterly Report - January through March 2003
Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
Lab SP 300322. Samples collected and received **January 10, 2003**

Sample Location	Surface. Sta. #1	Surface Sta. #2	Discharge Outlet	Standing Water G	Standing Water H
Sample ID	D	E	F	G	H
Temp. °F[1]	56.0	55.0	NA	57.0	56.3
pH[1] Units	8.4	8.4	NA	7.1	8.0
Al mg/l	0.2	0.1	NA	0.7	1.3
Cu mg/l	ND	ND	NA	0.10	0.14
Mg mg/l	108	149	NA	293	798
Zn mg/l	0.03	0.03	NA	0.07	0.05
Cond[2] umhos/cm	2,980	4290	NA	20300	59400
O&G mg/l	ND	ND	NA	3	ND
RadioIso[3] pCi/L	N/A	N/A	NA	N/A	NA
Ground water Elevation	N/A	N/A	NA	N/A	NA
TDS mg/l	N/A	N/A	NA	139,000	NA
Tide*	10:40	10:30	NA	11:00	10:20

*Slack water at high tide was 10:27 AM. Samples were collected between 10:20 AM - 11:00 AM.

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[1]Field testing performed using calibrated test equipment. The methodology is equivalent to EPA 150.1 for pH.

[2]Standard Methods Conductance test 2510B is equivalent to EPA 120.1

[3]Standard Method 7110C replaced EPA 900.0. EPA 900.0 is used for drinking water. Dissolved solid content of discharge effluent precluded usage of EPA 900.0 and accurate Gross Beta readings.

Sampling Results: May Quarterly Report - January through March 2003
Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
Lab SP 302567 Samples collected and received **March 13, 2003.**

Sample Location	Well #1	Well #2	Well #3	Surface. Sta. #1	Surface Sta. #2	Discharge Outlet	Standing Water G	Standing Water H
Sample ID	Well A	Well B	Well C	D	E	F	G	H
Temp. °F[4]	63.5	64.9	64.2	64.8	64.6	NA	61.5	64.6
pH[1] Units	7.4	6.8	7.0	8.3	8.4	NA	9.1	8.6
Al mg/l	1.8	3.0	0.7	0.1	ND	NA	1.1	0.4
Cu mg/l	0.09	0..17	0.02	0.01	ND	NA	0.08	0.06
Mg mg/l	266	2060	1600	122	162	NA	240	187
Zn mg/l	0.12	0.22	0.04	0.04	0.04	NA	0.07	0.05
Cond[2] umhos/cm	18,200	78,200	61,700	3,370	6080	NA	15,400	12,300
O&G mg/l	ND	ND	ND	ND	ND	NA	ND	ND
RadioIso[3] pCi/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground water Elevation	N/A	1'	3" 3"	N/A	N/A	NA	N/A	N/A
TDS mg/l	N/A	N/A	N/A	N/A	N/A	NA	9,600	7,700
Tide*	11:30	11:50	12:25	10:40	10:15	NA	10:55	10:25

*Slack water at low tide was 12:50 AM. Samples were collected between 10:15 AM - 12:25 AM.

Sampling Results: August Quarterly Report - April through June 2003
Halaco Engineering Co.
Monitoring and Reporting Programs No. 5673, WDR Order No. 80-58
FGL Lab report SP304790; 01-03, FGL collected and received samples May 9, 2003

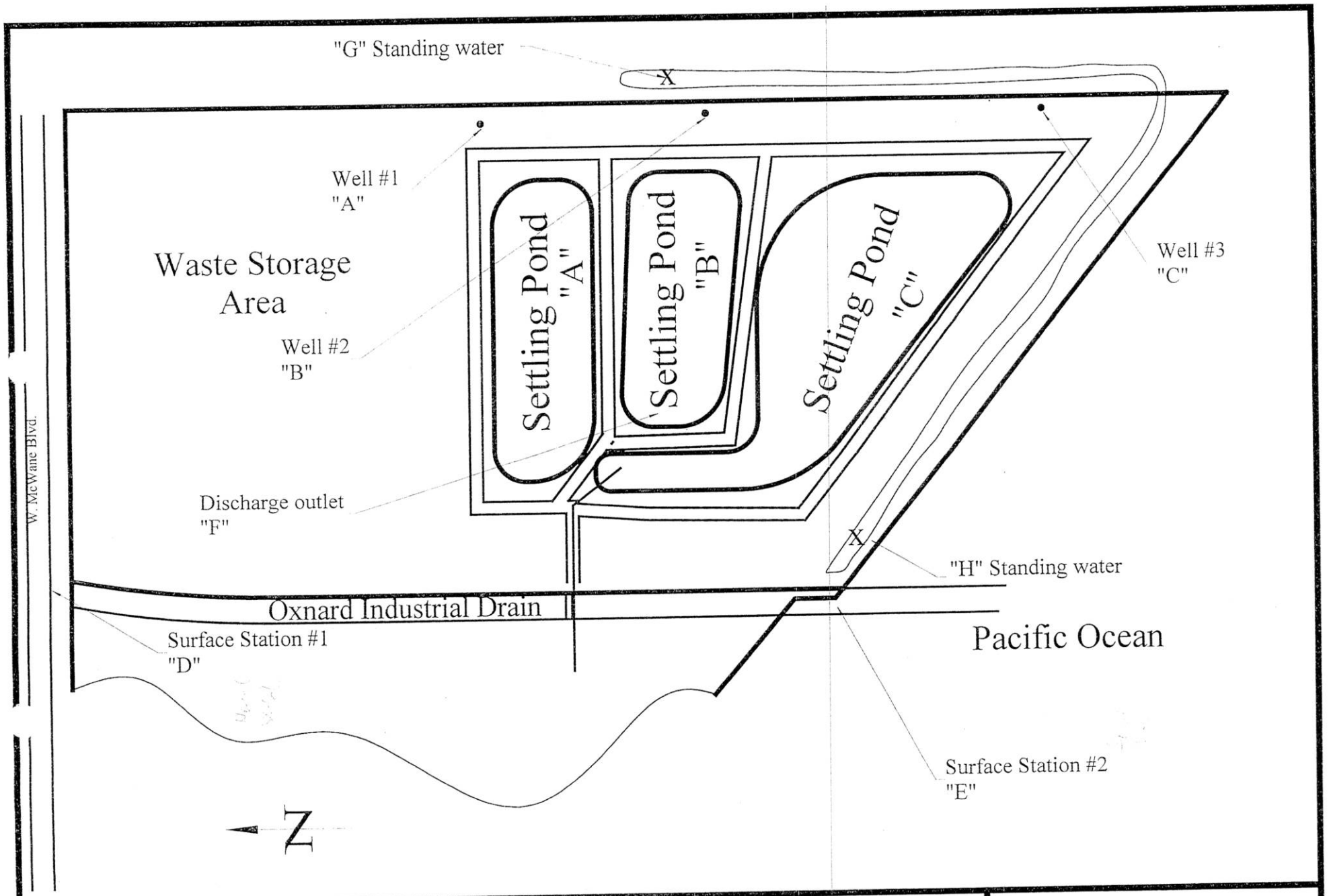
Analysis Units \ Location	Surface. Sta. #1 Upstream	Surface Sta. #2 Downstream	Standing Water	Standing Water
Sample ID	D	E	G	H
pH Units. Field Test	8.3	8.2	9.2	
Temperature °F[1] Field Test	63.1	62.1	71.6	No
Al mg/l EPA 200.7	0.1	0.3	3.9	Standing
Cu mg/l EPA 200.7	ND	ND	0.12	Water
Mg mg/l EPA 200.7	124	126	245	
Zn mg/l EPA 200.7	0.07	0.06	0.13	No
Cond umhos/cm[2] EPA 2510B	3870	3790	16600	Sample
O&G mg/l EPA 1664	ND	ND	3	Collected
Tide/Slack Water Time	11:15 AM	11:00 AM	11:30 AM	

*Slack water at low tide occurred at 11:14 AM. Samples were collected between 11:00 AM - 11:30 AM.

	April	May	June
Waste discharged to pond. To POTW *Gallons*	0	0	0
Water pumped from pond to plant. *Gallons*	0	0	0
Residue removed from pond deposited in disposal site. *Cubic yards*	0	0	0

[1]Field testing performed using calibrated test equipment. The methodology is equivalent to EPA 150.1 for pH.

[2]Standard Methods Conductance test 2510B is equivalent EPA 120.1.



Not to Scale	SAMPLE LOCATIONS Halaco - East	WDID#4 56S002656 Halaco Engineering Co. 6200 Perkins Road Oxnard, CA 93033 (818) 889-3820	Scale: 1" = 200' February 28, 2002 28 Acres

CDO Surface Water Samples

31 40875

HALACO SURFACE WATER SAMPLE - November 27, 2002

		North OID	South OID	Lagoon	Standing Water	Surf Line	Blank
		SWS4	SWS1	SWS2	SWS5	SWS3	
pH S.U.	EPA 150.1	8.1	8.1	8.2	DRY	8.3	ND
Temperature C		24	24	23	DRY	20	
Total Suspended Solids mg/L	EPA 160.2	15	47	22	DRY	25	ND
Gross Alpha and Beta					DRY		
Thorium					DRY		
Total Dissolved Solids mg/L	EPA 160.1	2620	13000	13000	DRY	14000	ND
Specific Conductance umhos/cm	EPA 120.1	8690	21000	21000	DRY	21000	
Sulfate mg/L	EPA 300.0	1350	1760	1540	DRY	1600	ND
Chloride mg/L	EPA 300.0	3450	6600	6510	DRY	6920	ND
Ammonia Nitrogen mg/L	EPA 350.3	1	2	2.8	DRY	0.71	ND
Nitrate Nitrogen mg/L	EPA 300.0	14.0	10.0	9.6	DRY	7.3	ND
Nitrite Nitrogen mg/L	EPA 354.1	0.34	0.22	0.41	DRY	0.63	ND
Oil and Grease	EPA 1664	1.1	ND	ND	DRY	ND	
Total Petroleum Hydrocarbon mg/L	EPA 8015				DRY		
C4 - C12		ND	ND	ND	DRY	ND	ND
C13 - C22		ND	ND	ND	DRY	ND	ND
C23 +		ND	ND	ND	DRY	ND	ND
Barium	EPA 200.7	ND	ND	ND	DRY	ND	ND
Chromium	EPA 200.7	ND	ND	ND	DRY	ND	ND
Copper mg/L	EPA 200.7	ND	0.06	ND	DRY	0.03	ND
Lead	EPA 200.7	ND	ND	ND	DRY	ND	ND
Nickel	EPA 200.7	ND	ND	ND	DRY	ND	ND
Zinc mg/L	EPA 200.7	0.07	0.23	ND	DRY	0.11	ND
Hardness mg/L	EPA 130.2	2000	2800	2600	DRY	2900	ND
Volatile Organic Carbons [sic]	EPA 8260B	ND	ND	ND	DRY	ND	ND

HALACO SURFACE WATER SAMPLE - January, 31, 2003							
		North OID	South OID	Lagoon	Standing Water	Surf Line	Blank
		SWS4	SWS1	SWS2	SWS5	SWS3	
pH S.U.	EPA 150.1	7.6	7.7	7.9	7.5	7.9	ND
Temperature C							
Total Suspended Solids mg/L	EPA 160.2	21	11	25	22	15	ND
Gross Alpha pCi/L	EPA 900.0	9.9	9.08	6.75	-6.18	-9.12	
Gross Beta pCi/L	EPA 900.0	9.64	12.7	23.8	668	18.9	
Thorium 228 pCi/L,	DOE EML HASL300	0.477	0.245	0.33	0.732	0.0139	
Thorium 230 pCi/L	DOE EML HASL300	0.557	0.888	1.49	2.59	1.14	
Thorium 232 pCi/L	DOE EML HASL300	121	0.091	0.142	0.137	0.144	
Total Dissolved Solids mg/L,	EPA 160.1	3130	3160	5790	21000.0	7000	ND
Specific Conductance umhos/cm	EPA 120.1	6270	6510	11000	50000	14000	ND
Sulfate mg/L	EPA 300.0	1180	1130	1220	1480	1150	ND
Chloride mg/L	EPA 300.0	870	730	15000	14100	3380	ND
Ammonia Nitrogen mg/L	EPA 350.3	0.31	0.12	0.13	150	ND	ND
Nitrate Nitrogen mg/L	EPA 300.0	13.0	13.0	9.8	17.0	9.3	ND
Nitrite Nitrogen mg/L	EPA 354.1	0.29	0.30	0.31	0	0.28	ND
Oil and Grease	EPA 1664	4.8	5.1	2.9	3.2	4	ND
Total Petroleum Hydrocarbon mg/L,	EPA 8015						
C4 - C12		ND	ND	ND	ND	ND	ND
C13 - C22		ND	ND	ND	ND	ND	ND
C23 +		ND	ND	ND	ND	ND	ND
Aluminum	EPA 200.7	ND	ND	ND	8.4	ND	ND
Barium	EPA 200.7	ND	ND	ND	0.59	ND	ND
Chromium	EPA 200.7	ND	ND	ND	ND	ND	ND
Copper mg/L	EPA 200.7	0.14	0.17	0.17	0.63	0.09	ND
Lead	EPA 200.7	0.95	0.95	0.097	0.13	ND	ND
Magnesium	EPA 200.7	150	130	240	540	210	ND
Nickel	EPA 200.7	ND	ND	ND	ND	ND	ND
Zinc mg/L	EPA 200.7	ND	ND	ND	0.37	ND	ND
Hardness mg/L	EPA 130.2	1260	1340	1660	3650.0	1760	ND
Volatile Organic Carbons [sic]	EPA 8260B	ND	ND	ND	ND	ND	ND

HALACO SURFACE WATER SAMPLE - JUNE 13, 2003								
		North OID	South OID	Lagoon	Standing Water	Surf Line		Blank
		SWS4	SWS1	SWS2	SWS5	SWS3	SWS6	
pH S.U.	EPA 150.1	7.8	7.9	7.8	7.9	8.1	7.8	ND
Temperature °C		22	21	21	21	20	21	21
Total Suspended Solids mg/L	EPA 160.2	5	8	25	13	ND	10	ND
Gross Alpha pCi/L	EPA 900.0	12.9	10.9	ND	ND	ND	ND	
Gross Beta pCi/L	EPA 900.0	10.4	14.6	25.6	366	21.4	153	
Thorium 228 pCi/L,	DOE EML HASL300	ND	ND	ND	ND	ND	*	
Thorium 230 pCi/L	DOE EML HASL300	0.864	0.813	0.779	ND	0.701	*	
Thorium 232 pCi/L	DOE EML HASL300	ND	ND	ND	ND	ND	*	
Total Dissolved Solids mg/L,	EPA 160.1	2870	3350	3640	12000.0	5140	9860	ND
Specific Conductance umhos/cm	EPA 120.1	4950	5820	6300	21000	9430	17000	ND
Sulfate mg/L	EPA 300.0	1150	1100	1010	920	890	910	ND
Chloride mg/L	EPA 300.0	760	800	880	4400	1450	3570	ND
Ammonia Nitrogen mg/L	EPA 350.3	0.23	0.11	0.21	8.5	ND	5.6	ND
Nitrate Nitrogen mg/L	EPA 300.0	8.9	8.3	7.3	6.8	6.1	1.2	ND
Nitrite Nitrogen mg/L	EPA 354.1	0.17	0.13	0.15	1	0.16	0.96	ND
Oil and Grease	EPA 1664	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbon mg/L,	EPA 8015							
C4 - C12		ND	ND	ND	ND	ND	ND	ND
C13 - C22		ND	ND	ND	ND	ND	ND	ND
C23 +		ND	ND	ND	ND	0.6	ND	ND
Aluminum	EPA 200.7	ND	ND	ND	ND	ND	ND	ND
Barium	EPA 200.7	ND	ND	ND	0.09	ND	0.09	ND
Chromium	EPA 200.7	ND	ND	ND	ND	ND	ND	ND
Copper mg/L	EPA 200.7	ND	ND	ND	0.12	ND	0.11	ND
Lead	EPA 200.7	ND	ND	ND	ND	ND	ND	ND
Magnesium	EPA 200.7	120	130	130	300	170	240	ND
Nickel	EPA 200.7	ND	ND	ND	ND	ND	ND	ND
Zinc mg/L	EPA 200.7	ND	0.08	ND	ND	ND	ND	ND
Hardness mg/L	EPA 130.2	1290	1290	1390	2190.0	1440	1490	ND
Volatile Organic Carbons [sic]	EPA 8260B	ND	ND	ND	ND	ND	ND	ND

*Sample contamination precluded timely analysis. Additional laboratory analysis will be conducted.

HALACO SURFACE WATER SAMPLE - August 5, 2003									
		North OID	South OID	Lagoon	Standing Water	Surf Line			Blank
		SWS4	SWS1	SWS2	SWS5	SWS3	SWS6	SWS7	
pH S.U.	Field	7.6	7.6	8.2	7.6	7.6	9.3	7.6	
Temperature F	Field	75	72	74	76	82	83	81	ND
Total Suspended Solids mg/L	EPA 160.2	ND	12	13	26	10	344	26	ND
Gross Alpha pCi/L	EPA 900.0	6.4+/-1.2	3.6+/-1.0	6.4+/-1.3	2.7+/-1.1	3.0+/-1.3	5.3+/-1.6	2.8+/-1.1	ND
Gross Beta pCi/L	EPA 900.0	19+/-2.7	23+/-1.0	12+/-2.1	88+/-7.3	30+/-4.2	319+/-14	180+/-10	ND
Thorium 228 pCi/L,	DOE EML HASL300	0.2+/-0.2	0.2+/-0.2	0.2+/-0.2	0.3+/-0.3	0.6+/-0.6	0.7+/-0.8	0.2+/-0.2	ND
Thorium 230 pCi/L	DOE EML HASL300	0.2+/-0.2	0.4+/-0.4	0.2+/-0.2	1.1+/-0.6	0.6+/-0.6	4.5+/-2.0	0.2+/-0.2	ND
Thorium 232 pCi/L	DOE EML HASL300	0.2+/-0.2	0.3+/-0.3	0.2+/-0.2	0.3+/-0.3	0.6+/-0.6	0.7+/-0.7	0.2+/-0.2	
Total Dissolved Solids mg/L,	EPA 160.1	1820	1950	2530	12200.0	36900	30600	10200	0.9
Specific Conductance umhos/cm	EPA 120.1	2400	2590	3820	18300	50600	41900	15300	~ND
Sulfate mg/L	EPA 300.0	910	895	992	920	2520	3290	1220	ND
Chloride mg/L	EPA 300.0	251	352	705	6300	20700	16100	6940	ND
Ammonia Nitrogen mg/L	EPA 350.3	ND	ND	ND	92.5	ND	0.3	53.5	ND
Nitrate Nitrogen mg/L	EPA 300.0	4.2	4.0	2.0	3.8	ND	ND	2.2	ND
Nitrite Nitrogen mg/L	EPA 354.1	ND	ND	ND	ND	ND	ND	0.36	ND
Oil and Grease mg/L	EPA 1664	ND	ND	ND	ND	ND	7	ND	ND
Total Petroleum Hydrocarbon mg/L,	EPA 8015								
C06 - C10 mg/L		ND	ND	ND	ND	ND	ND	ND	ND
C10 - C22 mg/L		ND	ND	ND	ND	ND	ND	ND	ND
C22 - C36 mg/L		ND	ND	ND	ND	ND	1.4	ND	ND
Aluminum mg/L	EPA 200.7	0.046	0.218	~ND	0.038	ND	0.280	0.146	ND
Barium mg/L	EPA 200.7	0.027	0.031	0.024	0.152	ND	0.169	0.147	ND
Chromium mg/L	EPA 200.7	ND	ND	ND	ND	ND	ND	ND	ND
Copper mg/L	EPA 200.7	0.014	0.17	0.012	0.04	~ND	0.066	0.035	ND
Lead mg/L	EPA 200.7	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium mg/L	EPA 200.7	91.4	96.5	117	233	844	487	209	ND
Nickel mg/L	EPA 200.7	0	~ND	~ND	~ND	ND	~ND	~ND	ND
Zinc mg/L	EPA 200.7	0.054	0.049	0.043	0.069	0.025	0.084	0.068	ND
Hardness mg/L	EPA 130.2	942	963	1030	1640.0	4330	3520	1510	ND
Volatile Organic Carbons [sic] ug/L	EPA 8260B	ND	ND	ND	ND	ND	ND	ND	ND

HALACO SURFACE WATER SAMPLE - October 27, 2003 - Associated Lab Request 118810									
		North OID	South OID	Lagoon	Standing Water	Surf Line			Blank
		SWS4	SWS1	SWS2	SWS5	SWS3	SWS6	SWS7	
pH S.U.	Field	7.8	8.0	7.9	Dry	7.8	Dry	Dry	
Temperature C	Field	19	20	19	Dry	18	Dry	Dry	ND
Total Suspended Solids mg/L	EPA 160.2	15	100	22	Dry	41	Dry	Dry	ND
Gross Alpha pCi/L	EPA 900.0	3.2+/-1.2	2.3+/-1.1	2.6+/-1.1	Dry	1.6+/-0.9	Dry	Dry	ND
Gross Beta pCi/L	EPA 900.0	63+/-8.9	76+/-9.7	13+/-3.7	Dry	24+/-5.0	Dry	Dry	ND
Thorium 228 pCi/L,	DOE EML HASL300	0.8+/-0.8	0.7+/-0.7	0.5+/-0.5	Dry	0.7+/-0.6	Dry	Dry	ND
Thorium 230 pCi/L	DOE EML HASL300	2.4+/-1.5	2.0+/-1.3	0.5+/-0.4	Dry	0.9+/-0.9	Dry	Dry	ND
Thorium 232 pCi/L	DOE EML HASL300	1.1+/-1.1	1.0+/-1.0	0.7+/-0.7	Dry	0.9+/-0.6	Dry	Dry	
Total Dissolved Solids mg/L,	EPA 160.1	31000	36700	15400	Dry	16700	Dry	Dry	0.9
Specific Conductance umhos/cm	EPA 120.1	42300	49600	70000	Dry	76000	Dry	Dry	~ND
Sulfate mg/L	EPA 300.0	2520	2890	2880	Dry	2870	Dry	Dry	ND
Chloride mg/L	EPA 300.0	17800	21000	20700	Dry	21300	Dry	Dry	ND
Ammonia Nitrogen mg/L	EPA 350.3	ND	ND	ND	Dry	ND	Dry	Dry	ND
Nitrate Nitrogen mg/L	EPA 300.0	0.8	ND	ND	Dry	ND	Dry	Dry	ND
Nitrite Nitrogen mg/L	EPA 354.1	ND	ND	ND	Dry	ND	Dry	Dry	ND
Oil and Grease mg/L	EPA 1664	19	20	10	Dry	15	Dry	Dry	ND
Total Petroleum Hydrocarbon mg/L,	EPA 8015								
C06 - C10 mg/L		ND	ND	ND	Dry	ND	Dry	Dry	ND
C10 - C22 mg/L		ND	ND	ND	Dry	ND	Dry	Dry	ND
C22 - C36 mg/L		ND	ND	ND	Dry	ND	Dry	Dry	ND
Aluminum mg/L	EPA 200.7	0.059	1.71	0.129	Dry	1.88	Dry	Dry	ND
Barium mg/L	EPA 200.7	0.015	0.028	0.015	Dry	0.06	Dry	Dry	ND
Chromium mg/L	EPA 200.7	ND	0.003	ND	Dry	0.004	Dry	Dry	ND
Copper mg/L	EPA 200.7	0.003	0.016	0.005	Dry	0.051	Dry	Dry	ND
Lead mg/L	EPA 200.7	ND	ND	ND	Dry	ND	Dry	Dry	ND
Magnesium mg/L	EPA 200.7	682	889	845	Dry	880	Dry	Dry	ND
Nickel mg/L	EPA 200.7	ND	0.003	ND	Dry	0.005	Dry	Dry	ND
Zinc mg/L	EPA 200.7	0.008	0.031	0.008	Dry	0.05	Dry	Dry	ND
Hardness mg/L	EPA 130.2	3500	4600	4390	Dry	4550	Dry	Dry	ND
Volatile Organic Carbons [sic] ug/L	EPA 8260B	ND	ND	ND	Dry	ND	Dry	Dry	ND

HALACO SURFACE WATER SAMPLE - November 25, 2003 - Associated Lab Request 120563			
		SWS4 OID North	SWS1 OID South
pH S.U.	Field	7.85	7.42
Specific Conductance umhos/cm	EPA 120.1	67000.00	70500.00
Ammomia Nitrogen mg/l	EPA 350.3	0.10	ND
Oil and Grease mg/L	EPA 1664	ND	ND
Aluminum mg/L	EPA 200.7	0.40	ND
Copper mg/L	EPA 200.7	ND	ND
Magnesium mg/L	EPA 200.7	1330.00	1270.00
Zinc mg/l	EPA 200.7	ND	ND

HALACO SURFACE WATER SAMPLE - February 6, 2004 - Associated Lab Request 124196

Low Tide 08:58		SWS-1	SWS-2	SWS-3	SWS-4	SWS-5	SWS-6	SWS-7
Parameter	Method		Dry			Dry	Dry	Dry
Time hh:mm	Field	08:45		08:15	07:45			
Temperature °C	Field	18.5		10.6	11.8			
pH Units	Field	8.08			7.95			
TDS mg/l	160.1	28600		36700	24800			
TSS mg/l	160.2	21		8	11			
Gross Alpha pCi/l	900	1.4+/-0.7		ND+/-0.6	2.6+/-0.8			
Gross Beta pCi/l	900	24+/-3.6		31+/4.1	19+/3.2			
Conductivity	120.1	42000		53500	37900			
Sulfate mg/l	300.0	2220		2570	1870			
Chloride mg/l	300.0	14200		18700	12300			
nitrate nitrogen mg/l	300.0	1.8		ND	2.4			
nitrite nitrogen mg/l	300.0	ND		ND	ND			
Ammonia nitrogen mg/l	350.1	0.4		ND	0.3			
Oil & grease mg/l	1664	ND		ND	ND			
Aluminum mg/l	200.7	0.073		0.047	0.136			
Barium mg/l	200.7	0.013		ND	0.020			
Chromium mg/l	200.7	ND		ND	ND			
Copper mg/l	200.7	0.005		0.003	0.005			
Lead mg/l	200.7	ND		ND	ND			
Magnesium mg/l	200.7	959		1240	963			
Zinc mg/l	200.7	0.049		0.021	0.024			
Hardness mg/l	EPA130.2	4640		6100	4890			

HALACO OXNARD INDUSTRIAL DRAIN SURFACE WATER SAMPLE

March 15, 2004 Associated Lab Request 126648

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

LowTide 12:18			OID - N SW-S4	OID - S SW-S1
Parameter		Method		
Time	hh:mm	Field	10:12	10:26
Temperature	°C	Field	11	11
pH	Units	Field	7.75	7.98
TDS	mg/l	160.1	6960	5820
Conductivity umhos/cm		120.1	10200	8900
nitrate nitrogen	mg/l	300.0	12.1	16.4
nitrite nitrogen	mg/l	300.0	ND	ND
Ammonia nitrogen	mg/l	350.1	ND	ND
Oil & grease	mg/l	1664	ND	ND
Aluminum	mg/l	200.7	0.226	0.103
Copper	mg/l	200.7	0.024	0.019
Magnesium	mg/l	200.7	168	206
Zinc	mg/l	200.7	0.053	0.013

HALACO SURFACE WATER SAMPLE - April 30, 2004 - Associated Lab Request 128620

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

High Tide 1:24 pm			SWS-1	SWS-2	SWS-3	SWS-4	SWS-5	SWS-6	SWS-7
Parameter		Method						Dry	Dry
Time	hh:mm	Field	08:30	09:00	09:10	12:50	08:35		
Temperature	°F	Field	67	66	63	67	71		
pH	Units	Field	6.89	7.01	7.11	7.21	6.76		
TDS	mg/l	160.1	2780	4360	34100	3920	11200		
TSS mg/l		160.2	3.6	2.8	7.0	16	20		
Gross Alpha	pCi/l	900	6.0+/-1	2.5+/-0.7	ND<1+/-0.7	8.1+/-1.1	2+/-0.8		
Gross Beta	pCi/l	900	54+/-4.9	118+/-8	320+/-16	32+/-3.8	519+/-18		
Conductivity	umhos/cm	120.1	3480	5850	47900	5450	15800		
Sulfate	mg/l	300.0	1220	1280	2680	1250	1490		
Chloride	mg/l	300.0	521	1420	19100	1220	5440		
nitrate nitrogen	mg/l	300.0	10.7	8.13	0.05	9.04	5.96		
nitrite nitrogen	mg/l	300.0	0.18	0.15	ND	0.19	0.60		
Ammonia nitrogen	mg/l	350.1	0.5	0.4	ND	0.2	17.6		
Oil & grease	mg/l	1664	1.12	ND	0.67	ND	ND		
Aluminum	mg/l	200.7	0.058	0.021	ND	0.107	0.255		
Barium	mg/l	200.7	0.025	0.025	ND	0.031	0.076		
Chromium	mg/l	200.7	0.011	0.020	0.034	0.014	0.023		
Copper	mg/l	200.7	0.008	0.008	0.003	0.012	0.083		
Lead	mg/l	200.7	0.011	0.020	0.019	0.016	0.024		
Magnesium	mg/l	200.7	131	169	1000	163	331		
Nickel	mg/l	200.7	0.003	0.003	0.007	0.005	0.005		
Zinc	mg/l	200.7	0.019	0.022	0.019	0.016	0.029		
Hardness	mg/l	EPA130.2	1167	1284	4869	1256	2094		

HALACO OXNARD INDUSTRIAL DRAIN SURFACE WATER SAMPLE

June 14, 2004 Associated Lab Request 130909

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

Low Tide 1:42 p.m.			OID - N SW-S4	OID - S SW-S1
Parameter		Method		
Time	hh:mm	Field	1:50 p.m.	2:10 p.m.
Temperature	°C	Field	23.7	24.4
pH	Units	Field	7.59	7.80
TDS	mg/l	160.1	3620	5460
Conductivity	umhos/cm	120.1	5530	8270
nitrate nitrogen	mg/l	300.0	6.6	5.5
nitrite nitrogen	mg/l	300.0	ND	ND
Ammonia nitrogen	mg/l	350.1	0.2	ND
Oil & grease	mg/l	1664	ND	ND
Aluminum	mg/l	200.7	0.181	0.065
Copper	mg/l	200.7	0.012	0.006
Magnesium	mg/l	200.7	123	164
Zinc	mg/l	200.7	0.024	0.010

HALACO SURFACE WATER SAMPLE - August 6, 2004 Associated Lab Request 134064

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

Low Tide 8:05am			SWS-1	SWS-2	SWS-3	SWS-4	SWS-5	SWS-6	SWS-7
Parameter		Method							
Time	hh:mm	Field							
Temperature	°F	Field							
pH	Units	Field							
TDS	mg/l	160.1	3620	4390	38600	3380	10600	10600	10700
TSS	mg/l	160.2	20	35	12	16	ND	25	11
Gross Alpha	pCi/l	900	1.4 +/- 0.6	2.4 +/- 0.7	1.1 +/- 0.7	4.3 +/- 0.9	1.0 +/- 0.6	2.7 +/- 0.8	1.9 +/- 0.7
Gross Beta	pCi/l	900	71 +/- 5.8	23 +/- 3.7	148 +/- 13	45 +/- 4.7	245 +/- 15	69 +/- 8.4	303 +/- 17
Conductivity	mhos/cm	120.1	4200	5040	41100	3930	14200	13600	13800
Sulfate	mg/l	300.0	1210	1210	2670	1160	1380	1440	1370
Chloride	mg/l	300.0	994	1410	19000	818	4870	5260	5120
nitrate nitrogen	mg/l	300.0	3.0	0.90	ND	3.8	0.50	0.20	0.06
nitrite nitrogen	mg/l	300.0	0.08	0.04	ND	0.10	0.60	0.90	0.30
Ammonia nitrogen	mg/l	350.1	0.10	ND	ND	0.20	29.7	16.3	29.9
Oil & grease	mg/l	1664	ND	ND	ND	ND	ND	ND	0.98
Aluminum	g/l	200.7	0.048	0.019	ND	0.038	0.314	0.21	0.021
Barium	mg/l	200.7	0.032	0.030	ND	0.030	0.077	0.090	0.064
Chromium	mg/l	200.7	0.005	0.005	0.007	0.004	0.007	ND	0.006
Copper	mg/l	200.7	0.055	0.063	0.042	0.061	0.080	0.070	0.056
Lead	mg/l	200.7	ND	ND	ND	ND	ND	ND	ND
Magnesium	mg/l	200.7	141	175	769	132	280	367	268
Nickel	mg/l	200.7	0.004	0.003	ND	0.005	0.004	ND	0.003
Potassium	mg/l	200.7	37.6	51.2	634	30.4	995	916	991
Zinc	mg/l	200.7	0.006	0.008	ND	0.008	0.018	ND	0.008
Hardness	mg/l	EPA130.2	1141	1288	3782	1087	1757	2272	1718
VOC		8206	ND	ND	ND	ND	ND	ND	ND
TPH		8015	ND	ND	ND	ND	ND	ND	ND

656981-01

HALACO SURFACE WATER SAMPLE - November 24, 2004 Associated Lab Request 140897

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

High Tide 1:24 pm			SWS-1	SWS-2	SWS-3	SWS-4	SWS-5	SWS-6	SWS-7
Parameter		Method							
Time	hh:mm	Field	07:00	07:30	07:15	07:15	No	No	No
Temperature	°F	Field	54	57	55	54	Water	Water	Water
pH	Units	Field	7.03	7.08	7.05	7.11	To	To	To
TDS	mg/l	160.1	19200	36100	36700	17100	Sample	Sample	Sample
TSS mg/l		160.2	10	18	15	30			
Gross Alpha	pCi/l	900	31.6+/-30.4	ND	ND	ND			
Gross Beta	pCi/l	900	166+/-63.1	358+/-189	268+/-189	268+/-63.1			
Conductivity	umhos/cm	120.1	25800	48100	45600	24100			
Sulfate	mg/l	300.0	1840	2510	2580	1750			
Chloride	mg/l	300.0	9400	18500	18900	8200			
nitrate nitrogen	mg/l	300.0	4.4	ND	ND	7.5			
nitrite nitrogen	mg/l	300.0	0.1	ND	ND	0.2			
Ammonia nitrogen	mg/l	350.1	0.4	ND	ND	0.8			
Oil & grease	mg/l	1664	ND	ND	ND	ND			
Aluminum	mg/l	200.7	0.049	0.021	0.031	0.146			
Barium	mg/l	200.7	0.020	ND	ND	0.024			
Calcium	mg/l	200.7	255	258	237	254			
Chromium	mg/l	200.7	0.012	0.013	0.014	0.013			
Copper	mg/l	200.7	0.006	0.003	ND	0.007			
Lead	mg/l	200.7	0.006	0.004	0.006	0.004			
Magnesium	mg/l	200.7	521	825	754	485			
potassium	mg/l	200.7	272	522	497	237			
Zinc	mg/l	200.7	0.009	0.007	0.009	0.017			
Hardness	mg/l	130.2	2780	4030	3690	2630			

Halaco Engineering CDO Sampling Locations

SWS - Surface Water Sampling Location
MW- Monitoring Well Location

Sampling locations are approximate.

December 2003

CDO Groundwater Samples

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

Table 2. Summary of Potentiometric Surface Elevations
Halaco Engineering Co.
Waste Management Unit
6200 Perkins Road, Oxnard, Ventura County, California
(results in feet)

Well I.D.	Wellhead Elevation (Top of Casing, Feet)	Date Measured	Depth to Groundwater (feet bgs)	Total Depth of Well (feet below top of casing)	Groundwater Elevation (feet AMSL)
MW-4RA	8.10	03/05/03	6.15	19.69	1.95
MW-4RB	8.90	03/05/03	7.05	30.15	1.85
MW-5	17.50	03/05/03	15.00	22.05	2.50
MW-6	11.90	03/05/03	10.81	19.27	1.09

Notes:
AMSL Above mean sea level
Bgs Below ground surface

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

Table 3. Laboratory Analytical Results of Groundwater Samples, TPH and VOCs

Halaco Engineering Co.
Waste Management Unit
6200 Perkins Road, Oxnard, Ventura County, California

Sample	Date	Total Petroleum Hydrocarbons (TPH) Carbon Chain Breakdown (mg/L)			Volatile Organic Carbons (VOC's)					
		TPH C_4-C_{12}	TPH C_{13}-C_{22}	TPH C_{23+}	Benzene ug/L	Ethyl-benzene ug/L	Toluene ug/L	Total Xylenes ug/L	MTBE ug/L	Cis-1,2-Dichloroethene
MW-4RA	03/05/03	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	0.62
MW-4RB	03/05/03	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Duplicate	03/05/03	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
MW-5	03/05/03	0.15	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
MW-6	03/05/03	0.33	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Trip Blank	03/05/03	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
PQL		0.05	10	--	1.0	1.0	1.0	2.0	2.0	0.5
MCL's		NE	NE	NE	1.0[1]	300[1]	150[1]	1,750[1]	13[1]	6[1]

Notes:

mg/L Milligrams per Liter
ug/L Micrograms per Liter
BQL Below Quantitative limit
MCL Maximum Contaminant Level
NE Not Established
PQL Practical Quantitation Limit
1 Primary MCL, California Department of Health Services Drinking Water Standards
MTBE methyl tertiary butyl ether

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

Table 4. Laboratory Analytical Results of Groundwater Samples
Physical Parameters, Ionic and Elemental Constituents
Halaco Engineering Co.
Waste Management Unit
6200 Perkins Road, Oxnard, Ventura County, California

Sample I.D.	Date	Ammonia as N mg/L	Chloride mg/L	Hardness mg/L	Nitrate as N mg/L	Nitrite as N mg/L	Oil and Grease mg/L	pH pH units	Conductivity umhos/cm	Sulphate mg/L	T.D.S mg/L	T.S.S mg/L	Aluminum mg/L	Barium mg/L	Chromium mg/L	Copper mg/L	Lead mg/L	Magnesium mg/L	Nickel mg/L	Zinc mg/L
MW-4RA	3/05/03	0.30	2,840	1,970	ND	0.022	ND	7.2	13,000	1,150	7,020	1,690	27	0.28	ND	0.06	ND	230	ND	0.31
MW-4RB	3/05/03	0.93	2,430	1,590	ND	0.012	ND	7.1	11,000	1,120	5,600	310	5.7	0.09	ND	0.05	ND	160	ND	0.17
Duplicate	3/05/03	1.1	2,170	1,590	ND	ND	1.1	7.3	12,000	1,120	5,860	390	12	0.14	ND	0.04	ND	420	ND	ND
MW-5	3/05/03	820	24,900	3,030	ND	0.45	1.6	8.7	92,000	530	50,000	940	27	1.4	ND	0.37	ND	190	ND	0.31
MW-6	3/05/03	860	27,600	3,230	7.4	0.012	ND	8.0	101,000	81	54,000	4,010	210	15	0.23	1.6	0.23	270	0.20	1.4
Trip Blank	3/05/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PQL		1.0	1,000	10	0.4	0.01	1.0	--	1.0	1,000	40	5.0	0.3	0.06	0.04	0.03	0.09	1.0	0.08	0.06
MCL's		NE	250[2]	NE	45.0[1]	1.0[1]	NE	6.5 - 8.5[3]	900[2]	250[2]	500[2]	NE	1.0[1]	1.0[1]	0.05[1]	1.3[1]	0.015[1]	NE	0.1[1]	5.0[2]

Notes:

mg/L Milligrams per Liter
T.D.S Total dissolved solids
T.S.S Total suspended solids
MCL Maximum Contaminant Level
NE Not Established
PQL Practical Quantitation Limit
1 Primary MCL, California Department of Health Services Drinking Water Standards
2 Secondary MCL, California Department of Health Services Drinking Water Standards
3 Secondary MCL, U.S. Environmental Protection Agency Drinking Water Standards

Table 5. Laboratory Analytical Results of Groundwater Samples
Radioactivity and Thorium Isotopes
Halaco Engineering Co.
Waste Management Unit
6200 Perkins Road, Oxnard, Ventura County, California

Sample I.D.	Date	Radioactivity		Thorium Isotopes		
		ALPHA (pCi/L)	BETA (pCi/L)	Thorium-228 (pCi/L)	Thorium-230 (pCi/L)	Thorium-232 (pCi/L)
MW-4RA	03/05/03	41.5	95.1	2.60	2.27	1.39
MW-4RB Duplicate	03/05/03	ND	53.5	ND	ND	ND
	03/05/03	20.6	48.9	ND	3.78	ND
MW-5	03/05/03	ND	6,420	ND	ND	1.38
MW-6	03/05/03	ND	6,220	ND	2.72	0.988
Trip Blank	03/05/03					
RL		3.0	4.0	1.0	1.0	1.0
MCL's		15[1]	50[1]	NE	NE	NE

Notes:

pCi/L Pico Curries per Liter
ND Non Detect
RL Reporting Level
MCL Maximum Contaminant Level
NE Not Established
1 Primary MCL, California Department of Health Services Drinking Water Standards

HALACO MONITORING WELL SAMPLE - August 5, 2003								
Well samples were collected between 8:15-10:00AM. Low tide occurred at 9:14 AM. MW-S1,-S2 sampled 3:15PM, 9/18/03- High tide 3:05 PM				North-Deep	North-Shallow			Blank
		MW6	MW5	MW4B	MW4A	MW-S1	MW-S2	
Water Depth from concrete well pad	piezeometric ft- inches	7' 2.3"	10' 1.5"	3' 1.8"	1' 7.7"			
pH S.U.	Field	7.4	7.7	7.1	7.2	7.2	6.8	ND
Temperature F	Field	78	76	69	70			
Total Suspended Solids mg/L	EPA 160.2	94	ND	22	ND	625	260	ND
Gross Alpha pCi/L	EPA 900.0	25+/-2.5	1.7+/-1.0	2.5+/-1.1	3.5+/-1.2	3.4+/-0.8	5.1+/-0.9	ND
Gross Beta pCi/L	EPA 900.0	342+/-14	67+/-4.9	34+/-3.5	26+/-3.1	140+/-7.6	370+/-12	ND
Thorium 228 pCi/L,	DOE EML HASL300	0.2+/-0.3	0.2+/-0.2	ND	ND	ND	0.2+/-0.2	ND
Thorium 230 pCi/L	DOE EML HASL300	3.6+/-1.1	0.3+/-0.2	0.3+/-0.3	0.3+/-0.3	0.3+/-0.3	1.2+/-0.5	ND
Thorium 232 pCi/L	DOE EML HASL300	0.3+/-0.2	0.2+/-0.2	ND	ND	0.4+/-0.4	0.4+/-0.4	ND
Total Dissolved Solids mg/L,	EPA 160.1	19300	3960	6320	3570.0	4080.0	9190.0	0.9
Specific Conductance umhos/cm	EPA 120.1	31400	5710	9030	5380	6320	14600	ND
Sulfate mg/L	EPA 300.0	631	1190	1270	1190	1100	733	ND
Chloride mg/L	EPA 300.0	10500	1380	2760	1260	1160	4500	ND
Ammonia Nitrogen mg/L	EPA 350.3	348	3.1	1.1	0.3	10.5	26.5	ND
Nitrate Nitrogen mg/L	EPA 300.0	1.1	5.0	ND	0.1	ND	ND	ND
Nitrite Nitrogen mg/L	EPA 354.1	5.82	0.31	ND	ND	ND	ND	ND
Oil and Grease mg/L	EPA 1664	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbon mg/L,	EPA 8015							
C6 - C10 mg/L		ND	ND	ND	ND	ND	ND	ND
C10 - C22 mg/L		ND	ND	ND	ND	ND	ND	ND
C22 - C36 mg/L		ND	ND	ND	ND	ND	ND	ND
Aluminum mg/L	EPA 200.7	0.926	0.095	0.041	0.062	10.2	2.8	ND
Barium mg/L	EPA 200.7	2.32	0.031	0.048	0.045	0.196	0.097	ND
Chromium mg/L	EPA 200.7	ND	ND	ND	ND	0.023	0.01	ND
Copper mg/L	EPA 200.7	0.08	0.016	0.01	0.01	0.19	0.06	ND
Lead mg/L	EPA 200.7	ND	ND	ND	ND	0.005	ND	ND
Magnesium mg/L	EPA 200.7	169	177	226	164	109	164	ND
Nickel mg/L	EPA 200.7	~ND	0	0.01	0.008	0.036	0.01	ND
Zinc mg/L	EPA 200.7	0.103	0.018	0.015	0.012	0.238	0.037	ND
Hardness mg/L	EPA 130.2	1490	1120	1720	1230.0	834.0	1148.0	ND
Volatile Organic Carbons [sic] ug/L	EPA 8260B	ND	ND	ND	ND		ND	ND

HALACO MONITORING WELL SAMPLE - tober 27, 2003 - Associated Lab Request 118810

Well samples were collected between 7:20-9:20 AM. High tide occurred at 9:43 AM.				North-Deep	North-Shallow			Blank
		MW6	MW5	MW4B	MW4A	MW-S1	MW-S2	
Water Depth from concrete well pad	piezeometric ft- inches	NA	14.1'	5.1'	5.12'	5.24'	3.84'	
pH S.U.	Field	7.6	7.6	7.3	7.6	7.6	7.9	7.3
Temperature C	Field	24	25	19	19	21	20	
Total Suspended Solids mg/L	EPA 160.2	28	36	53	28	88	5	ND
Gross Alpha pCi/L	EPA 900.0	119+/-5.5	9.2+/-1.6	2.0+/-1.0	2.7+/-0.9	2.6+/-0.9	3.6+/-1.2	ND
Gross Beta pCi/L	EPA 900.0	3060+/-56	389+/-13	3.1+/-2.1	1.2+/-1.7	95+/-6.4	740+/-20	ND
Thorium 228 pCi/L,	DOE EML HASL300	0.3/-0.3	0.3+/-0.2	0.3+/-.3	0.3+/-0.3	0.3+/-0.2	0.3+/-0.3	ND
Thorium 230 pCi/L	DOE EML HASL300	0.3+/-0.3	1.3+/-0.7	3.1+/-1.1	1.3+/-0.3	1.4+/-0.7	2.1+/-0.9	ND
Thorium 232 pCi/L	DOE EML HASL300	0.3+/-0.2	0.4+/-0.4	0.4+/-0.4	0.4+/-0.4	0.4+/-0.2	0.4+/-0.4	ND
Total Dissolved Solids mg/L,	EPA 160.1	50400	14600	7050	2610.0	3920.0	10300.0	9930.0
Specific Conductance umhos/cm	EPA 120.1	71500	21800	9930	3410	5630	15600	ND
Sulfate mg/L	EPA 300.0	4	630	1310	936	1250	606	ND
Chloride mg/L	EPA 300.0	31500	8240	2980	627	1140	5670	ND
Ammonia Nitrogen mg/L	EPA 350.3	937	93.2	1.1	0.4	5.3	67.5	ND
Nitrate Nitrogen mg/L	EPA 300.0	ND	ND	ND	0.6	ND	ND	ND
Nitrite Nitrogen mg/L	EPA 354.1	ND	ND	ND	ND	ND	ND	ND
Oil and Grease mg/L	EPA 1664	26	13	20	15	20	20	ND
Total Petroleum Hydrocarbon mg/L,	EPA 8015							
C6 - C10 mg/L		ND	ND	ND	ND	ND	ND	ND
C10 - C22 mg/L		ND	ND	ND	ND	ND	ND	ND
C22 - C36 mg/L		ND	ND	ND	ND	ND	ND	ND
Aluminum mg/L	EPA 200.7	0.93	0.897	0.555	0.509	0.228	0.081	ND
Barium mg/L	EPA 200.7	14.9	0.656	0.057	0.038	0.067	0.068	ND
Chromium mg/L	EPA 200.7	ND	0.003	ND	ND	ND	ND	ND
Copper mg/L	EPA 200.7	0.06	0.041	0.012	0.01	0.01	0.007	ND
Lead mg/L	EPA 200.7	ND	ND	ND	ND	ND	ND	ND
Magnesium mg/L	EPA 200.7	389	360	251	120	159	116	ND
Nickel mg/L	EPA 200.7	0.03	0.006	0.006	0.008	0.01	0.003	ND
Zinc mg/L	EPA 200.7	ND	0.048	0.043	0.007	0.012	0.012	ND
Hardness mg/L	EPA 130.2	3230	2790	1880	932.0	1300.0	786.0	ND
Volatile Organic Carbons [sic] ug/L	EPA 8260B	ND	ND	ND	ND	ND	ND	ND

HALACO MONITORING WELL SAMPLE -November 25, 2003- Capco Analytical Services Lab No. 032397							
Well samples were collected between9:35 and 11:05 AM. High tide occurred at 9:22 AM.							Blank
		MW-1R	MW-2RA	MW-2RB	MW-3RA	MW-3RB	
Water Depth from concrete well pad	piezeometric ft- inches	6.09	5.95	5.83	5.16	5.55	
pH S.U.	Field	6.9	7.7	7.3	7.8	7.5	7.3
Temperature C	Field	20.7	22.4	23.2	19.4	19.9	
Total Suspended Solids mg/L	EPA 160.2	44	1520	18	1900	14	ND
Gross Alpha pCi/L	EPA 900.0	ND+/-68.9	ND+/-102	ND+/-97.1	62.7+/-23.3	ND+/-90.5	ND
Gross Beta pCi/L	EPA 900.0	7040+/-281	9630+/-347	8640+/-321	2160+/-70.0	5530+/-189	ND
Thorium 228 pCi/L,	DOE EML HASL300	ND+/-2.11	ND+/-2.04	ND+/-3.82	ND+/-3.76	ND+/-2.42	ND
Thorium 230 pCi/L	DOE EML HASL300	2.38+/-1.94	ND+/-1.87	ND+/-2.21	12.0+/-8.49	ND+/-2.04	ND
Thorium 232 pCi/L	DOE EML HASL300	ND+/-1.09	ND+/-0.365	ND+/-.004	ND+/-3.76	ND+/-0.219	ND
Total Dissolved Solids mg/L,	EPA 160.1	46000	67000	51000	17000.0	31000.0	9930.0
Specific Conductance umhos/cm	EPA 120.1	86000	124000	98000	32000	60000	ND
Sulfate mg/L	EPA 300.0	930	1070	1640	810	870	ND
Chloride mg/L	EPA 300.0	28800	38800	27100	14500	21900	ND
Ammonia Nitrogen mg/L	EPA 350.3	240	410	390	33	220	ND
Nitrate Nitrogen mg/L	EPA 300.0	ND	ND	ND	ND	ND	ND
Nitrite Nitrogen mg/L	EPA 354.1	0.03	0.50	ND	0.37	ND	ND
Oil and Grease mg/L	EPA 1664	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbon mg/L,	EPA 8015						
C6 - C10 mg/L		0.11	0.16	0.16	ND	ND	ND
C10 - C22 mg/L		ND	ND	ND	ND	ND	ND
C22 - C36 mg/L		ND	ND	ND	ND	ND	ND
Aluminum mg/L	EPA 200.7	ND	2.7	0.74	2.8	ND	ND
Barium mg/L	EPA 200.7	0.59	0.8	1.3	0.13	0.34	ND
Chromium mg/L	EPA 200.7	ND	ND	ND	ND	ND	ND
Copper mg/L	EPA 200.7	ND	ND	0.078	0.19	ND	ND
Lead mg/L	EPA 200.7	ND	ND	ND	ND	ND	ND
Magnesium mg/L	EPA 200.7	1140	1730	1080	280	640	ND
Nickel mg/L	EPA 200.7	ND	ND	ND	ND	ND	ND
Zinc mg/L	EPA 200.7	0.055	0.073	0.099	0.16	ND	ND
Hardness mg/L	EPA 130.2	6785	10000	7280	2590.0	3790.0	ND
Volatile Organic Carbons [sic] ug/L	EPA 8260B	ND	ND	ND	ND	ND	ND

HALACO GROUND WATER SAMPLE - Fe. ıary 6, 2004 Associated Lab Request 124196

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

Low Tide 08:58		MW-1	MW-2A	MW-2B	MW-3A	MW-3B	MW-4A	MW-4B	MW-5	MW-6	MW-S1	MW-S2
Parameter	Method											
Well Water Depth ft	Field	3.83	3.6	3.8	2.75	3.22	6.10	6.92	13.1	9.6	4.7	3.5
Time hh:mm	Field	13:00	12:10	12:30	13:30	13:45	11:00	10:45	09:20	10:20	09:45	14:15
Temperature °C	Field	20.4	19.8	20.6	12.3	19.5	17.9	17.4	19.8	21.5	21.4	20.7
pH units	Field	7.09	7.56	7.37	7.63	7.77	7.35	7.92	7.36	7.85	7.66	8.18
TDS mg/l	160.1	42000	62400	37500	12900	21500	4060	4500	16800	50000	5800	10400
TSS mg/l	160.2	83	34	249	9.0	80	33	ND	7.0	92	9.0	6.0
Gross Alpha pCi/l	900	40+/-3	16+/-2.1	60+/-4.7	2.4+/–0.8	5.6+/-1.1	1.7+/-0.8	ND+/-0.6	6.5+/-1.2	150+/-5.8	1.7+/-0.6	3.4+/-0.8
Gross Beta pCi/l	900	560+/-28	540+/-29	480+/-27	480+/-14	280+/-24	22+/-3.2	15+/-2.8	795+/-19	410+/-35	220+/-9.4	685+/-16
Thorium 228 pCi/l	907	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A
Thorium 230 pCi/l	907	0.4+/-0.5	0.2+/-.04	0.2+/-0.4	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A
Thorium 232 pCi/l	907	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A
Conductivity mhos/cm	120.1	63800	94600	74400	21200	34300	5510	6200	27800	81700	9200	17200
Sulfate mg/l	300.0	675	1500	280	829	788	1010	1050	550	51	1160	544
Chloride mg/l	300.0	23000	34200	26400	6340	10400	1110	1280	8750	27600	2000	5020
nitrate nitrogen mg/l	300.0	ND	ND	ND	2.8	ND	ND	0.3	ND	ND	ND	ND
nitrite nitrogen mg/l	300.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia nitrogen mg/l	350.1	252	386	414	44.2	168	0.4	ND	202	442	26.6	86.8
Oil & grease mg/l	1664	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPH mg/l	8015	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A
Aluminum mg/l	200.7	0.313	1.45	1.53	0.056	0.700	1.43	0.237	0.067	2.22	0.044	0.220
Barium mg/l	200.7	0.320	0.421	0.665	0.092	0.172	0.068	0.026	0.323	8.26	0.090	0.106
Chromium mg/l	200.7	ND	ND	0.003	ND	ND	0.004	0.002	ND	0.004	ND	ND
Copper mg/l	200.7	0.005	0.071	0.006	0.006	0.006	0.012	0.012	0.006	0.109	0.019	0.013
Lead mg/l	200.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium mg/l	200.7	1090	1420	991	301	346	165	95.4	171	178	166	111
Zinc mg/l	200.7	0.012	0.051	0.022	0.028	0.043	0.026	0.023	0.011	0.047	0.033	0.041
Hardness mg/l	130.2	6600	10500	6840	1921	2335	1137	729	1476	1727	1271	731
VOCs mg/l	8260	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A
Radium 226 pCi/l										29.2 +/-1.8		
Radium 228 pCi/l										56.2 +/-2.3		

HALACO GROUND WATER SAMPLE - April 30, 2004 Associated Lab Request 128620

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

High Tide 1:24 pm		MW-1	MW-2A	MW-2B	MW-3A	MW-3B	MW-4A	MW-4B	MW-5	MW-6	MW-S1	MW-S2
Parameter	Method											
Well Water Depth ft	Field	2.41	3.68	2.84	1.78	2.55	5.26	5.53	10.94	8.62	1.57	0.85
Time hh:mm	Field	11:15	11:35	11:55	10:45	11:00	12:20	12:30	09:30	13:30	10:00	10:20
Temperature °F	Field	71	70	72	71	68	73	75	69	72	72	73
pH units	Field	6.91	6.98	7.32	7.23	7.25	7.18	7.22	6.95	7.33	7.18	7.10
TDS mg/l	160.1	39300	62400	48200	11200	17100	2970	5380	7380	47800	6260	11800
TSS mg/l	160.2	86	4.4	46	10	14	10	28	160	224	13	6.0
Gross Alpha pCi/l	900	22+/-2.1	17+/-2.1	37+/-2.5	3.3+/-1.1	2.8+/-0.9	2.2+/-0.7	ND<1+/-0.5	2.0+/-0.8	77+/-3.5	1.7+/-0.8	12+/-1.4
Gross Beta pCi/l	900	1930+/-39	2340+/-48	1740+/-41	1060+/-29	1250+/-31	75+/-5.6	95+/-6.6	275+/-1.3	2250+/-4.2	640+/-20	790+/-25
Thorium 228 pCi/l	907	ND	ND	ND	ND	ND	-	-	-	-	-	-
Thorium 230 pCi/l	907	0.8+/-0.5	ND	ND	ND	ND	-	-	-	-	-	-
Thorium 232 pCi/l	907	ND	ND	ND	ND	ND	-	-	-	-	-	-
Conductivity mhos/cm	120.1	56300	81200	65200	16200	23600	3890	7690	11100	88600	8810	16700
Sulfate mg/l	300.0	733	1220	294	1340	757	999	1260	1360	100	1690	1590
Chloride mg/l	300.0	22000	34400	25100	5500	9290	620	2020	3380	29000	2330	5040
nitrate nitrogen mg/l	300.0	ND	0.67	ND	0.19	0.14	3.13	0.34	6.72	ND	ND	1.49
nitrite nitrogen mg/l	300.0	0.04	0.47	ND	ND	ND	0.22	ND	ND	0.04	ND	0.20
Ammonia nitrogen mg/l	350.1	242	469	427	11.1	114	ND	ND	4.9	880	4.7	7.7
Oil & grease mg/l	1664	ND	0.78	ND	ND	ND	ND	0.78	ND	0.67	ND	0.78
TPH mg/l	8015	ND	ND	ND	ND	ND						
Aluminum mg/l	200.7	0.712	0.265	0.273	0.022	0.086	0.262	0.357	3.26	8.27	0.509	0.196
Barium mg/l	200.7	0.320	0.311	0.772	0.088	0.117	0.044	0.052	0.112	7.47	0.089	0.178
Chromium mg/l	200.7	0.032	0.031	0.028	0.022	0.022	0.014	0.013	0.033	0.033	0.019	0.023
Copper mg/l	200.7	ND	0.004	ND	0.006	0.004	0.014	0.003	0.075	0.095	0.028	0.051
Lead mg/l	200.7	0.015	0.003	0.012	0.023	0.020	0.018	0.016	0.024	0.025	0.019	0.022
Magnesium mg/l	200.7	772	1670	683	320	291	152	121	309	213	234	322
Nickel mg/l	200.7	0.010	0.014	0.009	0.005	0.007	0.005	0.004	0.006	0.020	0.016	0.014
Zinc mg/l	200.7	0.015	0.036	0.018	0.014	0.013	0.017	0.025	0.043	0.099	0.032	0.052
Hardness mg/l	130.2	4552	10880	4499	2066	1892	1136	946	1811	1858	1745	2143
VOCs mg/l	8260	ND	ND	ND	ND	ND						
Radium 226 pCi/l										21.5/-1.4		
Radium 228 pCi/l										47+/-2.2		

HALACO GROUND WATER SAMPLE - August 6, 2004 Associated Lab Request 134064

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

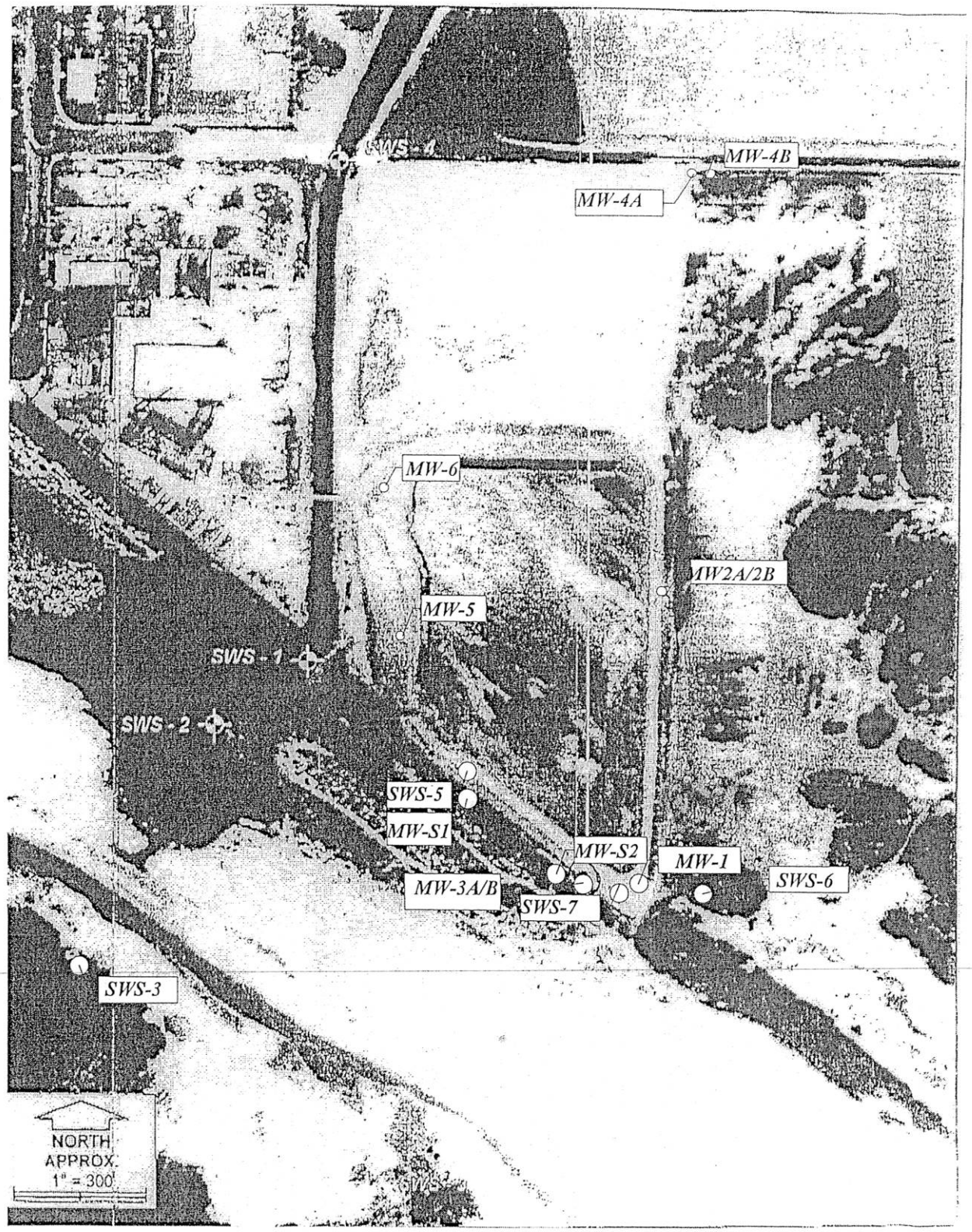
Low Tide 8:05 am		MW-1	MW-2A	MW-2B	MW-3A	MW-3B	MW-4A	MW-4B	MW-5	MW-6	MW-S1	MW-S2
Parameter	Method											
Well Water Depth ft	Field	2.17	1.98	3.34	0.33	1.09	3.48	4.44	5.55	7.54	1.21	0.50
Time hh:mm	Field	1:15	11:30	11:30	12:30	12:30	8:30	8:30	9:30	8:50	10:45	10:50
Temperature °F	Field	70	70	71	72	71	68	68	70	69	67	68
pH units	Field	7.05	7.09	7.02	7.20	7.13	7.10	7.07	7.05	7.15	7.13	7.10
TDS mg/l	160.1	24200	74900	55000	12500	9140	8010	8490	9980	52600	6710	11500
TSS mg/l	160.2	24	270	25	12	7.0	30	40	20	70	12	30
Gross Alpha pCi/l	900	8.6 +/- 1.1	15 +/- 1.5	33 +/- 2.2	2.5 +/- 0.7	1.7 +/- 0.6	2.9 +/- 0.8	2.0 +/- 0.7	1.7 +/- 0.7	96 +/- 3.7	1.7 +/- 0.7	1.9 +/- 0.7
Gross Beta pCi/l	900	232 +/- 16	1352 +/- 49	1142 +/- 41	236 +/- 15	335 +/- 17	64 +/- 6.9	86 +/- 7.9	172 +/- 11	1589 +/- 48	173 +/- 12	302 +/- 17
Conductivity mhos/cm	120.1	30000	75600	57200	15600	12100	9090	10100	12300	63500	7460	14100
Sulfate mg/l	300.0	882	1060	292	1360	622	1560	1470	1330	72	1370	1410
Chloride mg/l	300.0	13200	36700	26800	6130	4720	3020	3580	4430	27900	2430	5530
nitrate nitrogen mg/l	300.0	ND	0.30	ND	ND	0.2	ND	0.05	2.0	0.40	ND	ND
nitrite nitrogen mg/l	300.0	ND	0.80	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia nitrogen mg/l	350.1	139	508	451	28.3	52.6	0.40	1.3	1.8	861	12.6	25.4
Oil & grease mg/l	1664	ND	ND	0.60	ND	0.60	ND	0.60	0.60	ND	0.90	1.8
TPH mg/l	8015	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND
Aluminum mg/l	200.7	ND	11.7	ND	ND	ND	1.78	0.263	0.444	0.95	0.103	0.015
Barium mg/l	200.7	0.16	0.66	1.05	0.080	ND	0.089	0.075	0.060	7.21	0.074	0.067
Chromium mg/l	200.7	ND	0.060	0.030	ND	ND	0.010	0.007	0.008	ND	0.006	0.007
Copper mg/l	200.7	0.030	0.11	0.080	0.080	0.040	0.071	0.051	0.077	0.060	0.054	0.051
Lead mg/l	200.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium mg/l	200.7	431	1280	1080	471	204	282	278	300	239	232	270
Nickel mg/l	200.7	ND	ND	ND	ND	ND	0.008	ND	0.003	ND	0.004	0.004
Potassium mg/l	200.7	3790	10700	6150	935	1960	96	130	326	8890	626	1140
Zinc mg/l	200.7	ND	0.11	ND	ND	ND	0.018	0.012	0.018	0.007	0.005	ND
Hardness mg/l	130.2	2742	8928	7283	2841	1275	1756	1931	1702	2147	1750	1681
VOCs mg/l	8260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Radium 226 pCi/l										13.7 +/- 1.2		
Radium 228 pCi/l										42 +/- 3.1		

656981-01

HALACO GROUND WATER SAMPLE - November 24, 2004 Associated Lab Request 140897

Cease and Desist Order No. R4-2002-0064 Waste Discharge Order No. 80-58 (File No. 70-24)

High Tide 7:21 A.M.		MW-1	MW-2A	MW-2B	MW-3A	MW-3B	MW-4A	MW-4B	MW-5	MW-6	MW-S1	MW-S2
Parameter	Methd											
Well Water Depth ft	Field	6.3	5.14	5.63	3.98	4.4	7.32	8.44	13.0	10.8	3.5	5.0
Time hh:mm	Field	08:30	08:15	08:15	08:55	08:55	09:40	09:40	07:50	07:30	09:15	09:15
Temperature °F	Field	69	68	70	67	67	70	70	72	73	67	67
pH units	Field	7.18	7.13	7.11	7.08	7.05	7.05	7.06	7.10	7.15	7.14	7.12
TDS mg/l	160.1	15500	66500	49100	8340	8020	4120	4500	17800	50300	8700	8570
TSS mg/l	160.2	67	23	20	10	35	9.0	60	7.0	28	9.0	16
Gross Alpha pCi/l	900	310+/-30.4	1770+/-91.3	1130/-91.3	187+/-9.1	494+/-9.3	11.0+/-9.1	ND	419+/-30.4	1360+/-91.3	73.1+/-9.1	220+/-9.1
Gross Beta pCi/l	900	2160+/-67.2	8550+/-217	6080+/-197	536+/-18.9	1390+/-26.0	54.1+/-18.9	56.6+/-18.9	1950+/-64.6	7150+/-208	348+/-18.9	511+/-18.9
Thorium 228 pCi/l	907	0.3+/-0.5	1.1+/-1.8	0.3+/-0.6	0.2+/-0.5	ND						
Thorium 23 pCi/l	907	0.2+/-0.4	0.7+/-1.2	0.6+/-0.6	0.2+/-0.4	0.2+/-.02						
Thorium 2 pCi/l	907	0.6+/-0.6	1.8+/-1.8	0.7+/-0.7	0.6+/-0.6	0.3+/-0.3						
Conductivity mhos/cm	120.1	22400	86700	66800	11900	12700	6360	6850	26000	72500	13100	13500
Sulfate mg/l	300.0	537	1230	258	1150	958	1250	1170	635	90	1760	1210
Chloride mg/l	300.0	7260	35000	26100	3510	3420	1100	1340	8870	22900	3120	3560
nitrate nitrogen mg/l	300.0	1.2	1.8	0.6	0.1	0.9	ND	0.4	0.6	0.1	ND	ND
nitrite nitrogen mg/l	300.0	ND	0.1	ND	ND	ND	ND	ND	ND	ND	0.1	ND
Ammonia nitro mg/l	350.1	75.5	451	453	21.6	49.6	0.3	0.7	175	908	ND	21.4
Oil & grease mg/l	1664	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPH mg/l	8015	ND	ND	ND	ND	ND						
Aluminum mg/l	200.7	0.009	ND	ND	ND	0.090	0.020	0.067	ND	ND	ND	0.262
Barium mg/l	200.7	0.010	0.049	0.092	ND	ND	ND	ND	0.039	0.981	0.013	0.009
Calcium mg/l	200.7	18.6	156	99.1	26.4	13.8	23.1	26.0	29.2	52.8	64.2	29.2
Chromium mg/l	200.7	ND	0.006	0.004	ND	ND	ND	ND	ND	ND	ND	ND
Copper mg/l	200.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.006
Lead mg/l	200.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium mg/l	200.7	20.6	132	80.4	29.8	14.2	24.0	21.3	27.5	30.0	41.5	31.5
Potassium mg/l	200.7	2540	13680	8240	650	1778	8.86	8.36	2620	10720	452	686
Zinc mg/l	200.7	ND	ND	0.005	ND	ND	ND	ND	0.016	0.025	ND	ND
Hardness mg/l	130.2	131	932	578	188	93	156	152	186	255	331	204
VOCs mg/l	8260	ND	ND	ND	ND	ND						
Radium 226 pCi/l			1.9+/-0.5									
Radium 228 pCi/l			11+/-1.4									



Halaco Engineering CDO Sampling Locations

SWS - Surface Water Sampling Location
MW- Monitoring Well Location

Sampling locations are approximate.

December 2003

Appendix H.4
EPA NEIC Site Inspection (1980)

NEIC

D20

National Enforcement Investigations Center, Denver

U.S. Environmental Protection Agency

Office of Enforcement

Table 1

AQUEOUS SAMPLE DESCRIPTION

STATION NUMBER	STATION LOCATION	PHYSICAL DESCRIPTION
03	Scrubber Wastewater Discharge to Pond	Colorless liquid with < 1% settled brown fine particulate matter
04	Waste Washwater Discharge to Pond	Colorless liquid with ~ 5% gray granular solids
05	Canal Downstream of Halaco	Colorless liquid
06	Canal at Bridge to Waste Pond	Colorless liquid
07	Canal Immediately Upstream of Halaco	Colorless liquid
08	Wetland at N.W. Edge of Waste Disposal Area	Light brown liquid with < 1% solids
09	N.W. Area of Pond Near Discharge	Colorless liquid with ~ 5% gray granular solids
10	S.E. Corner of Pond	Colorless liquid with ~ 5% gray granular solids
11	Settling Pond South of Discharge in Standing Water	Colorless liquid
12	Canal ¼ mile Upstream of Halaco	Colorless liquid
13	Canal ½ mile Upstream of Halaco	Colorless liquid
14	Seepage from NE Corner area of Berm	Light brown liquid with < 5% settled fine particulate
15	Wetland East of Pond	Light brown liquid with < 1% settled fine particulate
16	Runoff S. of S. Berm	Light brown liquid with < 1% settled fine particulate

TABLE 9 - Quantitative Results for the Aqueous Samples

		SYM. NO.	03	03	03	04	04	04	04	04	05	05	05
		DATE	12/9	12/11	12/11	12/9	12/10	12/10	12/11	12/11	12/9	12/10	12/10
		TIME	1530	1300	1300	1530	1530	1530	1300	1300	1030	0920	0920
		MATL. TYPE.	TOT	TOT	DISS	TOT	TOT	DISS	TOT	DISS	TOT	TOT	DISS
PARAMETER	UNITS	LOD											
Ag	mg/L	0.005	0.008	ND	0.006	0.119	0.050	ND	0.019	ND	ND	ND	ND
Al	"	0.5	110	140	ND	5100	5300	0.5	4400	6.6	ND	ND	ND
As	"	0.007	0.086	0.033	NA	NA	NA	NA	NA	NA	ND	ND	NA
B	"	0.1	1.4	1.4	1.3	15.	12.	2.1	11.	2.2	1.0	0.9	1.2
Ba	"	0.004	1.47	0.49	0.13	11.8	14.6	2.61	9.35	1.69	0.056	0.059	0.057
Be	"	0.008	ND	ND	ND	0.248	0.285	ND	0.134	ND	ND	ND	ND
Ca	"	0.06	340	350	350	440	790	780	510	560	240	260	290
Cd	"	0.002	0.016	0.015	0.006	0.068	0.050	ND	0.054	ND	ND	ND	ND
Co	"	0.008	ND	0.012	ND	0.138	0.092	ND	ND	ND	ND	ND	ND
Cr	"	0.04	0.34	0.28	ND	20.	12.	0.11	11.	ND	ND	ND	ND
Cu	"	0.006	5.3	3.3	0.061	140	48.6	ND	82.0	ND	ND	ND	ND
Fe	"	0.06	7.6	7.3	ND	220	190	0.37	190	0.09	0.19	0.29	ND
Hg	"	0.0001	0.0002	0.0005	NA	0.0003	0.0007	NA	0.0005	NA	0.0004	0.0002	NA
K	"	0.3	6900	250	250	14000	17000	13000	14000	12000	220	230	210
Mg	"	0.05	330	190	180	2400	3800	280	2400	370	110	110	110
Mn	"	0.007	1.89	2.61	0.54	70.4	50	0.190	48.9	0.130	0.436	0.423	0.433
Mo	"	0.03	ND	0.05	0.05	ND	ND	ND	ND	ND	ND	0.04	0.04
Na	"	0.5	8800	1200	1000	22000	17000	17000	13000	13000	560	490	450
Ni	"	0.03	0.15	0.12	0.05	4.2	1.1	0.21	3.1	ND	ND	ND	ND
Pb	"	0.02	0.25	0.15	ND	ND	0.80	0.12	3.58	ND	ND	ND	ND
Sb	"	0.007	0.031	0.018	NA	NA	NA	NA	NA	NA	ND	ND	NA
Se	"	0.010	0.03	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA
Si	"	0.08	NA	NA	8.7	NA	NA	35	NA	25	NA	NA	12
Sr	"	0.002	2.42	2.90	3.15	5.39	7.34	5.81	8.19	5.65	2.14	2.34	2.43
Ti	"	0.01	1.20	1.56	ND	2.55	10.0	0.03	25.4	0.03	ND	ND	ND
Tl	"	0.005	ND	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA
V	"	0.01	0.04	0.04	ND	0.81	0.07	ND	0.67	ND	ND	ND	ND
Zn	"	0.009	8.76	3.42	0.017	114	19.4	ND	46.1	0.015	0.026	0.016	0.012
Zr	"	0.02	0.12	0.08	0.03	0.35	0.50	0.07	0.87	0.08	ND	ND	ND
NH_3-N	"	0.2	NA		14	830		300		200	3		6
Br	"	20	92		ND			230		210			
Cl	"	3	18000		2000			42000		33000			
F	"	1	3		3			9		3			
NO_3^--N	"	2	ND		ND			ND		ND			
NO_2^--N	"	4	ND		9			ND		ND			
PO_4^{3-}-P	"	8	ND		ND			ND		ND			
$SO_4^=$	"	24	560		1200			690		890			

TABLE 9 (continued)

		SYS. NO.	05	05	06	06	06	06	06	07	07	07	07	07		
		DATE	12/11	12/11	12/9	12/10	12/10	12/11	12/11	12/9	12/10	12/10	12/11	12/11		
		TIME	0935	0935	1038	0930	0930	0945	0945	1045	0940	0940	0950	0950		
		ANAL. TYPE.	TOT	DISS	TOT	TOT	DISS	TOT	DISS	TOT	TOT	DISS	TOT	DISS		
PARAMETER	UNITS	LOD														
Ag	mg/L	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Al	"	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
As	"	0.007	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA		
B	"	0.1	1.1	1.4	0.9	1.1	1.2	1.2	1.4	1.1	1.0	1.2	1.1	1.3		
Ba	"	0.004	0.061	0.060	0.045	0.051	0.057	0.059	0.054	0.046	0.049	0.049	0.049	0.048		
Be	"	0.008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Ca	"	0.06	280	320	250	260	290	280	320	250	270	290	290	330		
Cd	"	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Co	"	0.[illegible]8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Cr	"	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Cu	"	0.006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Fe	"	0.06	0.26	ND	0.18	0.26	ND	0.35	ND	0.34	0.25	ND	0.33	ND		
Hg	"	0.0001	0.0002	NA	0.0002	0.0002	NA	0.0002	NA	0.0004	ND	NA	ND	NA		
K	"	0.3	220	210	140	160	140	160	170	120	160	140	150	140		
Mg	"	0.05	130	140	100	110	110	120	130	100	120	120	120	120		
Mn	"	0.007	0.458	0.476	0.412	0.437	0.457	0.412	0.428	0.411	0.458	0.485	0.397	0.402		
Mo	"	0.03	0.09	0.08	0.06	ND	0.04	0.05	0.07	ND	0.05	0.08	0.09	0.07		
Na	"	0.5	660	610	410	450	400	490	520	360	470	450	410	420		
Ni	"	0.03	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND		
Pb	"	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Sb	"	0.007	ND	NA	ND	ND	NA	0.008	NA	ND	ND	NA	ND	NA		
Se	"	0.01	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA		
Si	"	0.08	NA	12	NA	NA	12	NA	12	NA	NA	12	NA	12		
Sr	"	0.002	2.61	2.85	2.17	2.37	2.51	2.66	2.86	2.21	2.46	2.57	2.68	2.83		
Ti	"	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Tl	"	0.005	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA		
V	"	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.010	ND		
Zn	"	0.009	0.013	ND	0.011	0.024	0.012	0.020	ND	0.011	0.010	0.011	0.012	ND		
Zr	"	0.020	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
NH_3-N	"	0.2		4	2		3		3	1		2		2		

TABLE 9 (continued)

		STA. NO.	08	09	09	10	10	11	11	12	12
		DATE	12/09	12/09	12/10	12/9	12/10	12/9	12/10	12/10	12/10
		TIME	1410	1435	1345	1505	1410	1520	1415	0950	0950
		ANAL. TYPE.	TOT	TOT	DISS	TOT	DISS	TOT	DISS	TOT	DISS
PARAMETER	UNITS	LOD									
Ag	mg/L	0.005	ND	0.048		0.052		ND		ND	ND
Al	"	0.5	ND	1800		820		13		ND	ND
As	"	0.007	ND	NA		NA		ND		ND	NA
B	"	0.1	0.2	6.5		4.1		1.1		1.1	1.4
Ba	"	0.004	0.047	5.83		24.6		1.75		0.045	0.049
Be	"	0.008	ND	0.081		0.170		ND		ND	ND
Ca	"	0.06	39	340		340		340		290	320
Cd	"	0.002	ND	0.024		0.052		ND		ND	ND
Co	"	0.008	ND	0.033		0.010		ND		ND	ND
Cr	"	0.04	ND	4.7		2.2		0.06		ND	ND
Cu	"	0.006	0.026	52.7		18.0		0.223		ND	ND
Fe	"	0.06	0.50	68		44		0.93		0.21	ND
Hg	"	0.0001	0.0003	0.0004		0.0007		ND		0.0002	NA
K	"	0.3	92	8600		9800		6800		150	130
Mg	"	0.05	21	1200		1520		337		120	130
Mn	"	0.007	0.242	23.8		18.6		0.459		0.443	0.472
Mo	"	0.03	0.04	ND		ND		ND		0.05	0.09
Na	"	0.5	140	12000		14000		8500		480	490
Ni	"	0.03	ND	1.1		0.50		0.50		ND	ND
Pb	"	0.02	ND	ND		0.36		0.33		ND	ND
Sb	"	0.007	ND	NA		NA		ND		ND	NA
Se	"	0.0[illegible]0	ND	ND		ND		ND		ND	NA
Si	"	0.08	NA	NA		NA		NA		NA	12
Sr	"	0.002	0.340	3.68		4.13		2.49		2.58	2.82
Ti	"	0.01	ND	1.60		1.95		0.39		ND	ND
Tl	"	0.005	ND	ND		ND		ND		ND	NA
V	"	0.010	ND	0.40		0.20		ND		ND	ND
Zn	"	0.009	0.055	26.8		15.8		1.17		0.016	ND
Zr	"	0.020	ND	0.39		1.03		0.14		ND	ND
NH_3-N	"	0.2	3	280	120	200	170	100	100		1

TABLE 9 (continued)

		SYA. NO.	12	12	13	13	13	13	14	14	14	14	15	15	16	16
		DATE	12/11	12/11	12/10	12/10	12/11	12/11	12/10	12/10	12/11	12/11	12/10	12/10	12/10	12/10
		TIME	1000	1000	1000	1000	1015	1015	1300	1300	1330	1330	1400	1400	1430	1430
		ANAL. TYPE.	TOT	DISS	TOT	DISS	TOT	DISS	TOT	DISS	TOT	DISS	TOT	DISS	TOT	DISS
PARAMETER	UNITS	LOD														
Ag	mg/L	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Al	"	0.5	ND	ND	ND	ND	ND	ND	7.7	ND	15	ND	3.4	ND	1.5	ND
As	"	0.007	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA
B	"	0.1	1.1	1.3	1.1	1.4	1.2	1.3	1.2	1.3	1.2	1.4	0.9	0.9	0.6	0.5
Ba	"	0.004	0.042	0.042	0.040	0.044	0.034	0.042	0.358	0.320	0.430	0.348	0.300	0.089	0.148	0.128
Be	"	0.003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ca	"	0.06	280	330	300	320	320	330	940	960	960	1000	180	200	290	290
Cd	"	0.002	ND	ND	ND	ND	ND	ND	ND	ND	0.003	ND	ND	ND	ND	ND
Co	"	0.008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cr	"	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cu	"	0.006	ND	ND	ND	ND	ND	ND	0.037	ND	0.065	ND	0.115	0.030	0.060	0.042
Fe	"	0.06	0.24	ND	0.23	ND	0.23	ND	9.5	0.07	17	0.07	1.5	0.35	0.60	0.16
Hg	"	0.0001	ND	NA	0.0002	NA	0.0002	NA	0.0006	NA	0.0002	NA	ND	NA	ND	NA
K	"	0.3	130	110	130	110	120	100	9900	9400	12000	9700	1000	1000	2700	2400
Mg	"	0.05	110	110	110	110	110	110	157	167	159	174	130	130	199	208
Mn	"	0.007	0.316	0.316	0.379	0.405	0.296	0.296	2.52	2.41	2.72	2.74	0.534	0.421	0.440	0.456
Mo	"	0.03	0.07	0.07	0.08	0.07	ND	0.08	ND	ND	ND	ND	ND	0.04	ND	ND
Na	"	0.5	340	310	370	360	280	290	8200	7200	9800	7500	1600	1500	2200	2000
Ni	"	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND
Pb	"	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sb	"	0.007	ND	NA	0.012	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA
Se	"	0.01	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA
Si	"	0.00	NA	12	NA	12	NA	12	NA	8.0	NA	8.6	NA	1.8	NA	2.1
Sr	"	0.002	2.67	2.81	2.61	2.80	2.69	2.85	3.10	3.36	3.08	3.50	1.51	1.58	1.50	1.62
Ti	"	0.01	ND	ND	ND	ND	ND	ND	0.45	0.03	0.81	0.03	0.06	ND	0.02	ND
Tl	"	0.005	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA
V	"	0.01	ND	ND	ND	ND	ND	ND	0.024	ND	0.033	ND	ND	ND	ND	ND
Zn	"	0.009	0.019	ND	0.037	ND	0.015	0.032	0.073	ND	0.125	ND	0.141	0.016	0.068	0.020
Zr	"	0.02	ND	ND	ND	ND	ND	ND	0.08	0.07	0.08	0.08	ND	ND	0.03	0.03
NH_3-N	"	0.2		1		1		0.6		400		400		30		60

Table 10

SUMMARY OF FIELD MEASUREMENTS

Station	12/9/80			12/10/80			12/11/80			pH		COND.			TEMP. °C		
No.	pH	cond	temp	pH	cond	temp	pH	cond	temp	min	max	min	max	avg	min	max	avg
03	8.3		19.0				8.0	8K	18.0	8.0	8.3	8K	8K	8K	18.0	19.0	18.5
04	8.4		18.5				8.4		18.0	8.4	8.4				18.0	18.5	18.25
05	7.7	3.4K	10.0	7.9	3.9K	10.0	8.0	5.6K	10.0	7.7	8.0	3.4K	5.6K	4.3K	10.0	10.0	10.0
06	7.9	3.9K	10.0	7.6	3.4K	10.0	8.1	5.1K	10.0	7.6	8.1	3.4K	5.1K	4.1K	10.0	10.0	10.0
07	8.0	3.5K	10.0	7.9	3.6K	10.0	8.1	4.3K	10.0	7.9	8.1	3.5K	4.3K	3.8K	10.0	10.0	10.0
08	8.8									8.8	8.8						
09	8.4	82K		8.6		16.0				8.4	8.6	82K	82K	82K	16.0	16.0	16.0
10	8.7	91K		8.5		15.5				8.5	8.7	91K	91K	91K	15.5	15.5	15.5
11		52K		8.5	48K	11.0				8.5	8.5	48K	52K	50K	11.0	11.0	11.0
12				7.9	3.6K	9.5	8.0	3.5K	8.5	7.9	8.0	3.5K	3.6K	3.5K	8.5	9.5	9.0
13				8.0	3.0K	8.5	8.1	3.4K	9.0	8.0	8.1	3.0K	3.4K	3.2K	8.5	9.0	8.75
14				8.4	42K	16.0			13.0	8.4	8.4	42K	42K	42K	13.0	16.0	14.5
15				8.7		13.5				8.7	8.7				13.5	13.5	13.5
16				8.4		14.0				8.4	8.4				14.0	14.0	14.0

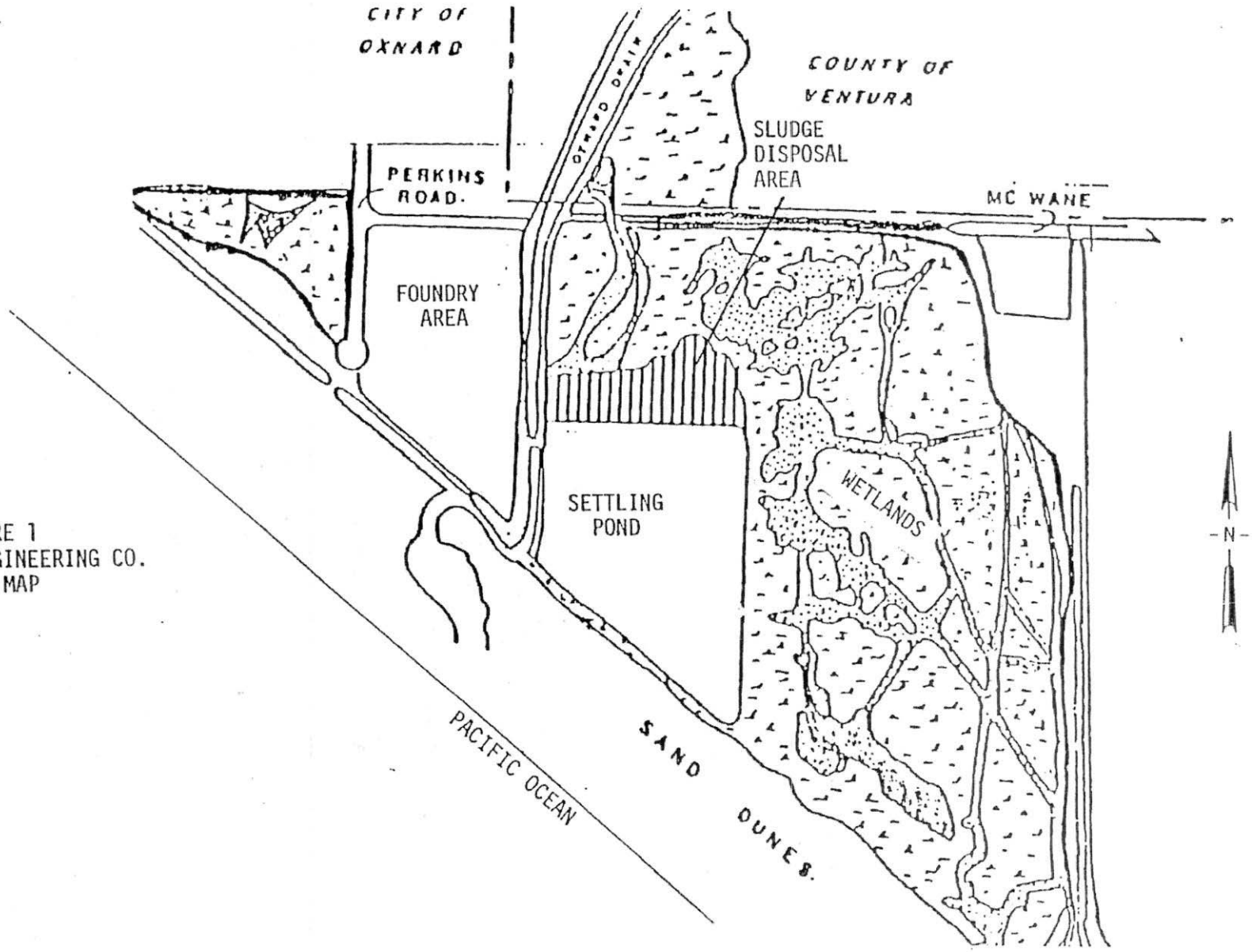


FIGURE 1
HALACO ENGINEERING CO.
SITE MAP

(After California Dept. of Fish and Game Sketch, 1980)

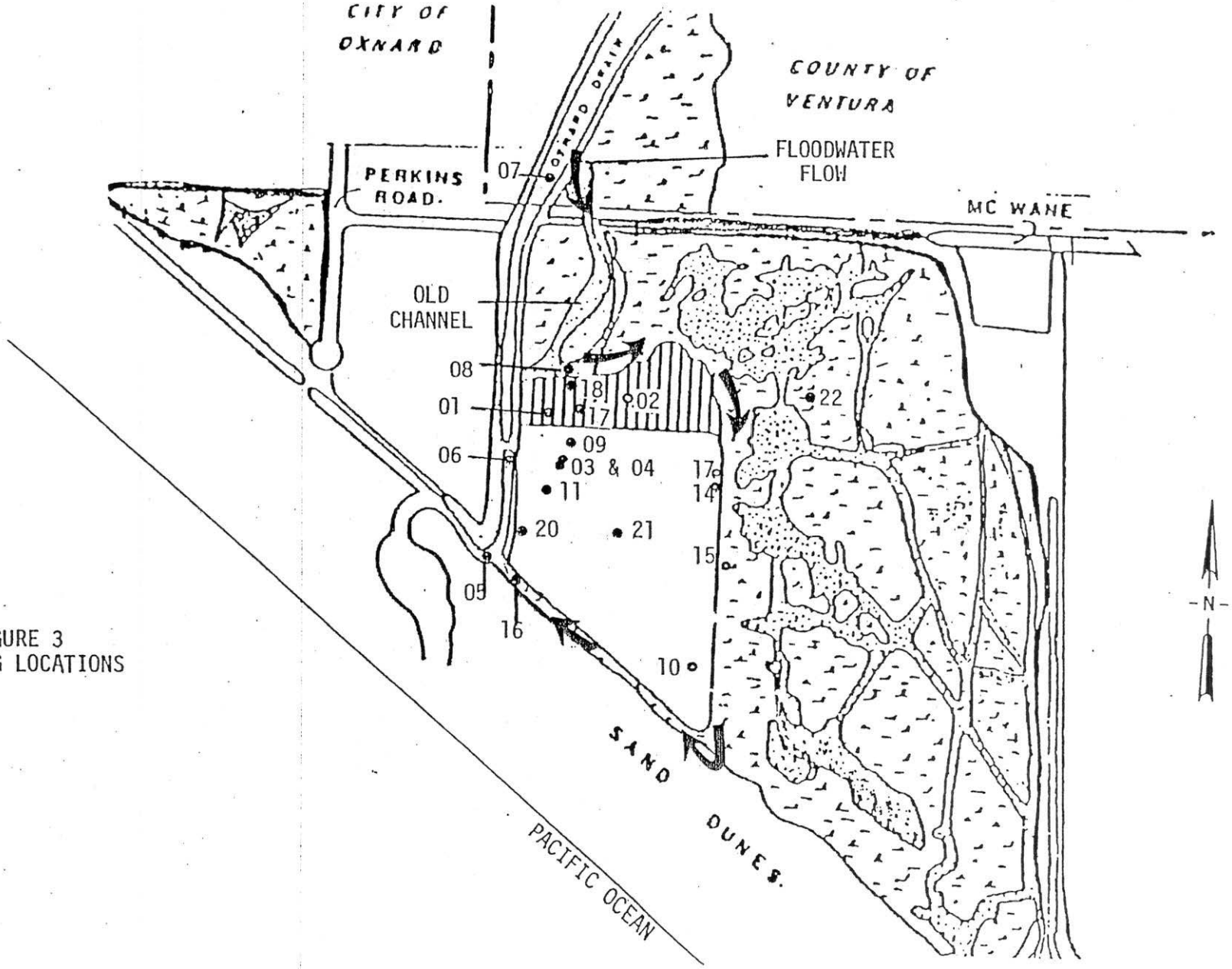


FIGURE 3
SAMPLING LOCATIONS

Appendix H.5
EPA Ecology & Environment, Inc.
Site Inspection (1991)

0475

ecology and environment, inc.
160 SPEAR STREET, SAN FRANCISCO, CALIFORNIA 94105, TEL. 415/777-2811
International Specialists in the Environment

MEMORANDUM

TO: Carolyn Douglass
Lisa Nelson, EPA Region IX

FROM: James M. James, Ecology and Environment, Inc. JMJ

DATE: August 7, 1992

SUBJECT: Completed Work, Work Assignment No. 20-18-9J00

CC: Wenona Garside, EPA Contract Officer
Rob Stern, EPA Project Officer

Attached is the following completed:

PA____ SI____ EPI PA____ PA Review____ SI Review____

NPL Prioritization____ SWIFT PA____ SWIFT SI____

Other ESI Summary Report

Site Name: Halaco Engineering Company

EPA ID #: CAD009688052 (1242)

City, County: Oxnard, Ventura County

Latitude: 34°8'26" Longitude: 119°10'40"

State Recommendation:
(for Reviews only)

FOR EPA USE ONLY

CERCLIS Lead: ESI complete 8/7/92 cjd hwrons 8/10/92

kj/hec/cwm-trans

recycled paper

Table 2

SUMMARY OF ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

Halaco Engineering Company
September 10 - 13, 1991
(in $\mu g/L$)

Analyte	Settling Pond	East Wetlands		Oxnard Industrial Drain				Off-site	
	P-1	P-4	P-5	P-23	P-24	P-21	P-25	P-22	CRDL
Aluminum	5,000,000E	15,600L	23,300	510L	130U	811L	130U	14,000	200
Barium	2,690L	722L	1,150L	24.5L	35.3L	38.4L	30.7L	130L	200
Copper	113,000	500U	1,420L	50.0U	50.0U	50.0U	50.0U	22.7L	25.0
Manganese	--	4,850	6,710	49.8L	72.2L	77.2L	112L	492	15.0
Silver	200U	200U	212L	20.0U	20.0U	20.0U	20.0U	2.0U	10.0
Zinc	--	593L	1,090L	20.4L	20.0U	20.0U	20.0U	64.4	20.0
Ammonia (mg/L)	415	1,220	848	0.052	0.058	0.037	0.038	0.046	0.030

E = A precipitate, high in aluminum, formed during sample digestion. This result should be regarded as an estimate of the minimum concentration at which the analyte is present.

L = Result is above the Method Detection Limit, but below the Contract Required Detection Limit (CRDL). Samples P-1, P-4 and P-5 were diluted by a factor of 100. Samples P-21, P-23, P-24, and P-25 were diluted by a factor of 10.

U = Analyte was undetected at the given concentration.

kj/halaco/t2

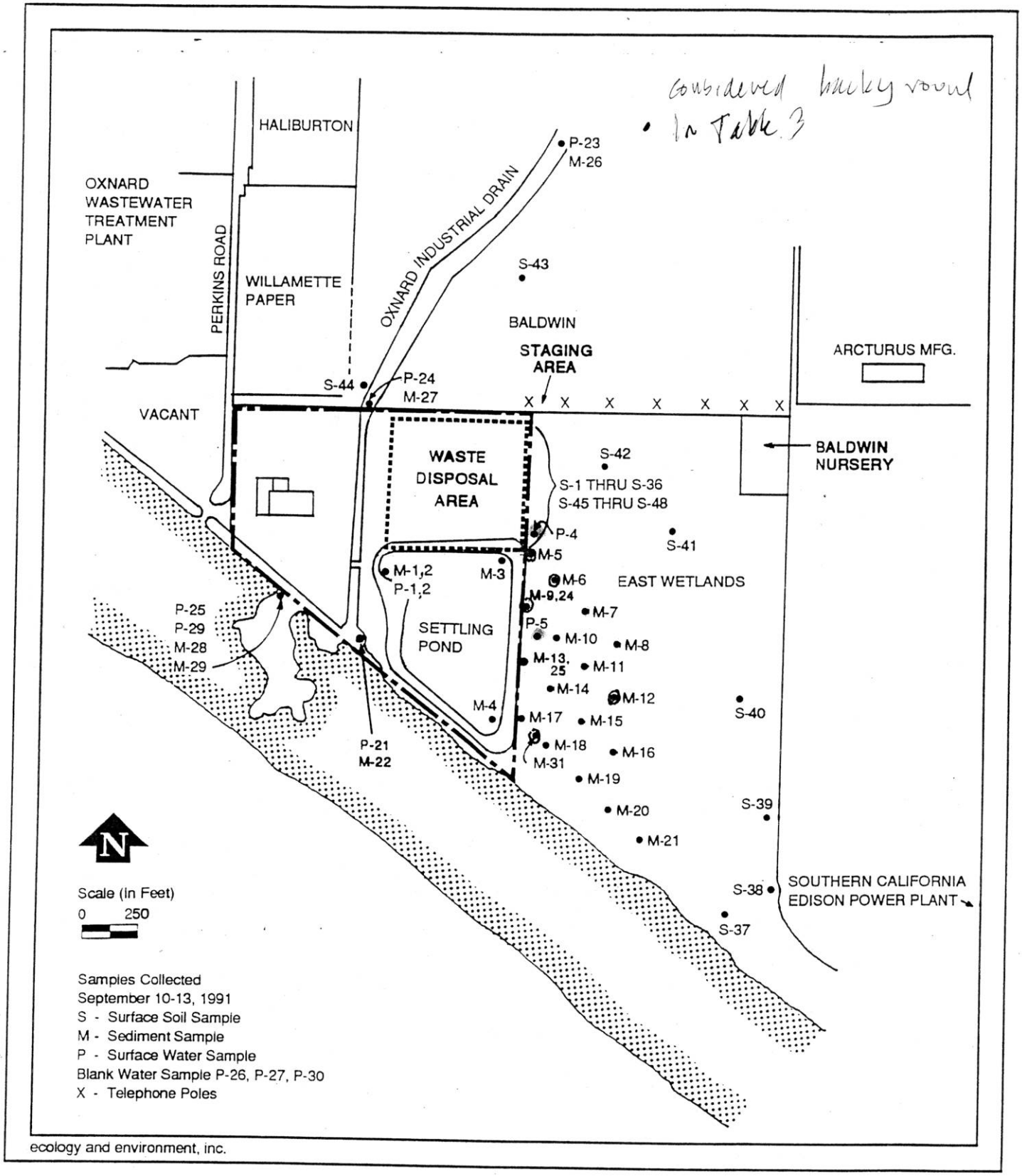


Figure 2

LSI SAMPLE LOCATIONS MAP
HALACO ENGINEERING CO.
OXNARD, CA

Appendix H.6
RWQCB Site Inspections (1998, 1999)

RWQCB Site Inspection Surface Water Chemistry Data, 1998 and 1999
Halaco Site, Oxnard, California

			August 14, 1998				August 19, 1999						
				Surface Water				Seep			Surface Water		
Paramter		Units	Wastewater Effluent	OID North	OID Middle	OID South	Wastewater Effluent	WET-1 South	WET-2 Middle	WET-3 North	OID-3 North	OID-2 Middle	OID-1 South
General Chemistry	EC	mg/L	8,430	3,120	3,070	3,420	8,880	3,460	2,730	3,860	2,800	2,840	2,890
	TDS	mg/L	25,900	3,190	3,160	3,520	60,700	23,000	40,000	20,200	3,110	3,180	3,300
	pH	mg/L	8.5	7.9	7.5	7.5	9.0	8.0	7.9	8.2	7.4	7.4	7.6
	Hardness	mg/L	4,600	1,440	1,400	1,460	1,080	5,000	9,000	4,700	1,250	1,250	1,250
	Calcium	mg/L	209	324	294	315	278	850	1,320	773	250	264	254
	Magnesium	mg/L	950	140	150	158	106	650	1,330	571	137	138	142
	Sodium	mg/L	7,820	518	480	602	4,640	3,360	4,280	2,600	351	491	558
	Potassium	mg/L	680	19	20	28	14,900	3,440	6,080	2,710	50	55	58
	Iron	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Manganese	mg/L	0.18	<0.03	<0.03	<0.03	0.03	0.1	6.7	0.14	0.06	0.05	0.04
	Total Alkalinity	mg/L	169	255	217	223	635	120	76	135	179	177	170
	Bicarbonate	mg/L	173	312	265	272	77	146	93	165	218	216	207
	Carbonate	mg/L	16	<1	<1	<1	343	<1	<1	<1	<1	<1	<1
	Hyroxide	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Chloride	mg/L	14,100	596	576	769	34,800	12,200	24,100	11,000	814	854	913
	Sulfate	mg/L	2,000	1,280	1,300	1,290	787	1,730	888	1,770	1,070	1,060	1,100
	Fluoride	mg/L	25	0.9	0.9	0.9	18.5	2.6	4.8	2.4	0.7	0.7	0.7
Nitrogen	Nitrate	mg/L	16	110	108	105	1	4.3	14.1	1.6	4.4	4.3	4.1
	Ammonia	mg/L	52.8	0.2	0.5	1	460	89.4	268	80.8	1.7	1.1	1.3
	Nitrite	mg/L	<0.03	0.1	<0.03	0.05	<0.03	0.4	0.4	<0.03	0.2	0.1	0.2
	Organic	mg/L	1.2	0.5	0.3	0.2	6	17	16	7.5	0.6	1.3	1.2
Metals	Barium	ug/L	265	56	54	106	1,090	542	1,020	489	73	145	80
	Silver	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Chromium	ug/L	<10	<10	<10	<10	<10	10	<10	<10	<10	<10	<10
	Arsenic	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Mercury	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Lead	ug/L	1458	<10	<10	<10	<10	<10	380	35	<10	<10	<10
	Selenium	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	Cadmium	ug/L	<1	<1	<1	<1	<1	<1	13	3	<1	<1	<1
	Nickel	ug/L	219	<20	<20	<20	<20	<20	103	43	<20	<20	<20
	Zinc	ug/L	323	<50	<50	<50	426	202	2,850	907	91	88	84
	Copper	ug/L	956	<10	<10	<10	350	230	1,810	830	<10	<10	<10
	Aluminum	ug/L	78,000	192	172	161	13,500	2,200	17,000	18,800	54	360	106
Radio-nuclides	K-40	pCi/L	not analyzed				10,610	not analyzed			44.7	25.9	55.0
	U-238	pCi/L					0.657				4.54	4.96	4.77
	U-235	pCi/L					<0.026				0.187	0.173	0.195
	U-234	pCi/L					0.658				4.75	5.56	5.42
	Th-232	pCi/L					<0.098				<0.016	<0.021	0.012
	Th-228	pCi/L					<0.792				<0.034	<0.044	<0.042
	Th-230	pCi/L					0.684				0.05	0.075	0.091
	Gross Alpha	pCi/L					n/a				9.63	8.03	6.44
	Gross Beta	pCi/L					n/a				43.6	55.1	33.35

Note:
< = Not detected at less than the indicated detection limit.

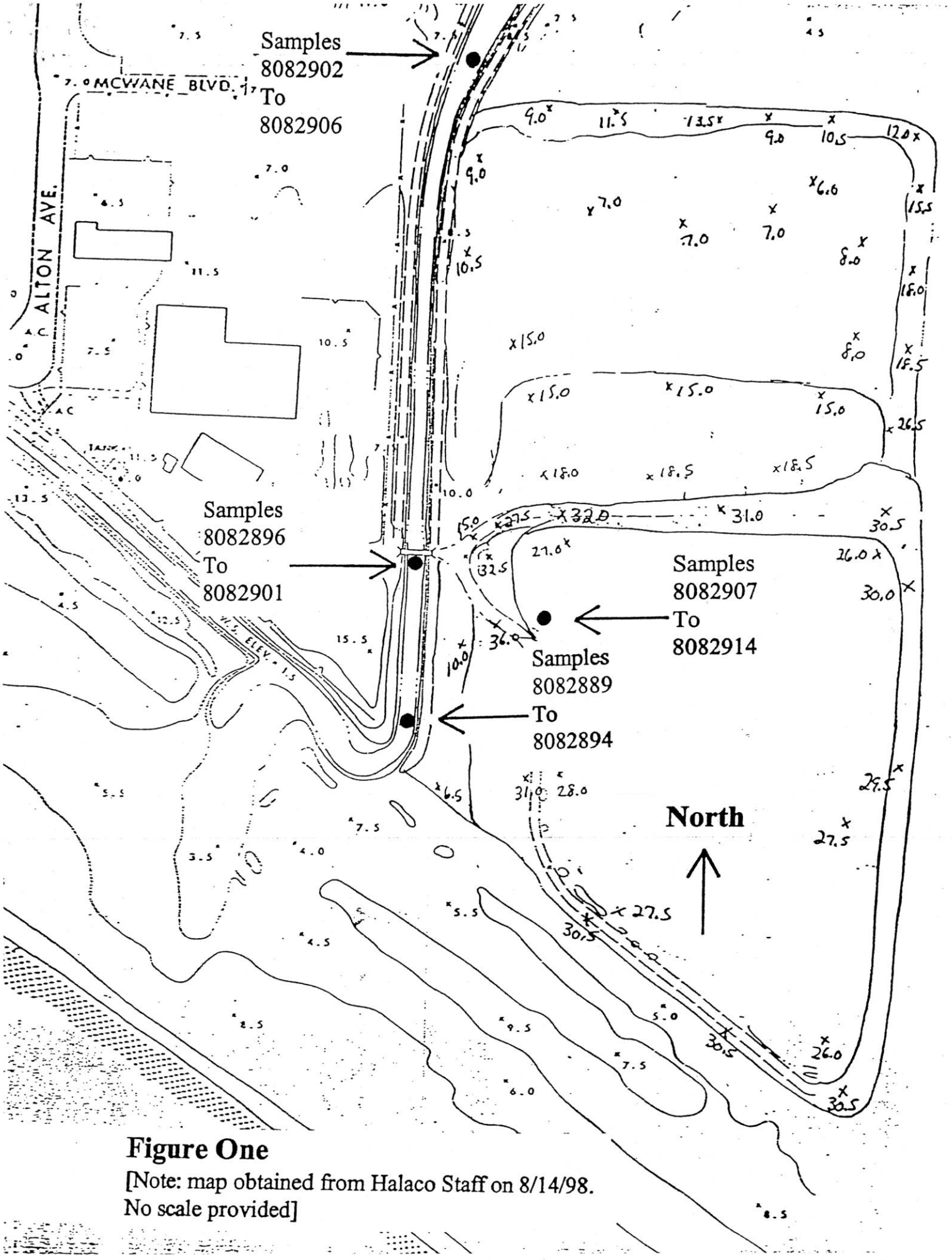
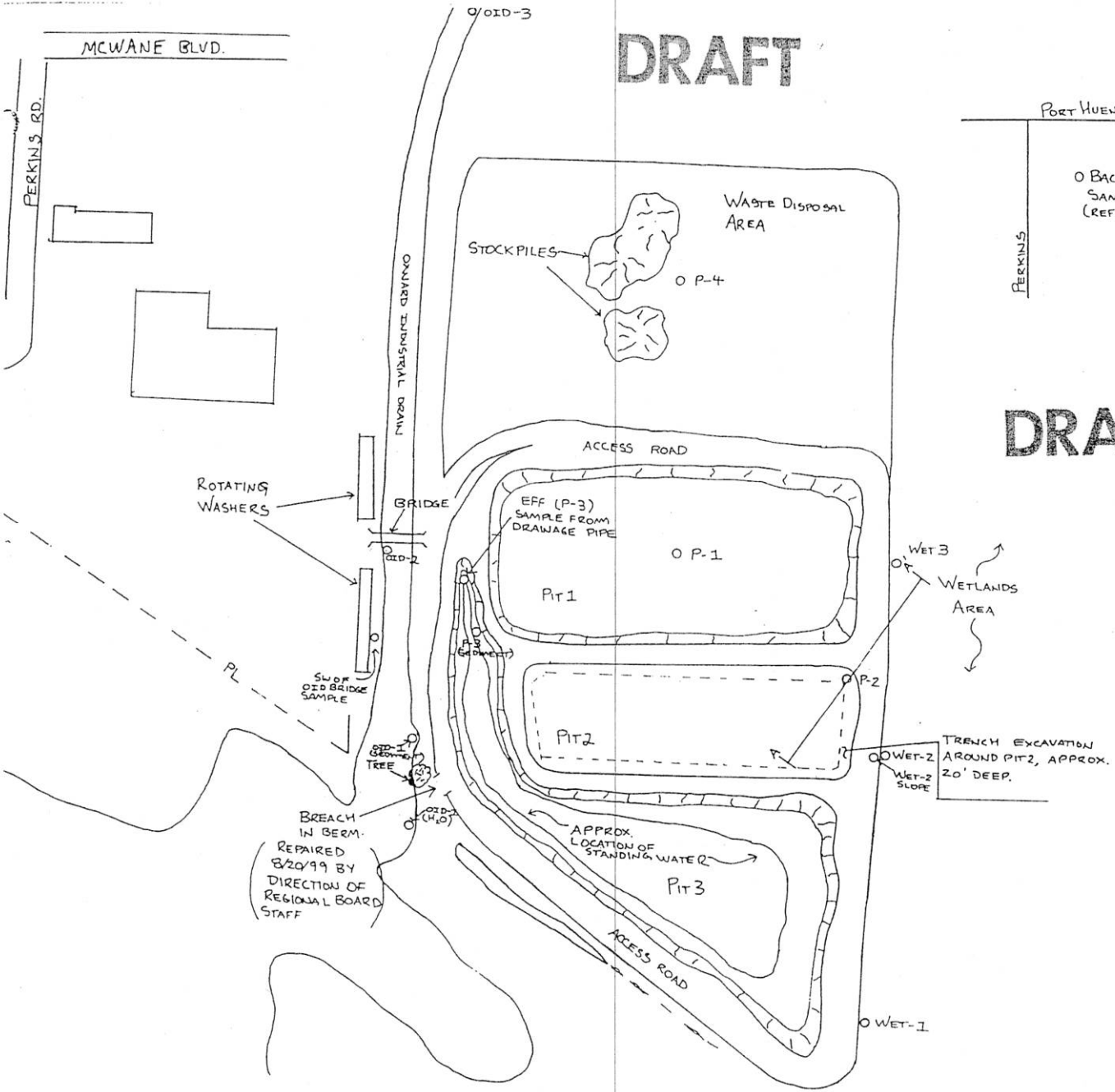
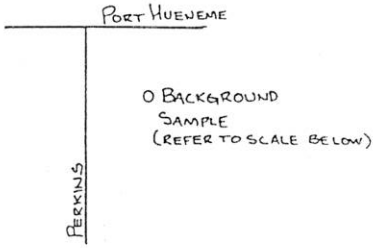


Figure One

[Note: map obtained from Halaco Staff on 8/14/98.
No scale provided]





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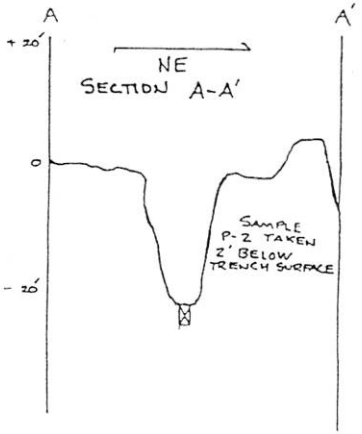


NOTES:

1.) DATUM IS REFERENCED TO PIT-2 SURFACE OF 0' AND NOT ACTUAL GROUND ELEVATION

2.) VERTICAL SCALE IS NOT EQUAL TO HORIZONTAL SCALE

HALACO ENGINEERING
6200 PERKINS RD.
OXNARD

NOTES:

1.) SAMPLES COLLECTED 8/19/99 BY RWQCB (RB-4) AND DHS STAFF

DRAWN BY: MP

CHECKED BY: RV

0' — 200'

Appendix H.7
EPA Site-wide Integrated Assessment (2006)

Integrated Assessment
Halaco Engineering Company
Oxnard, California
Ventura County

EPA ID No.: CAD009688052
USACE Contract No.: W91238-05-F-0052
Work Order No.: 12767.062.317

January 10, 2007

Prepared for:
U.S. Environmental Protection Agency
Region 9

Prepared by:
Ben Castellana, Ph.D.
Weston Solutions, Inc.

Sherman Oaks, CA

Table 3-5: Metals Data - Water Matrix (in ug/L)

Sample ID	Aluminum		Antinomy		Arsenic		Barium		Beryllium		Cadmium		Chromium		Cobalt		Copper		Iron		Lead		Magnesium		Manganese		Nickel		Silver		Vanadium		Zinc	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Surface Water Samples																																		
WS7	20	J	60	U	4.7	J	42.3	J	0.09	J	5	U	10	U	50	U	5.7	J	84.9	J	10	U	215000		110		3.6	J	10	U	0.82	J	5.1	J
WS8	22.8	J	6.2	J	10	U	37.1	J	0.08	J	5	U	10	U	50	U	5.5	J	102		10	U	167000		109		4.5	J	10	U	0.63	J	8	J
WS9	47	J	60	U	8	J	33.6	J	0.08	J	5	U	10	U	50	U	5.3	J	192		10	U	141000		118		3.9	J	10	U	1.1	J	13.1	J
WS10	19.3	J	60	U	5.9	J	34.3	J	0.06	J	5	U	10	U	50	U	5.2	J	141		10	U	140000		154		4.2	J	10	U	1.6	J	11.8	J
3x Bkgd	**141**		**-**		**30**		**126.9**		**0.27**		**-**		**-**	**-**	**-**		**17.1**		**576**		**-**		**645000**		**462**		**13.5**		**-**		**4.8**		**39.3**	
WS1	**417**		60	U	5.1	J	41.9	J	0.21	J	5	U	10	U	50	U	19.4	J	305		10	U	148000		148		4.9	J	10	U	1.8	J	47.5	J
WS2	148	J	60	U	5.5	J	142	J	5	U	0.36	J	10	U	50	U	**45.3**		147		10	U	343000		297		3	J	10	U	50	U	32.1	J
WS3	**425**		60	U	10	U	153	J	0.21	J	0.41	J	10	U	50	U	**67.1**		175		10	U	314000		**1100**		3.5	J	10	U	50	U	44	J
WS4	61.4	J	60	U	10	U	36.5	J	0.07	J	5	U	10	U	50	U	5.5	J	127		10	U	153000		128		3.9	J	10	U	0.83	J	12.6	J
WS5	46.2	J	60	U	10	U	33.3	J	0.1	J	5	U	10	U	50	U	5.3	J	129		10	U	133000		131		4.4	J	10	U	1.2	J	12.3	J
WS6	**534**		60	U	6.9	J	59.4	J	0.25	J	5	U	10	U	50	U	15.9	J	355		10	U	160000		98.8		5.2	J	10	U	1.5	J	33.8	J
Groundwater Samples																																		
MCL			**6**		**10**		**2000**		**4**		**5**		**100**				**1300**				**15**													
MW-5	1440		60	U	10	U	105	J	0.15	J	0.92	J	13.5		50	U	43.4		945		10	U	385000		237		6	J	10	U	3.3	J	45.7	J
3xbkgd	**4320**		**-**		**-**		**315**		**0.45**		**2.76**		**40.5**		**-**		**130.2**		**2835**		**-**		**1155000**		**711**		**18**		**-**		**9.9**		**137.1**	
MW-1	2380		60	U	10	U	**417**		0.2	J	5	U	3.1	J	50	U	9.3	J	**4430**		10	U	191000		567		13.4	J	10	U	6.6	J	40.8	J
MW-2	1240		9.2	J	6.5	J	**665**		0.07	J	0.92	J	10	U	1.6	J	73.4		1080		10	U	1470000		**4500**		8.1	J	10	U	3.3	J	63.5	
MW-4	**6200**		60	U	10	U	126	J	0.47	J	5	U	0.73	J	1.2	J	15.8	J	**4560**		10	U	298000		400		9	J	10	U	9.3	J	29.3	J
MW-6	1710		60	U	6.5	J	**5400**		0.15	J	0.59	J	0.73	J	2.5	J	19.1	J	1560		10	U	186000		**728**		3.5	J	10	U	2.8	J	51.4	J
MW-11	1010		60	U	7.3	J	110	J	0.15	J	5	U	10	U	1.9	J	59.3		**26800**		**61.8**		425000		**1250**		15	J	10	U	1.8	J	**318**	
MW-12	1200		60	U	7.1	J	**1570000**		0.16	J	**10.3**		10	U	**281**		**147**		692		10	U	**2700000**		**1150**		6.7	J	8.4	J	2.6	J	95.2	
MW-13	671		60	U	10	U	147	J	5	U	5	U	10	U	50	U	19.2	J	**4310**		**35.9**		296000		465		5.4	J	10	U	1.3	J	70.1	
MW-14	**9240**		60	U	4.5	J	249		0.57	J	5	U	13.7		4	J	82.3		16200		**18.8**		179000		**1390**		15.3	J	10	U	25.8	J	245	
MW-15	2660		60	U	10	U	141	J	0.17	J	5	U	3.7	J	1.2	J	3.6	J	**8130**		10	U	100000		**805**		3.9	J	10	U	7.8	J	29.9	J
MW-16	41800	J-	60	U	40.8	J-	570	J-	1.7	J	0.95	J	41.2	J-	11.1	J-	148	J-	70500	J-	10	U	524000	J-	6610	J-	31.7	J-	10	U	92.2	J-	200	J-
MW-17	12500	J	18.7	J	10	U	896	J	22.7	J	398	J	159	J	63.6	J	8630	J	117000	J	4350	J	11100000	J	328000	J	107	J	56	J	50	U	90100	J
MW-18	2920000	J-	60	U	264	J-	5030	J-	355	J-	135	J-	3810	J-	307	J-	77700	J-	1040000	J-	2790	J-	4110000	J-	98600	J-	1610	J-	571	J-	1490	J-	51500	J-
MW-19	1190		60	U	5.5	J	**2020**		0.12	J	5	U	10	U	50	U	8.8	J	1050		10	U	718000		**2510**		40	U	10	U	2.1	J	15.7	J

Notes:

Laboratory Metals Data by EPA Method 6010 or CLP Method CLPAS ILM05.2.

ug/L = micrograms per liter.

Q = Data qualifier

J = Analyte detected, result is approximate.

U = Analyte not detected; reported value is the method detection limit

Bkgd - background; samples and calculations are in yellow highlight.

3xBkgd = Three times the highest background value for analyte.

ND = analyte was not detected in background; any detect in downgradient sample is considered significant.

J- = Result is estimated, biased low due to sample preservation

Boldface = Results exceed 3x background; approximated (J-flagged results are not boldfaced, even when low-biased results exceed 3x background.

Table 3-6 Radionuclide Data - Water Matrix (in pCi/L)											
		^{137}Cs		^{40}K		^{228}Th		^{230}Th		^{232}Th	
		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Groundwater											
MW5-270606-1750	Bkgd	3.6	U	660		0.557	U	0.433	U	0.443	U
3x Bkgd		**-**		**1980**		**-**		**-**		**-**	
MW11-280606-1647		3.44	U	659		0.344	U	0.246	U	0.268	U
MW12-280606-1550		18.7	U	**19800**		**105**		**0.995**		**0.424**	
MW1-270606-1810		5.9	U	**3560**		0.496	U	0.621	U	0.3171	U
MW13-280606-1738		4.08	U	862		0.329	U	0.291	U	0.236	U
MW14-280606-1500		3.33	U	129		**0.754**		**1.39**		**0.872**	
MW15-280606-1822		5.04	U	52.7	U	**1.41**		**0.988**		**0.48**	
MW16-280606-0925		5.2	U	**5540**		**1.05**		**0.61**		**0.27**	
MW18-290606-0930		4.9	U	**6710**		0.48	U	0.276	U	0.212	U
MW19-280606-1030		4.83	U	**7370**		0.611	U	0.351	U	0.205	U
MW2A-280606-0758		5	U	**7390**		0.695		0.345		0.278	U
MW4-270606-1830		3.98	U	143		**0.686**		**0.806**		**0.694**	
MW6-270606-1735		3.99	U	**6840**		1.34		2.17		0.549	U
Surface Water											
WS7-280606-1540	Bkgd	3.24	U	24.8	U	0.67	U	0.329	U	0.239	U
WS8-280606-1600	Bkgd	2.71	U	45.5		0.697	U	0.195	U	0.279	U
WS9-280606-1615	Bkgd	2.84	U	42.5		1.22	U	0.637	U	0.682	U
WS10-280606-1630	Bkgd	3.3	U	27	U	0.391	U	0.197	U	0.259	U
3x Bkgd		**-**		**136.5**		**-**		**-**		**-**	
WS1-270606-1245		2.81	U	44.8	U	1.372	U	0.902	U	0.608	U
WS2-270606-1440		3.06	U	**264**		0.815	U	0.642	U	0.552	U
WS3-280606-0952		3.12	U	**198**		0.765	U	0.419	U	0.396	U
WS4-280606-0958		3.15	U	81		0.753	U	0.424	U	0.407	U
WS5-280606-1016		3.56	U	51.6	U	0.518	U	0.68	U	0.68	U
WS6-290606-0815		2.99	U	53.9	U	0.761	U	0.408	U	0.313	U

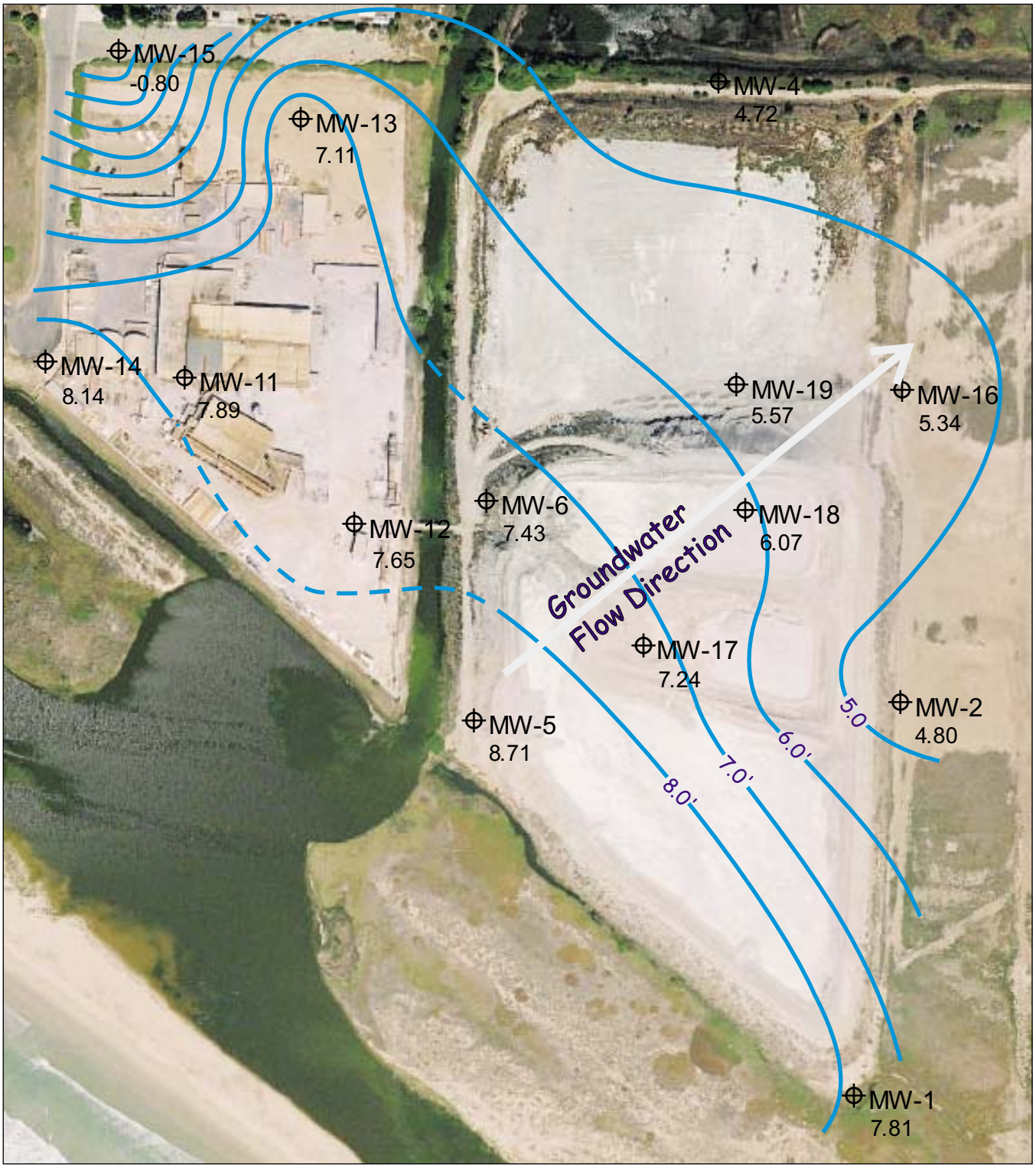
Notes:

pCi/L = PicoCuries per Liter
Bkgd = background sample
^{137}Cs = Cesium-137 isotope
^{40}K = Potassium-40 isotope
^{228}Th = Thorium-228 isotope
^{230}Th = Thorium-230 isotope
^{232}Th = Thorium-232 isotope
WMU = Waste Management Unit
OID = Oxnard Industrial Drain
U = Analyte not detected; result is the method detection limit.
Q = Data Qualifier
Boldface = results that exceed 3 times background where analyte is detected in background. Because of the large number of non-detected analytes in the background samples, the normal 2 standard deviations above the background population for each matrix could not be applied. Results in downgradient samples are, instead compared to 3 times the highest reported background, or detected results where the analyte is not detected in background (denoted by a "-" in the "3x Bkgd" row).

Table 3-7: Detectable Volatile Organic Compounds (VOC) Data - Water Matrix

Sample ID Prefix	Background	Chloromethane		Acetone		Methyl tert-butyl ether (MTBE)		2-Butanone		Benzene	
Surface Water Samples		Results (ug/L)	Q	Results (ug/L)	Q	Results (ug/L)	Q	Results (ug/L)	Q	Results (ug/L)	Q
WS7	bkgd	0.50	U	5.4	J	0.50	U	5.0	U	0.50	U
WS8	bkgd	0.50	U	8.0	J	0.50	U	5.0	U	0.50	U
WS9	bkgd	0.50	U	7.8	J	0.50	U	5.0	U	0.50	U
WS10	bkgd	0.50	U	8.2	J	0.51	J	5.0	U	0.50	U
3x Bkgd		-		24.6		1.53		-		-	
WS1		0.50	U	6.4	J	0.50	U	5.0	U	0.50	U
WS2		0.50	U	5.0	R	0.50	U	5.0	U	0.50	U
WS3		0.50	U	5.0	R	0.50	U	5.0	U	0.50	U
WS4		0.50	U	6.3	J	0.50	U	5.0	U	0.50	U
WS5		0.50	U	5.2	J	0.50	U	5.0	U	0.50	U
WS6		0.50	U	8.7	J	0.50	U	5.0	U	0.50	U
Groundwater Samples											
MW5	bkgd	0.50	U	5.0	R	0.50	U	5.0	U	0.50	U
3x Bkgd		-		-		-		-		-	
MW1		0.50	U	5.0	R	0.50	U	5.0	U	0.50	U
MW2A		0.50	U	18	J	0.50	U	5.0	U	0.50	U
MW4		0.50	U	6.5	J	0.50	U	5.0	U	0.50	U
MW6		**2.8**		9.8	J	0.50	U	5.0	U	0.50	U
MW11		0.50	U	5.4	J	0.50	U	5.0	U	0.50	U
MW12		0.50	U	270	J	0.50	U	5.0	U	**0.74**	
MW13		0.50	U	7.5	J	0.50	U	5.0	U	0.50	U
MW14		0.50	U	8.1	J	0.50	U	5.0	U	0.50	U
MW15		0.50	U	5.0	R	0.50	U	5.0	U	0.50	U
MW16		0.50	U	5.0	R	0.50	U	5.0	U	0.50	U
MW17		0.50	U	800	J	0.50	U	**40**		0.50	U
MW18		0.50	U	160	J	0.50	U	7.0	J	0.50	U
MW19		0.50	U	60	J	0.50	U	**12**		**0.68**	

Notes: ug/L = micrograms per Lite U = Analyte not detected; result is the method J = Analyte detected, result is approximate.
bkgd = background sample Q = Data Qualifier
R = Analyte not detected at quantifiable level; result is the laboratory reporting limit.



0 500 1000

Scale in Feet

N

MW-2
4.80

Monitoring Well Location w/elevation in feet above mean sea level.

5.0

Groundwater elevation contours interpolated from field measurements in feet above mean sea level.

Figure 3-3: Groundwater Monitoring Wells and Groundwater Gradient
Halaco Engineering, Inc. IA
Oxnard, Ventura Co. CA

0 500 1000

Scale in Feet

N

Sediment sample location (results in mg/kg)

Surface water sample location (results in ug/L)

WESTON SOLUTIONS

Figure 3-4: Surface Water Pathway

Halaco Engineering, Inc. IA
Oxnard, Ventura Co. CA

Map showing downgradient sample locations where metals data exceed three-times background.

Appendix H.8
EPA Southeast Smelter Investigation (2007)

Summary Report
Halaco Metal Recyclers

6200 Perkins Road
Oxnard, California

Prepared For:

United States Environmental Protection Agency
Region IX, Emergency Response Section
2250 Obispo Avenue, Suite 101
Signal Hill, California 90755

Prepared By:

U.S. EPA START Contractor – Team 9
3700 Industry Avenue, Suite 102
Lakewood, California 90712

May 16, 2008

Table 5-10
Halaco Metal Recyclers
Radiation Assessment - Groundwater Sample Results

Sample Name	**Region 9 PRG Residential [A]**	**3x Bkg from IA**	B1-W	B3-W	B6-W	B12-W	B3D-W	B4-W	B20-W	B9-W	B17-W
Sample date			6/11/2007	6/11/2007	6/11/2007	6/11/2007	6/11/2007	6/11/2007	6/11/2007	6/11/2007	6/11/2007
Sample location											
Rad Alpha Spec (pCi/L)											
Thorium-228	0.445	0.557 U	**2.84**	**61.1**	**63.8**	**111**	**58.8**	**70.8**	**31.7**	**142**	**18.9**
Thorium-230	0.523	0.433 U	**4.91**	**17.2**	**118**	**233**	**14.9**	**118**	**55.9**	**111**	**30.6**
Thorium-232	0.471	0.443 U	**3.21**	**7.12**	**53.6**	**148**	**7.5**	**50.2**	**27.7**	**57.0**	**16.7**
Rad Gamma Spec											
Radium-226	0.000823	--	**0.859**	**39.0**	**0.908**	**1.67**	**46.9**	**0.952**	**0.795**	**77.4**	ND
Radium-228	0.0458	--	ND	**207**	ND	ND	**239**	**4.3**	**9.68**	**206**	**2.55**

Notes

[A] U.S. EPA Region 9 Preliminary Remediation Goals (PRGs) for residential soil; October 2004
ND Analyte not detected above laboratory detection limits
pCi/L picocurrie per liter
Bolded values above site specific screening values

LEGEND

● Sample location

N

0 37.5 75 150 Feet

HALACO ENGINEERING
6200 PERKINS ROAD
OXNARD, CALIFORNIA

FIGURE 5-8
SOIL BORING LOCATIONS

TEAM 9

Y:\Projects\START\Halaco\GIS\ArcGIS\Projects\Fianl_project\5-8_SoilBoring Locations .mxd 080501 ALE

Appendix I
Supplemental Surface Water and Groundwater Chemistry Time Series Charts

Contents

I.1 OID Surface Water, Long-term Monitoring
I.2 Groundwater, Long-term Monitoring
I.3 Groundwater, Post Onsite Discharge Monitoring

Appendix I.1
OID Surface Water, Long-term Monitoring

Figure I-1
OID Surface Water - pH
Long-term Monitoring

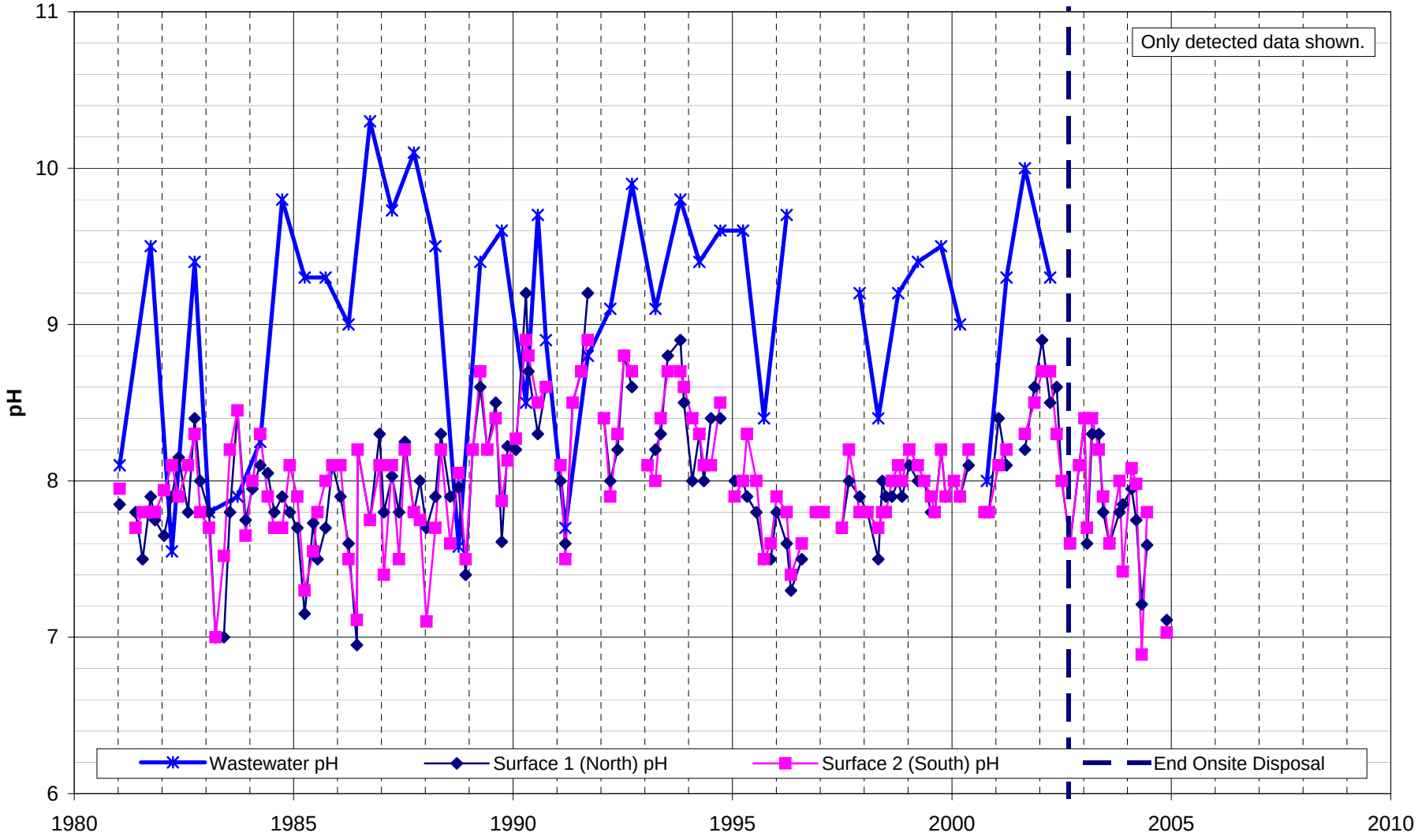


Figure I-2
OID Surface Water - Magnesium
Long-term Monitoring

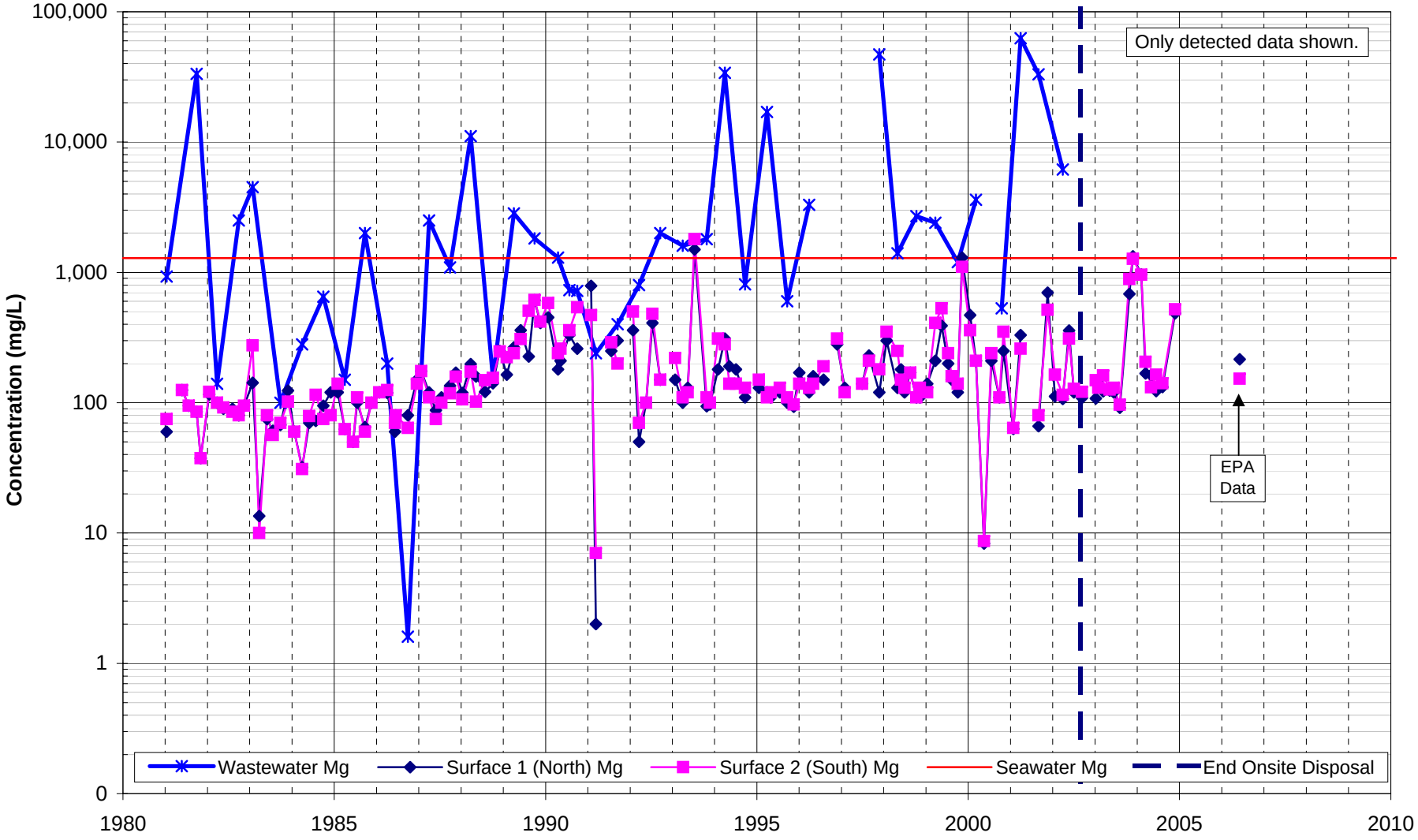


Figure I-3
OID Surface Water - Aluminum
Long-term Monitoring

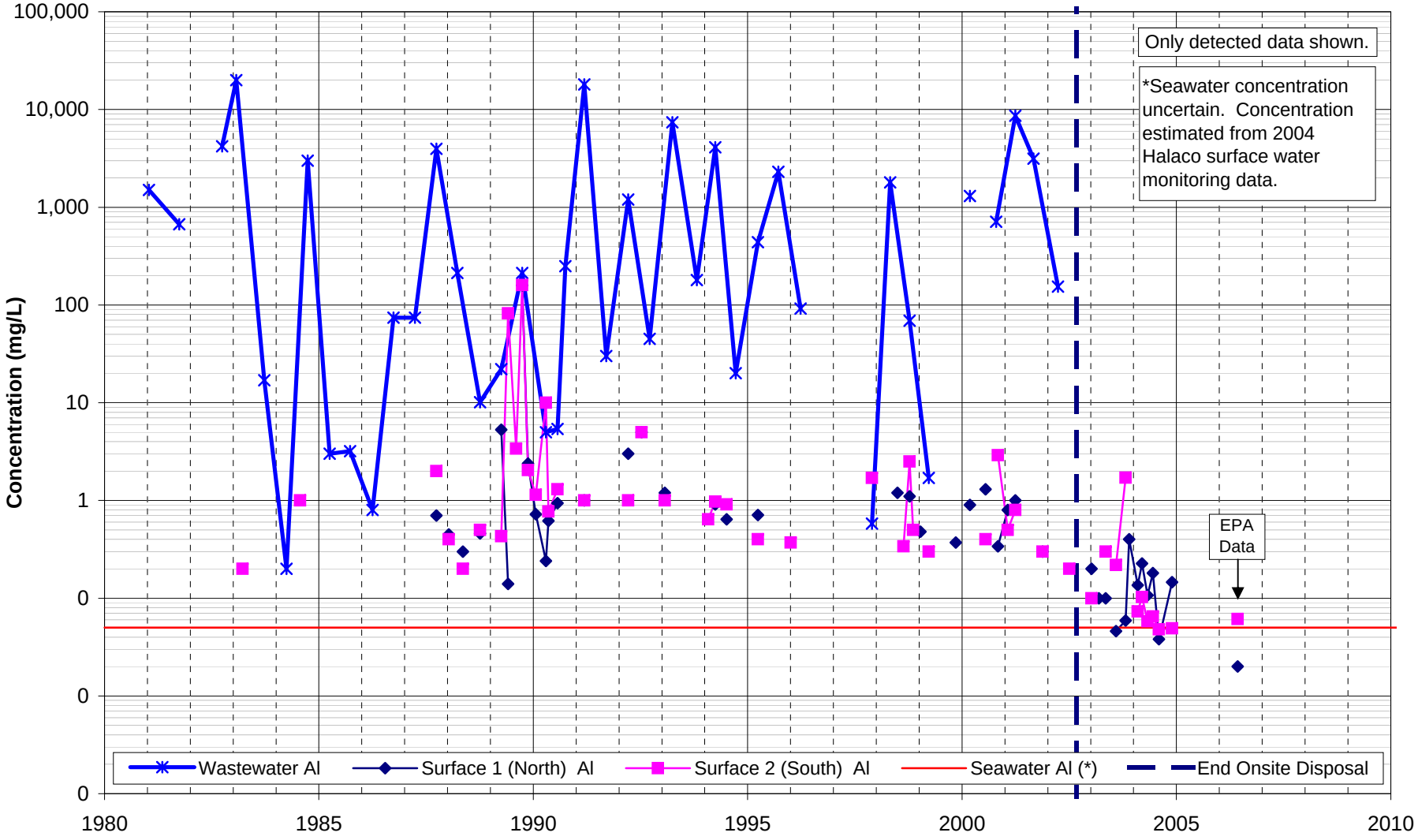


Figure I-4
OID Surface Water - Copper
Long-term Monitoring

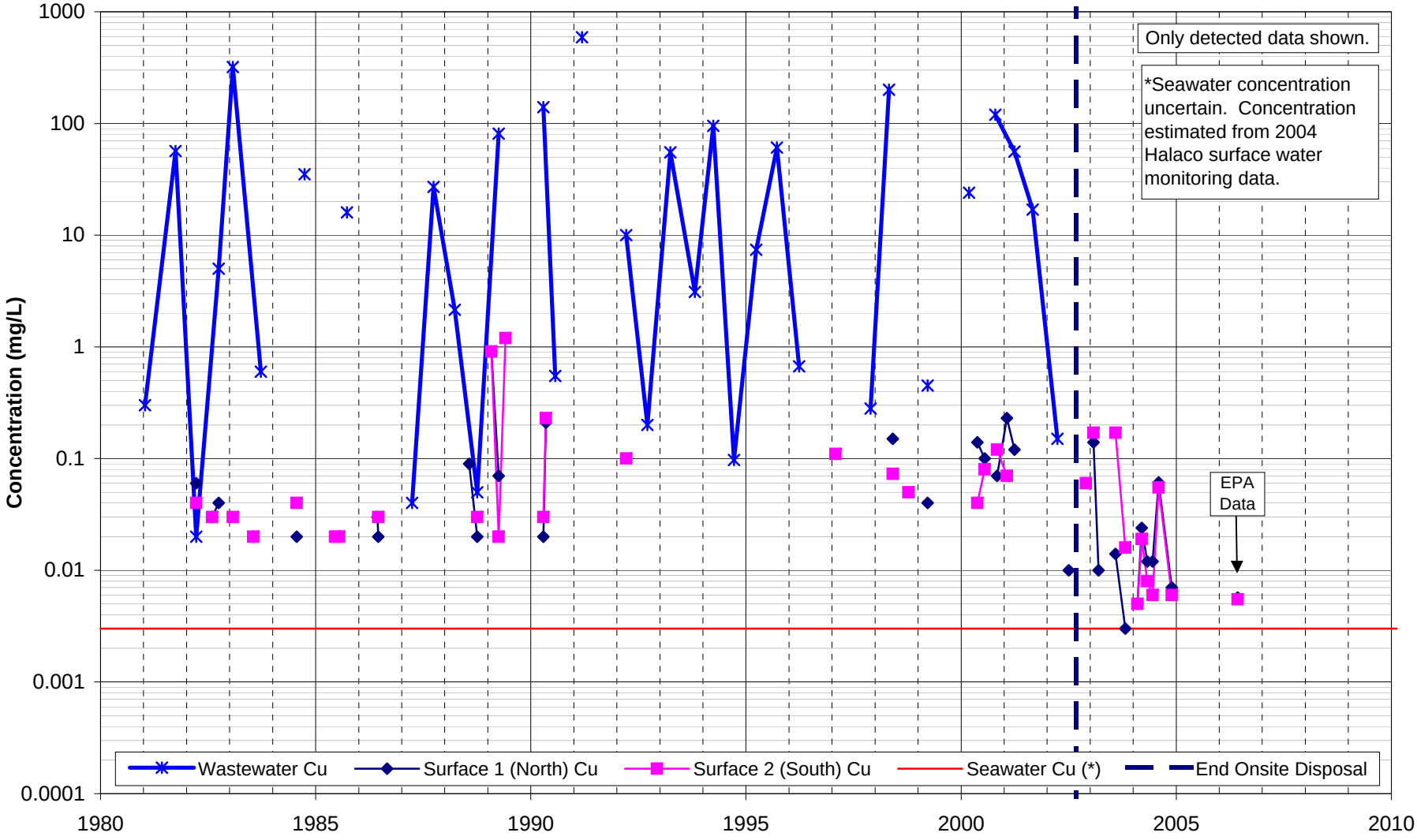
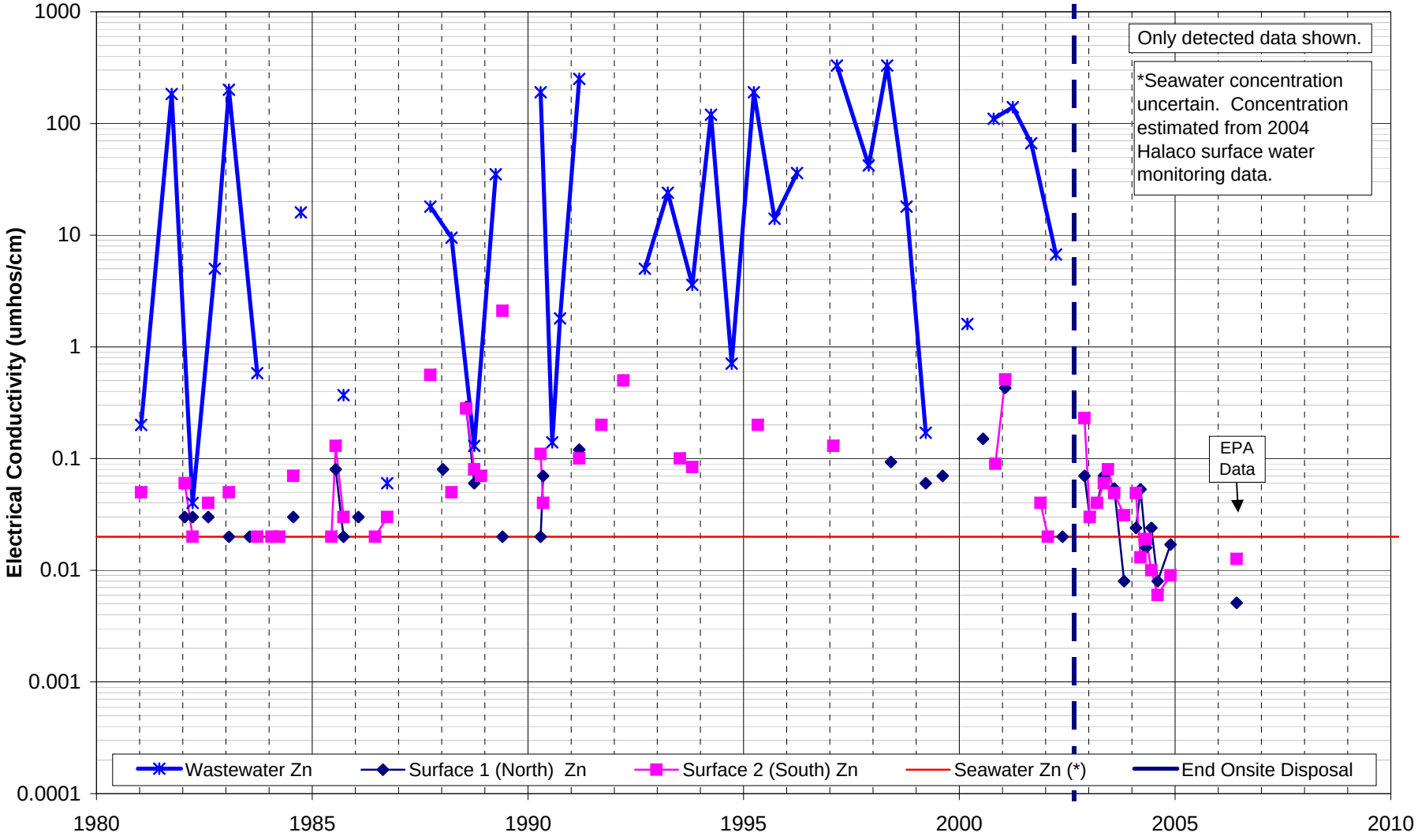


Figure I-5
OID Surface Water - Zinc
Long-term Monitoring



Appendix I.2
Groundwater, Long-term Monitoring

Figure I-6
Groundwater - pH
Long-term Monitoring

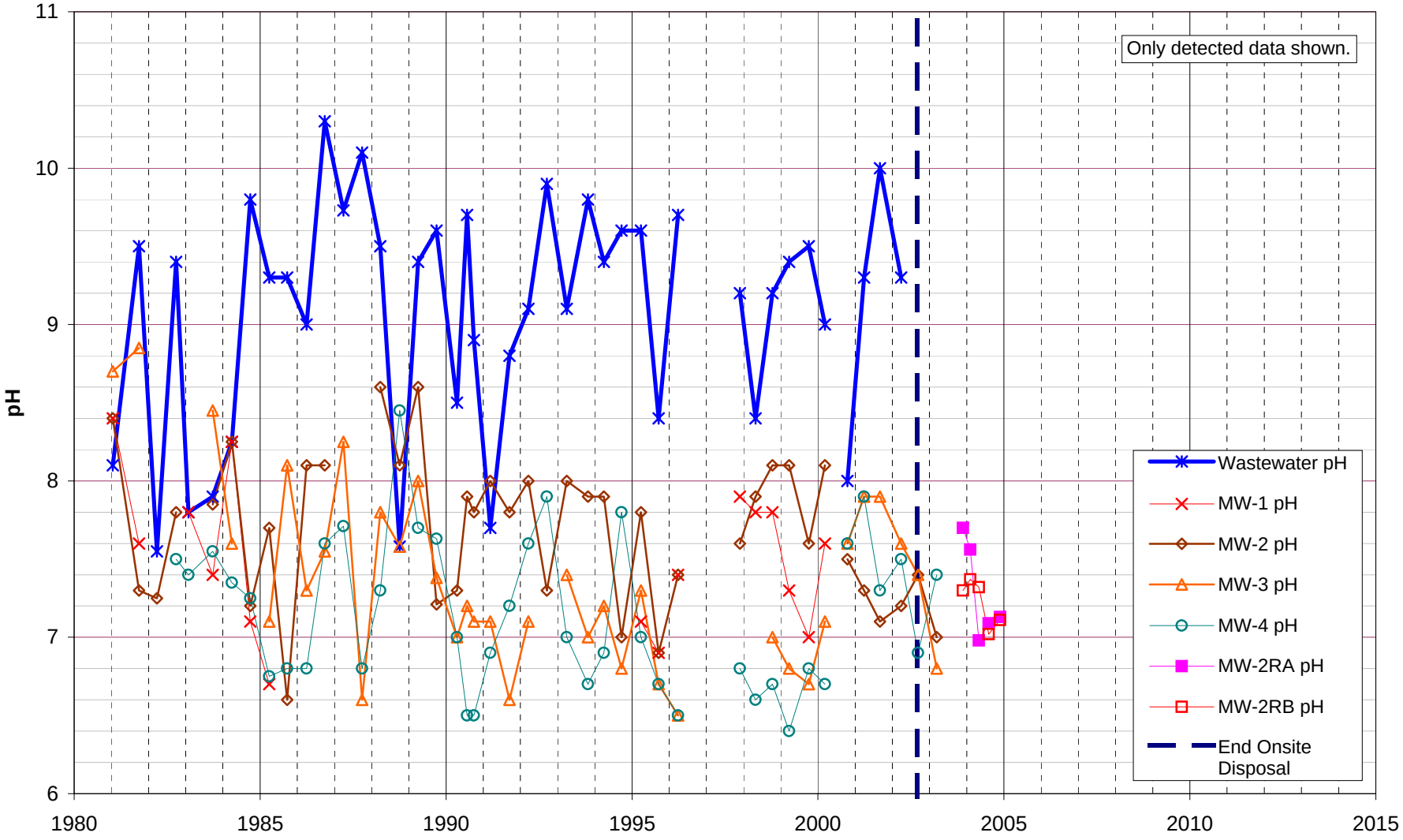


Figure I-7
Groundwater - Magnesium
Long-term Monitoring

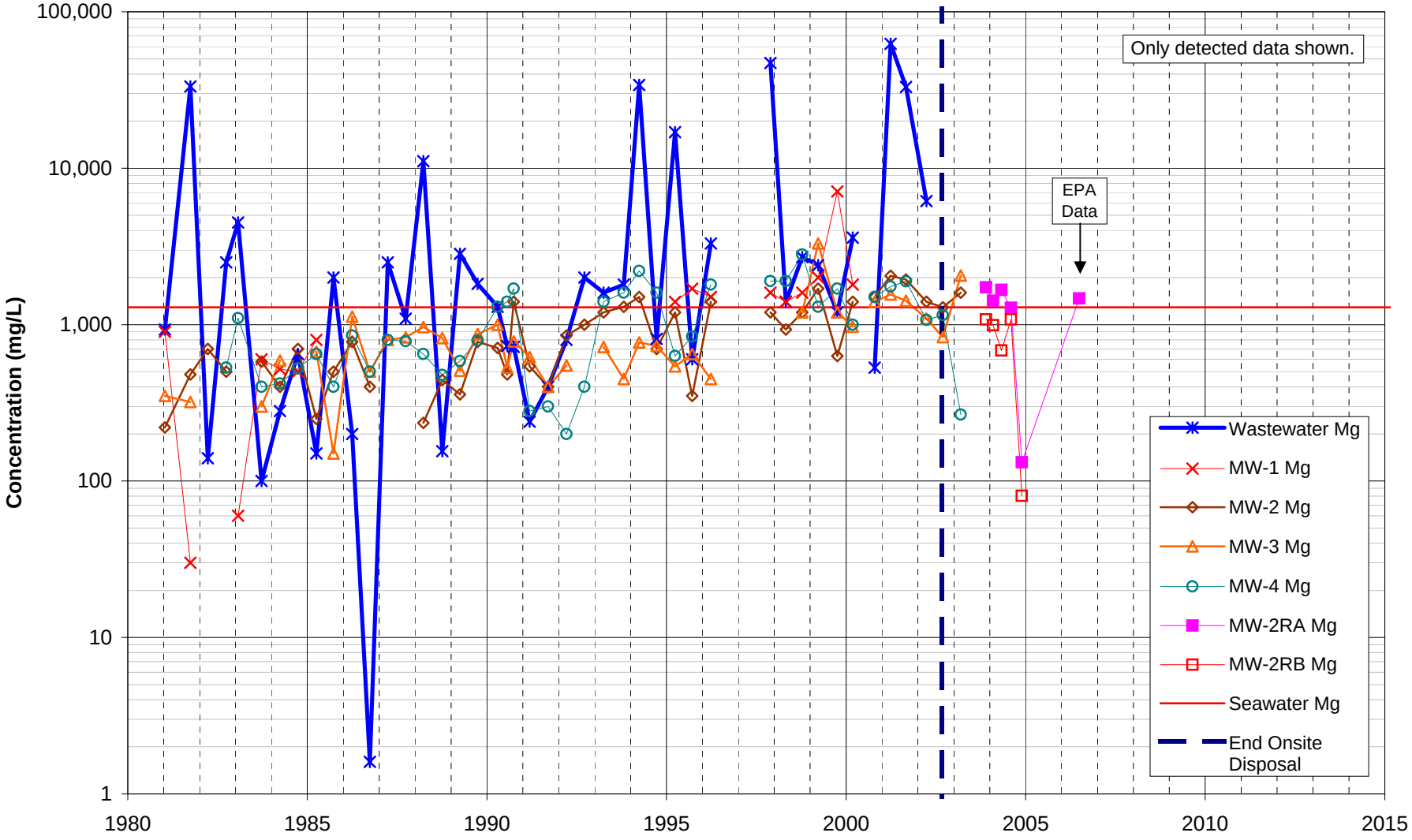


Figure I-8
Groundwater - Aluminum
Long-term Monitoring

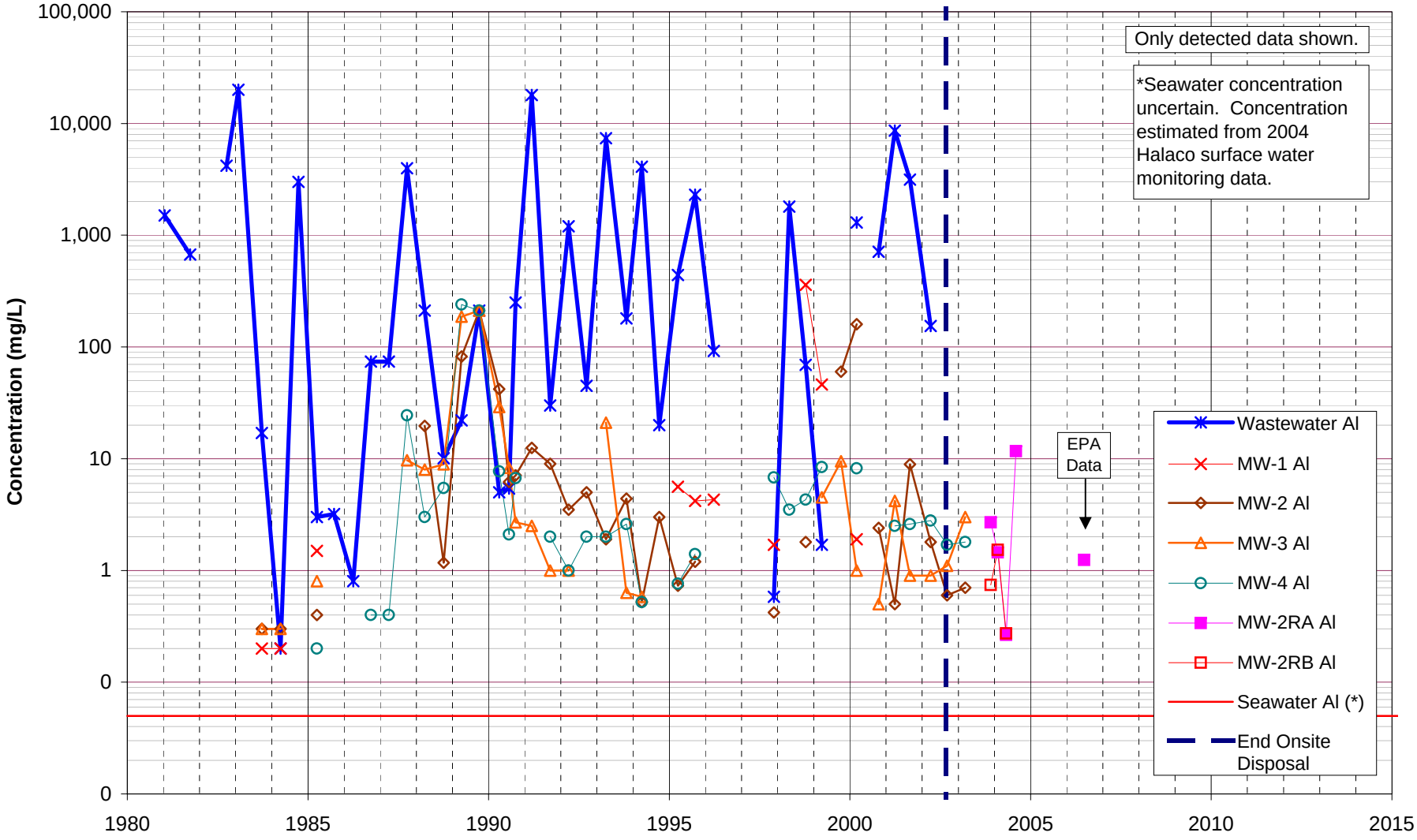


Figure I-9
Groundwater - Copper
Long-term Monitoring

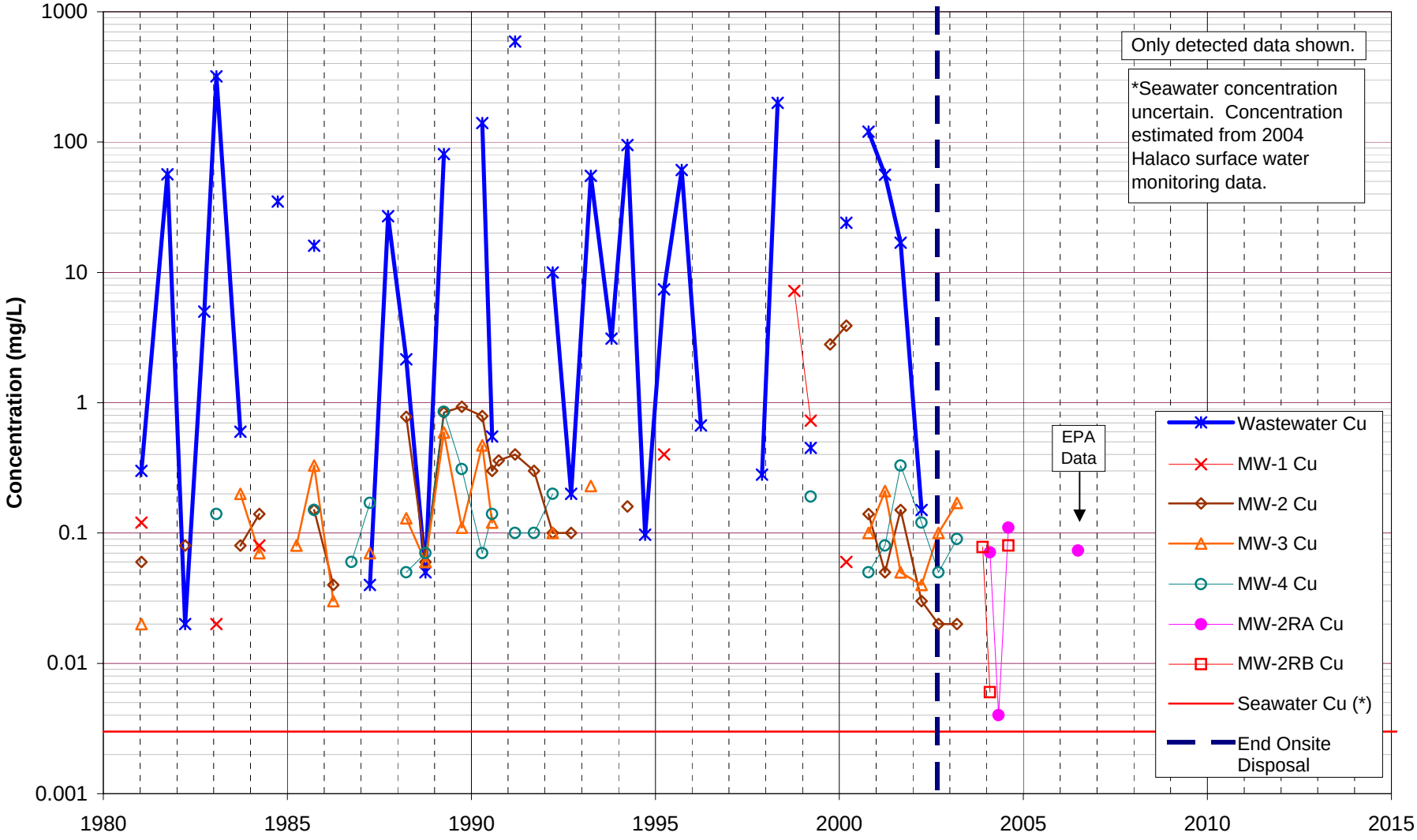
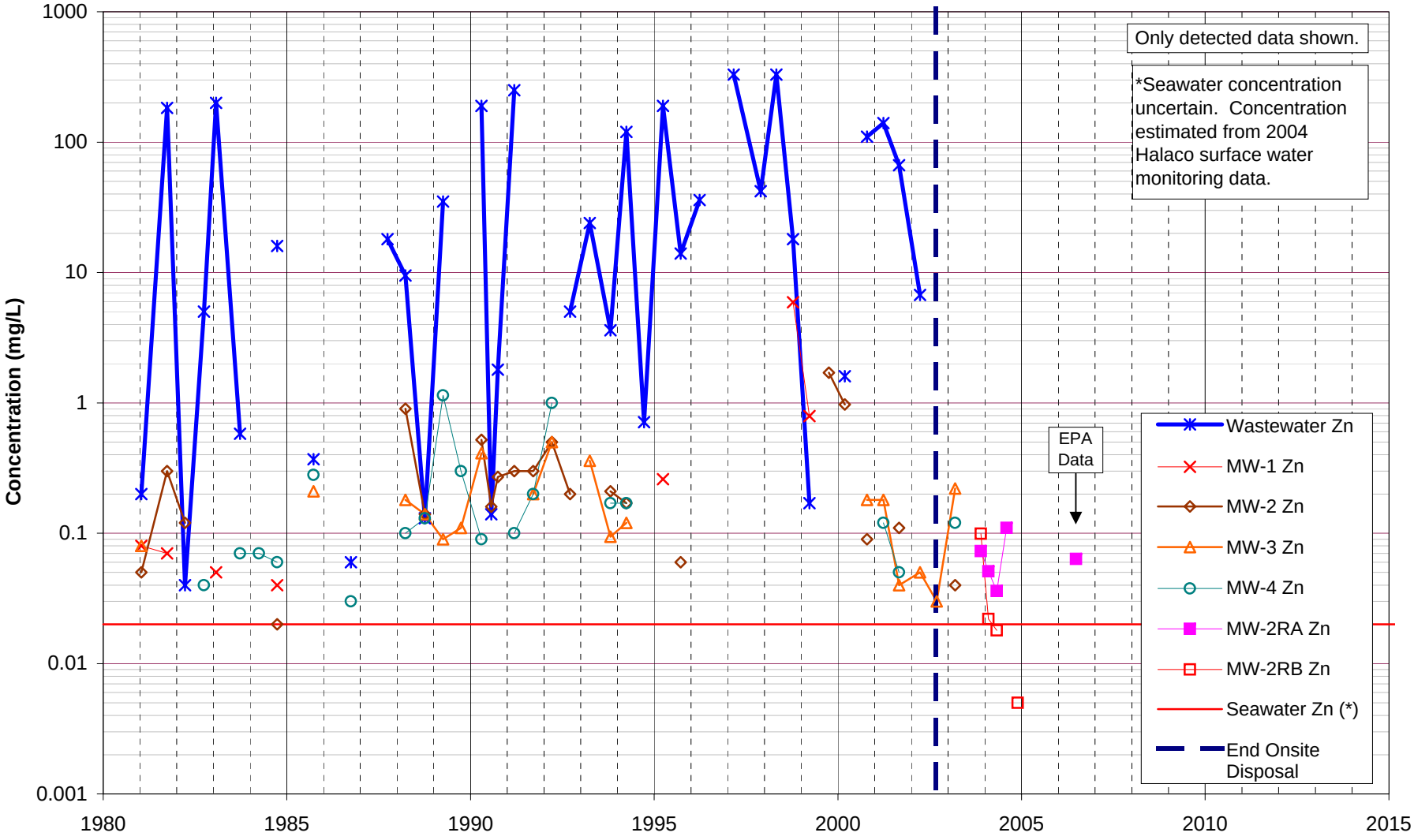


Figure I-10
Groundwater - Zinc
Long-term Monitoring



Appendix I.3
Groundwater, Post Onsite Discharge Monitoring

Figure I-11
Groundwater - Magnesium
Post Onsite Discharge Monitoring

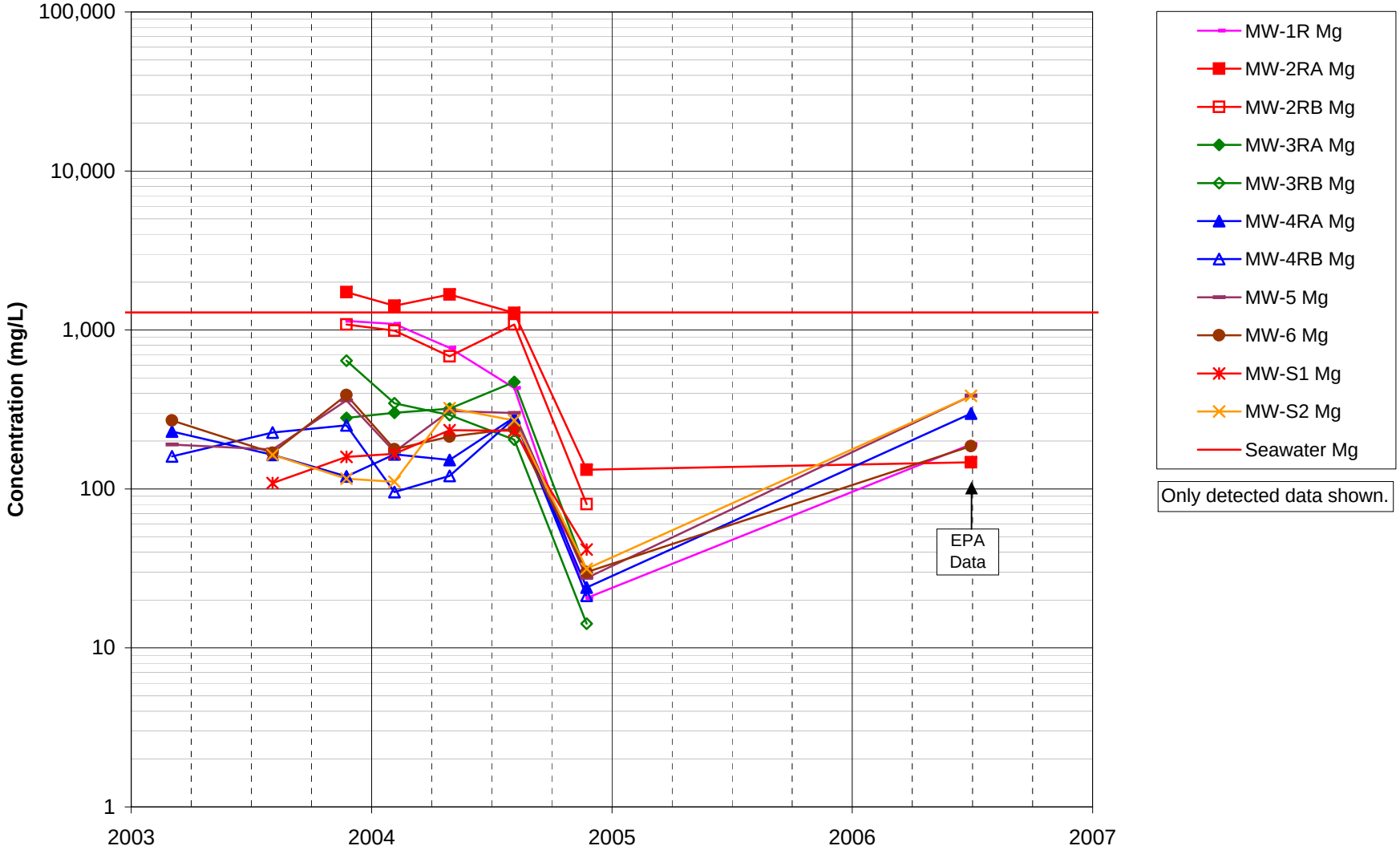


Figure I-12
Groundwater - Potassium
Post Onsite Discharge Monitoring

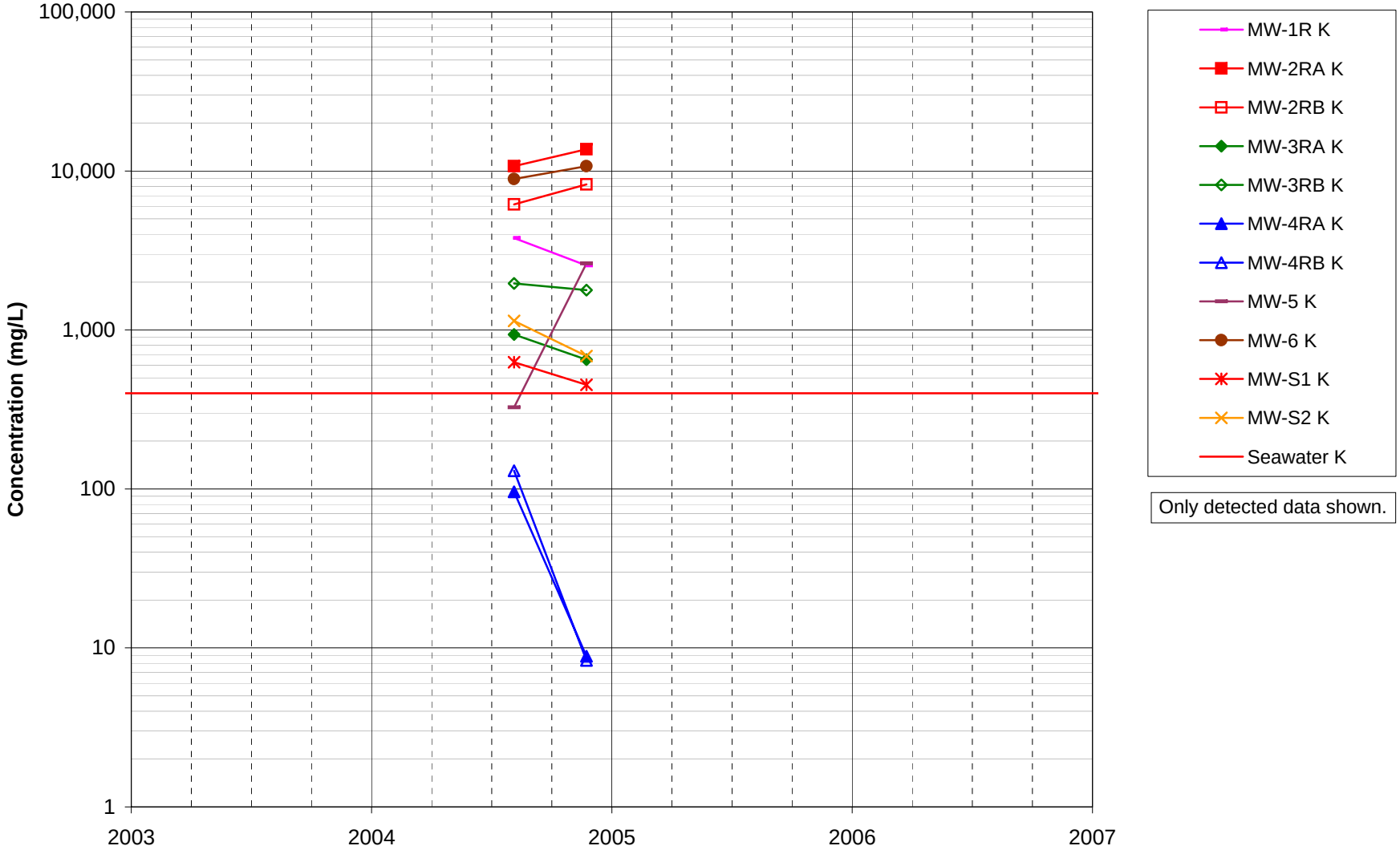


Figure I-13
Groundwater - Aluminum
Post Onsite Discharge Monitoring

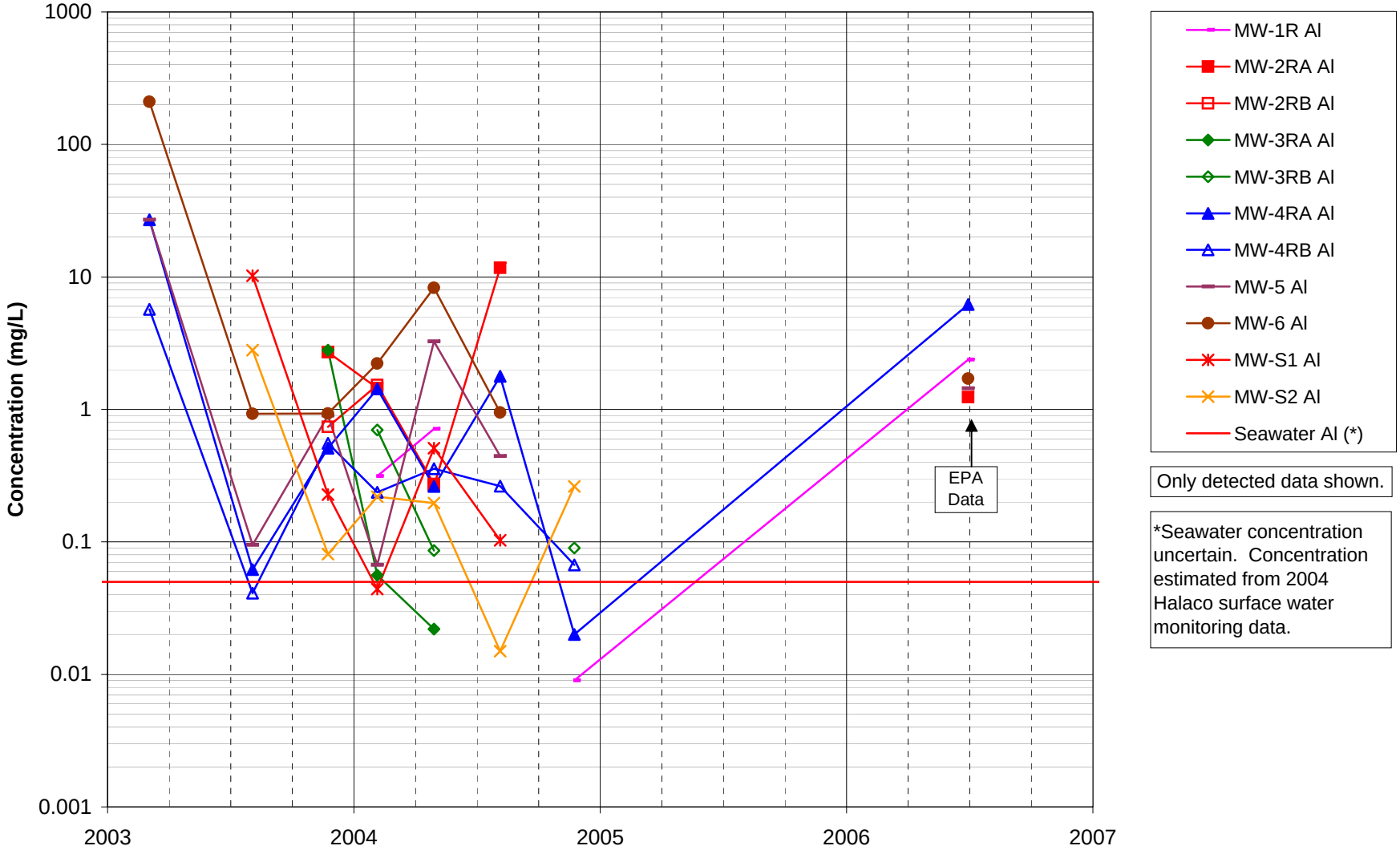


Figure I-14
Groundwater - Copper
Post Onsite Discharge Monitoring

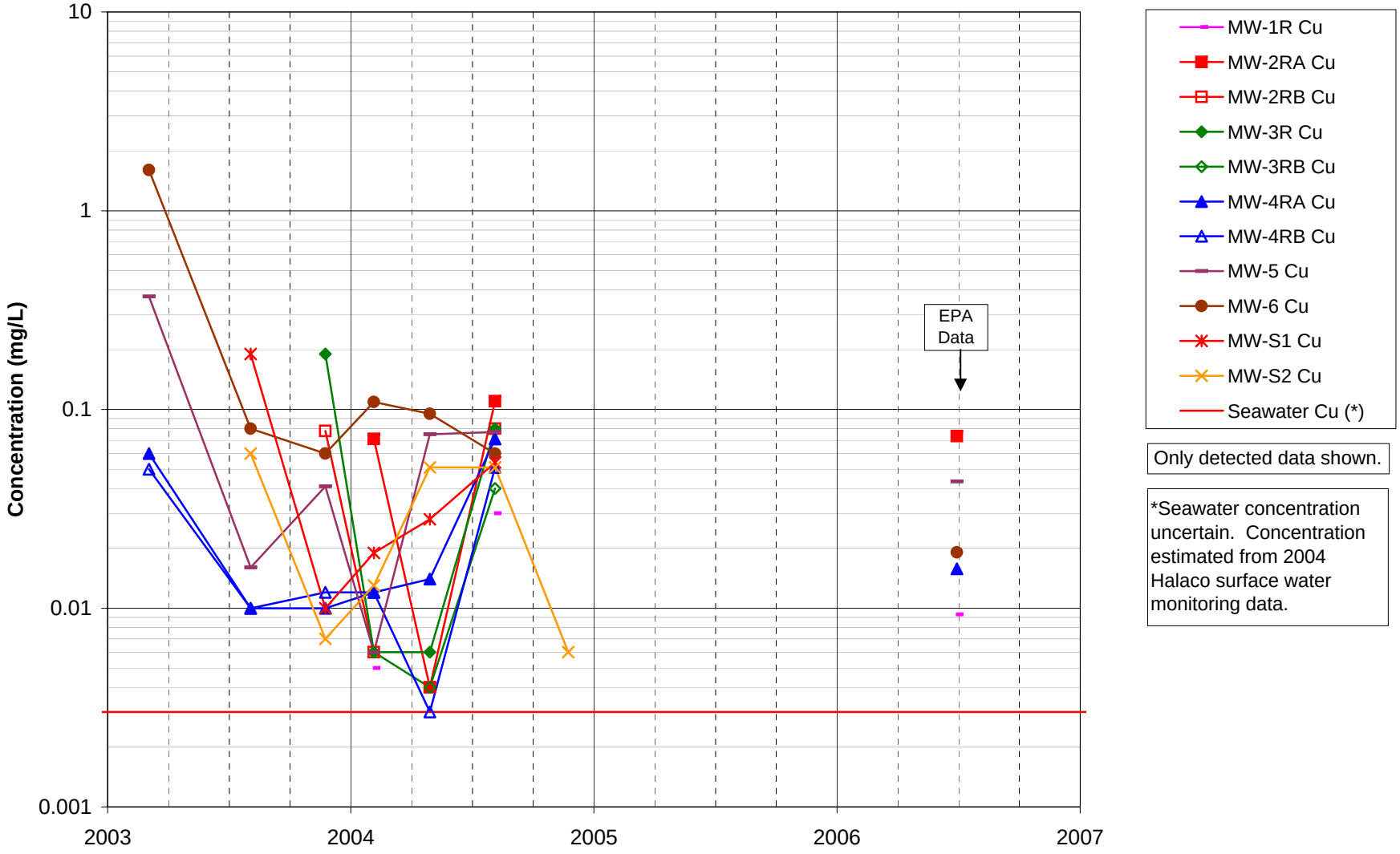
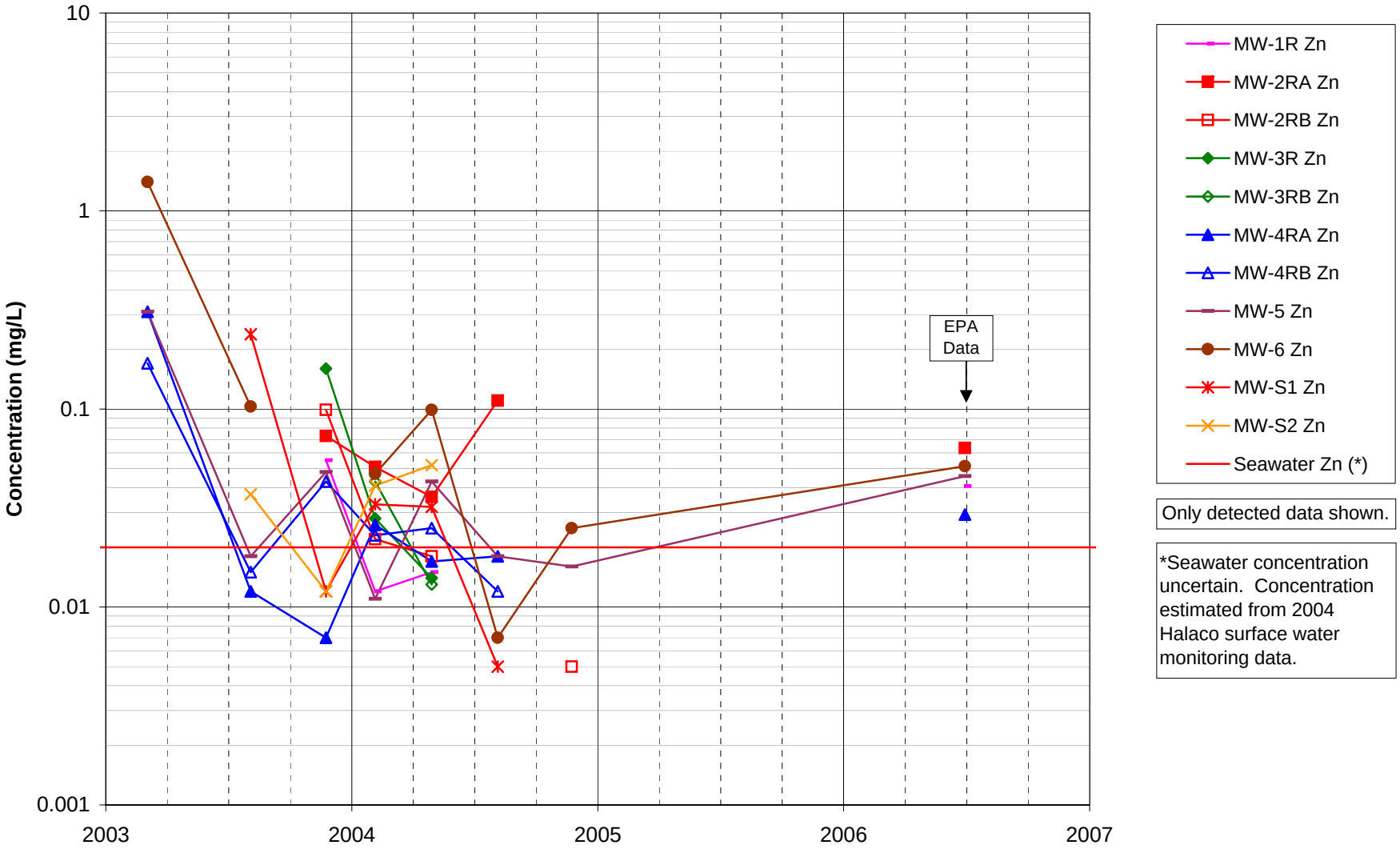



Figure I-15
Groundwater - Zinc
Post Onsite Discharge Monitoring