COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY
Northern and Central California, Nevada, and Utah
Contract No. N62474-94-D-7609 (CLEAN II)
Contract Task Order No. 0108

Prepared For

DEPARTMENT OF THE NAVY
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Engineering Field Activity, West
Naval Facilities Engineering Command
San Bruno, CA 94066-5006

ALAMEDA POINT
ALAMEDA, CALIFORNIA

DATA SUMMARY REPORT FOR QUARTERLY GROUNDWATER MONITORING

NOVEMBER 1997 - AUGUST 1998

Prepared By

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December 8, 1998

Mr. Dennis Wong
Remedial Project Manager
Engineering Field Activity West
Naval Facilities Engineering Command
900 Commodore Drive, Building 206 (U)
San Bruno, CA 94066-5006

Subject: **Transmittal of Data Summary Report For Quarterly Groundwater Monitoring Alameda Point, California**
CLEAN II Contract No. N62474-94-D-7609, Contract Task Order No. 0108

Dear Mr. Wong:

Tetra Tech EM Inc. (TtEMI) has enclosed five copies of the Data Summary Report For Quarterly Groundwater Monitoring prepared under contract task order (CTO) 0108. The purpose of the report is to document and interpret analytical results for groundwater samples collected from November 1997 to August 1998 at Alameda Point. This report replaces all previously distributed reports including quarterly updates.

If you have any questions concerning the enclosed documents, please contact me at (916) 853-4516.

Sincerely,

Matthew D. Udell
Project Manager

Enclosures (5)

cc: File

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ACRONYMS AND ABBREVIATIONS

AVGAS	Aviation gasoline
bgs	Below ground surface
Bay Area	San Francisco Bay Area
BSA	Bay Sediment Aquitard
BTEX	Benzene, toluene, ethylbenzene, and xylene compounds
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	Contract Task Order
COC	Chain of custody
cm/s	Centimeters per second
DSR	Data summary report
DCB	Dichlorobenzene
DCA	Dichloroethane
DCE	Dichloroethene
Diesel	Diesel-range organics
EFA West	Engineering Field Activity West
EPA	Environmental Protection Agency
FWBZ	First Water-Bearing Zone
FWBZL	First Water-Bearing Zone Lower
FWBZU	First Water-Bearing Zone Upper
Gasoline	Gasoline-range organics
IR	Installation restoration
IDW	Investigation-derived waste
MS/MSD	Matrix spike/matrix spike duplicate
MCL	Maximum contaminant level
MLLW	Mean lower low water
μg/L	Micrograms per Liter
mg/L	Milligrams per Liter
Motor oil	Motor oil-range organics
NAS	Naval Air Station
PCB	Polychlorinated biphenyl
PRC	PRC Environmental Management, Inc.
PARCC	Precision, accuracy, representativeness, completeness, and comparability
QAPP	Quality assurance project plan
QA/QC	Quality assurance/quality control
RI/FS	Remedial investigation/feasibility study
SWBZ	Second Water-Bearing Zone
SWBZL	Second Water-Bearing Zone Lower
SWBZU	Second Water-Bearing Zone Upper
SVOC	Semivolatile organic compound
SOP	Standard operating procedure
SOW	Statement of work
TDS	Total dissolved solids
TEPH	Total extractable petroleum hydrocarbons
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons

ACRONYMS AND ABBREVIATIONS (Continued)

TPPH	Total purgeable petroleum hydrocarbons
PCE	Tetrachloroethene
TtEMI	Tetra Tech EM Inc.
TCA	Trichloroethane
TCE	Trichloroethene
U&A	Uribe and Associates
UST	Underground storage tank
VOC	Volatile organic compound

1.0 INTRODUCTION

This data summary report (DSR) was prepared by Uribe & Associates (U&A) for the Department of the Navy, Engineering Field Activity West (EFA West), Naval Facilities Engineering Command. The DSR presents the analytical results for four quarters of groundwater sampling at the former Naval Air Station (NAS) Alameda (now known as Alameda Point). In addition, groundwater elevation data are presented and well maintenance and repair activities are summarized. Production of this report and the associated field activities were authorized by Tetra Tech EM Inc. (TtEMI), formerly known as PRC Environmental Management, Inc. (PRC), under Contract Task Order (CTO) No. 0108 as part of the Comprehensive Long-Term Environmental Action Navy Contract No. N62474-94-D-7609 (CLEAN II).

The major tasks authorized under CTO 0108 included: (1) preparing a groundwater monitoring plan, (2) conducting a limited 24-hour tidal influence study and generating a tidal study report, (3) closing a 450-foot-deep former water supply well by grouting in place and generating a well closure report, (4) conducting periodic depth to groundwater measurements in selected wells, (5) inspecting approximately 250 on-site wells and performing well maintenance and repair as needed, and (6) sampling groundwater from 90 selected monitoring wells during four quarterly sampling events over the course of 1 year and generating a report summarizing the results.

This report addresses Tasks 4 through 6, while information about the other tasks is presented in other reports. This DSR consists of six sections. The remainder of Section 1.0 presents the purpose of the quarterly sampling and describes Alameda Point. Section 2.0 introduces the field work methods and procedures, and Section 3.0 summarizes the regional and local geology and hydrogeology. The results of the quarterly sampling are presented, by installation restoration (IR) site, in Section 4.0. A summary of the well maintenance and repair activities is presented in Section 5.0. Report conclusions appear in Section 6.0. The "Final Groundwater Monitoring Plan" (PRC and U&A 1997b) was prepared under Task 1 in October 1997. Information about Tasks 2 and 3 appear in the "Tidal Influence Study" (PRC and U&A 1997a) and the "Well Closure Report for the Pan American Well" (PRC and U&A 1997c).

1.1 PURPOSE

Quarterly groundwater sampling was conducted to obtain analytical data in order to characterize the distribution and concentration of chemicals in the groundwater underlying Alameda Point. The quarterly sampling was conducted in accordance with the strategy presented in the "Groundwater Monitoring Plan"

(PRC and U&A 1997b) prepared for Alameda Point. The data obtained from quarterly sampling will supplement the existing soil and groundwater analytical data collected during the remedial investigation (RI) currently being conducted at Alameda Point. This DSR presents the rationale for the quarterly groundwater monitoring at each IR site sampled and the analytical results for the each quarter of sampling.

1.2 SITE DESCRIPTION AND BACKGROUND

Alameda Point is located on the east side of San Francisco Bay in the city of Alameda, California (Figure 1.2-1). The facility occupies the western end of the island of Alameda and was officially closed in May 1997. The eastern part of Alameda Point is developed with office and industrial buildings, while runways and associated support facilities occupy the western part. Naval operations at Alameda Point have ceased, with the exception of employees working on the base closure, base environmental cleanup, conversion of the base to civilian use, or managing biological resources.

Twenty-two potentially contaminated hazardous waste sites were identified at Alameda Point during the RI. Figure 1.2-2 shows these sites (note that no boundaries are shown for Site 18, the facility-wide storm-drain system). Contaminants identified at the sites during previous sampling include volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polychlorinated biphenyls (PCB), pesticides, total petroleum hydrocarbons (TPH), metals, and alpha and/or beta radiation (PRC and Montgomery Watson 1993a and 1993b). Quarterly groundwater sampling took place under CTO 0108 at the following 18 sites (note that in some cases, adjacent sites were considered together):

- Site 1, 1943 - 1956 Disposal Area
- Site 2, West Beach Landfill
- Site 3, Area 97, Abandoned Fuel Storage
- Site 4, Building 360 Aircraft Engine Facility
- Site 5, Building 5, Aircraft Rework Facility and Site 10, Missile Rework Facility
- Site 6, Building 41, Aircraft Intermediate Maintenance Facility
- Site 7, Building 459, Navy Exchange Fuel Station
- Site 9, Building 410, Paint Stripping

- Site 11, Building 14, Aircraft Engine Test Cell and Site 21, Service Station
- Site 12, Building 10, Power Plant
- Site 13, Former Oil Refinery and Site 19, Hazardous Waste Storage Area
- Site 14, Fire-Training Area
- Site 16, CANS C-2 Area
- Site 22, Building 547, Service Station
- Site 23, Building 530 Missile Rework Operations

In addition, four background monitoring wells (MBG-1 through MBG-4), located near the eastern and northeastern perimeters of the base, were sampled. The locations of the wells included in this quarterly groundwater monitoring program are shown on Figure 1.2-3.

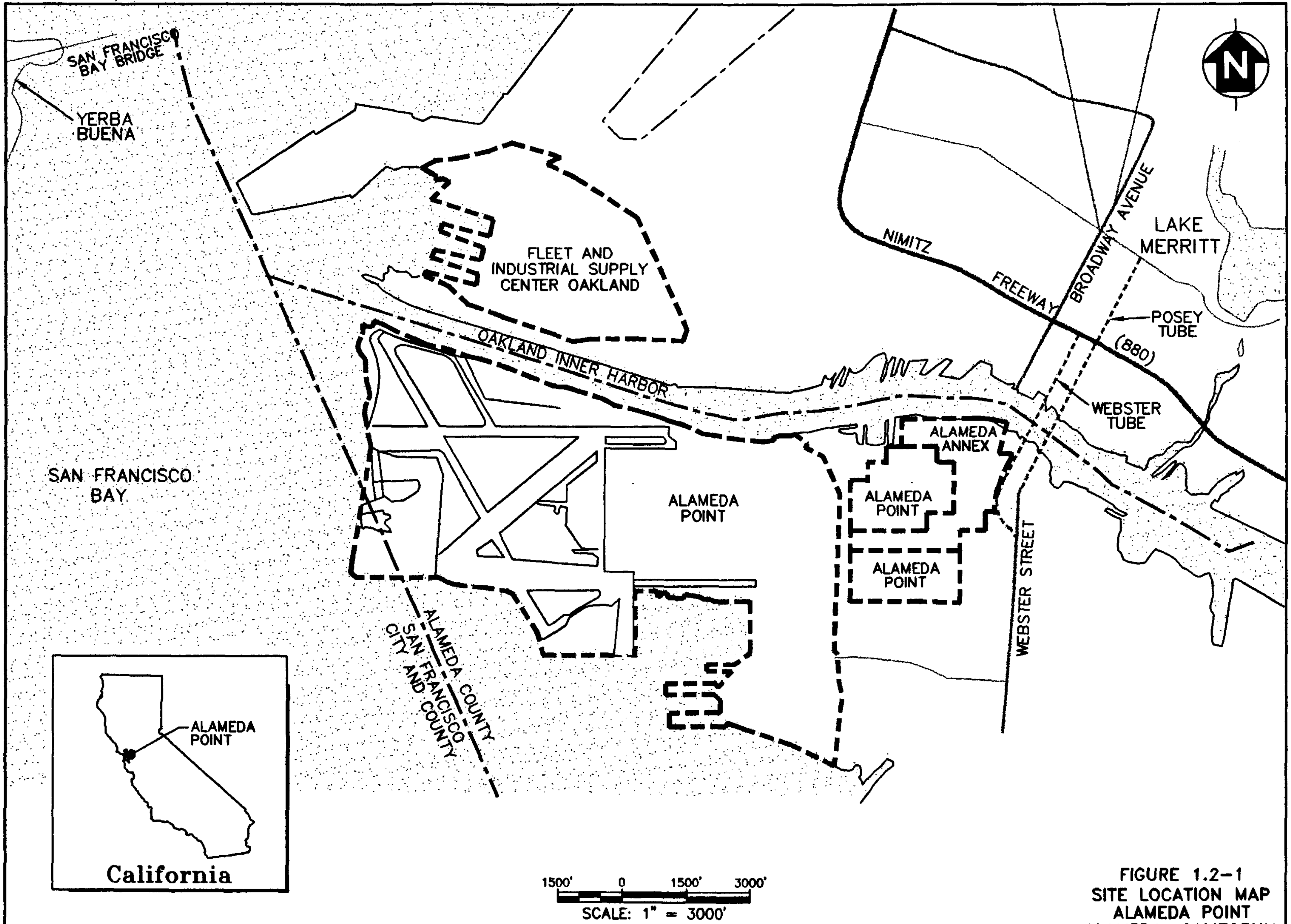
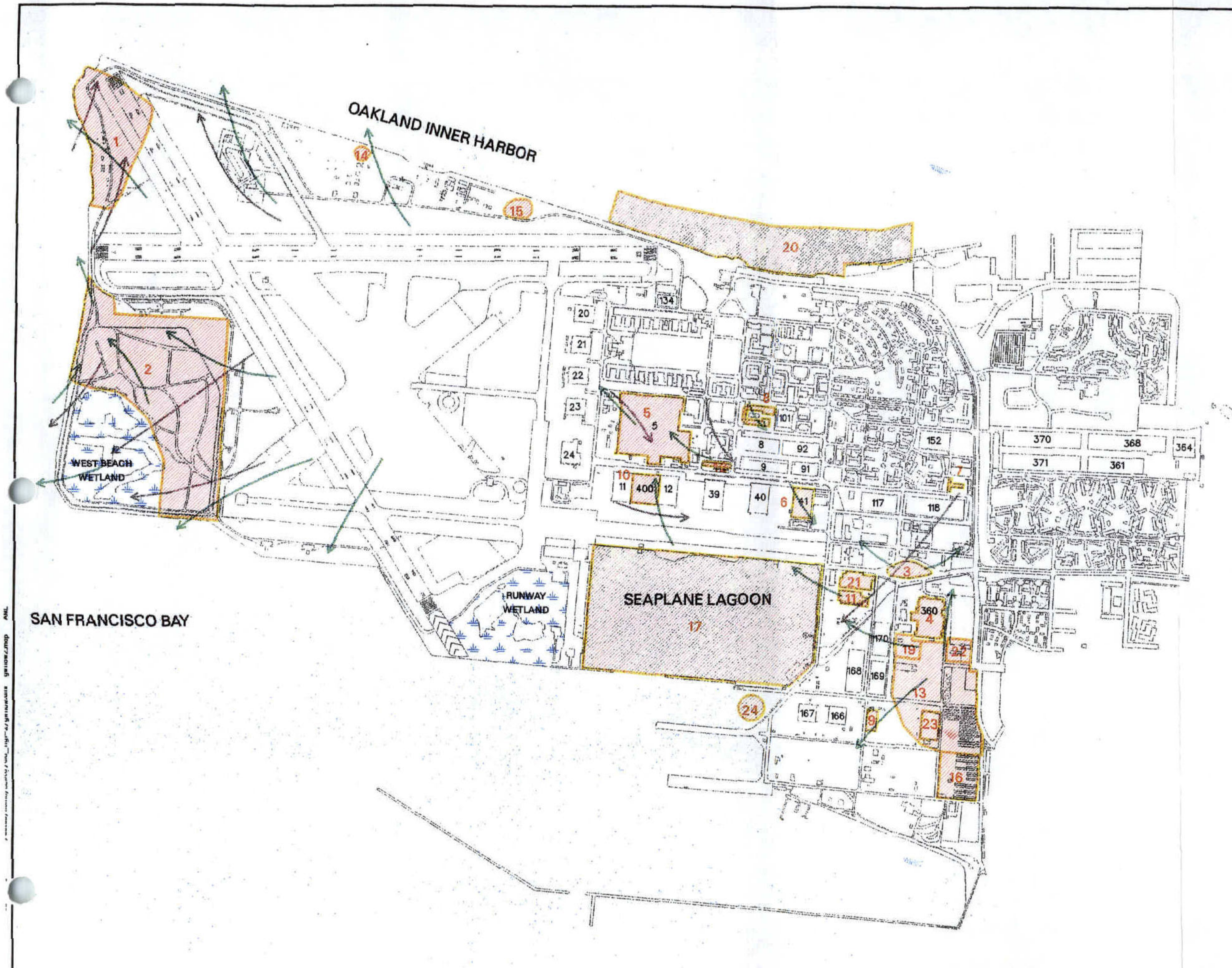


FIGURE 1.2-1
SITE LOCATION MAP
ALAMEDA POINT
ALAMEDA, CALIFORNIA

SOURCE: USGS, OAKLAND WEST, CALIFORNIA QUADRANGLE

DATE: 2/25/99 VEC DN O:\ALAMEDA\AA-FLOC.DWG



LEGEND

- INSTALLATION RESTORATION SITES
- APPROXIMATE WETLANDS AREAS
- ESTIMATED GROUNDWATER FLOW FIRST WATER BEARING ZONE
- ESTIMATED GROUNDWATER FLOW SECOND WATER BEARING ZONE

NOTE: GENERAL GROUNDWATER FLOW DIRECTIONS BASED ON MAY 2, 1997 GROUNDWATER ELEVATION MEASUREMENTS

N

600 0 600 1200

SCALE: 1" = 1200'

FIGURE 1.2-2
INSTALLATION RESTORATION SITES AND GROUNDWATER FLOW DIRECTIONS
ALAMEDA POINT
ALAMEDA, CALIFORNIA

FIGURE 1.2-3
QUARTERLY GROUNDWATER SAMPLING
MONITORING WELL LOCATIONS
ALAMEDA POINT
ALAMEDA, CALIFORNIA

2.0 FIELD WORK METHODS AND PROCEDURES

Four quarterly rounds of groundwater sampling have been conducted over the course of 1 year. Prior to the first round of groundwater sampling, water-level measurements were taken from approximately 200 wells to provide depth-to-groundwater information for the various hydrostratigraphic units underlying Alameda Point. The first round of sampling took place in late October and early November 1997. Ninety groundwater samples and 23 quality assurance/quality control (QA/QC) samples (10 duplicate samples, 11 trip blanks, 1 equipment rinsate blank, and 1 field blank) were collected during the first sampling round. The second round of sampling took place in early February 1998. Eighty-nine groundwater samples, 2 investigation-derived waste (IDW) tank samples, and 21 QA/QC samples (10 duplicate samples, 9 trip blanks, one equipment rinsate blank, and 1 field blank) were collected during the second round. The third round of sampling took place in early May 1998. Ninety groundwater samples and 21 QA/QC samples (10 groundwater samples, 9 trip blanks, 1 equipment rinsate blank, and 1 field blank) were collected during the third round. The fourth round of sampling took place in early August 1998. Seventy-two groundwater samples, 2 IDW tank samples, and 16 QA/QC samples (seven duplicate samples, seven trip blanks, one equipment rinsate blank, and one field blank) were collected during the fourth round. The groundwater sampling procedures conducted at each well consisted of measuring the depth to water, purging the monitoring wells, collecting groundwater samples with a disposable bailer, labeling sample bottles, packing and shipping samples, and transferring IDW generated during sampling activities to the IDW storage area. These procedures are discussed in the following subsections.

2.1 GROUNDWATER-LEVEL MEASUREMENT

Prior to the first round of groundwater sampling, water-level measurements were taken in approximately 200 wells during the course of 1 day. Depth-to-groundwater measurements were taken using electronic water-level sounders and recorded on field forms in accordance with the standard operating procedure (SOP) for groundwater sampling (SOP No. 010). The applicable SOPs are included in Volume II, Appendix A of the "Groundwater Monitoring Plan" (PRC and U&A 1997b). In addition to the synoptic water-level measurements taken from approximately 200 wells, water levels were measured each quarter in the quarterly sampling wells just prior to sampling and recorded on well purging and sampling forms; these measurements were taken over the course of 2 weeks or more. Copies of the well purging and sampling forms for each sampling round are included in the appendix to this report. Groundwater potentiometric surface maps, based on data collected during quarterly sampling, are presented on Figures 2.1-1 through 2.1-4 appearing at the end of Section 2.0. These potentiometric surface maps are organized by quarter, region, and water-bearing zone, and include Figure 2.1-1 (quarterly maps for the first water bearing zone (FWBZ), western region), Figure 2.1-2 (quarterly maps for the FWBZ, central region), Figure 2.1-3 (quarterly maps for the FWBZ, southeastern region), and Figure 2.1-4 (quarterly maps for the second water bearing zone (SWBZ) for the entire facility).

2.2 MONITORING WELL PURGING

Prior to collecting samples, the monitoring wells were purged to remove stagnant water to ensure that the groundwater samples collected were representative of aquifer conditions. Shallow monitoring wells were purged using a disposable bailer, and deep monitoring wells with larger purge volumes were purged using a submersible electric pump and a generator. Physical parameters, including temperature, pH, and conductivity, were measured and recorded on well purging and sampling forms during purging (Appendix).

Monitoring wells were purged until the physical parameters measured during the purging process had stabilized. Unless a well purged dry, a minimum of three and a maximum of five well-casing volumes were removed. All purge water was collected as IDW. Physical parameters were measured in the field during purging in accordance with the SOP for each parameter (see SOP Nos. 011, 012, and 013 in Volume II, Appendix A of the "Groundwater Monitoring Plan," PRC and U&A 1997b).

2.3 GROUNDWATER SAMPLING

After the wells were purged, groundwater samples were collected from monitoring wells using disposable bailers and poured into laboratory-prepared sample bottles, which were labeled in the field. Groundwater sampling was conducted as described in SOP No. 010 (Volume II, Appendix A of the "Groundwater Monitoring Plan," PRC and U&A 1997b).

If a well purged dry before three well-casing volumes were removed, and before well purging was complete, groundwater samples to be analyzed for VOCs or TPH purgeables were collected as soon as there was sufficient water in the well. Groundwater samples to be analyzed for other chemical contaminants were collected after the well recovered to 80 percent of the initial water level, within 24 hours after purging.

Groundwater samples destined for metals analyses were filtered in the field. The required volume of water was collected in a laboratory-cleaned, unpreserved, 1-liter plastic bottle. The water from this unpreserved sample bottle was then filtered directly into a laboratory-cleaned, 1-liter plastic bottle containing nitric-acid preservative. The filtering and transfer process was performed using a peristaltic pump, a length of disposable 15-millimeter silicone tubing, and a disposable 0.45-micron filter.

After samples were collected and labeled, the sample bottles were packed in refrigerated coolers (cooled to 4°C or less using ice) and shipped under chain-of-custody (COC) control to Recra LabNet. This analytical laboratory, in order to perform work for the Navy, complies with the Navy CLEAN II Laboratory Statement of Work (SOW) (PRC 1995), which specifies analytical protocols, QC criteria, and standard deliverables, thereby, promoting comparable data.

2.4 INVESTIGATION–DERIVED WASTE HANDLING

Groundwater removed during purging of on-base wells was collected in drums as IDW and transferred at least daily to a large baker tank located at the designated Alameda Point IDW storage area, near Site 4. The volume of groundwater purged from each well was recorded on the well purging and sampling form (Appendix). Drums were used only for transferring water to the IDW area and not to store purge water.

2.5 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

The quality assurance project plan (QAPP), Volume IIb of the "Groundwater Monitoring Plan" (PRC and U&A 1997b), specified the procedures and the QA/QC requirements used to ensure that environmental data of sufficient quantity and quality were collected to meet the project objectives identified for the quarterly groundwater sampling at Alameda Point.

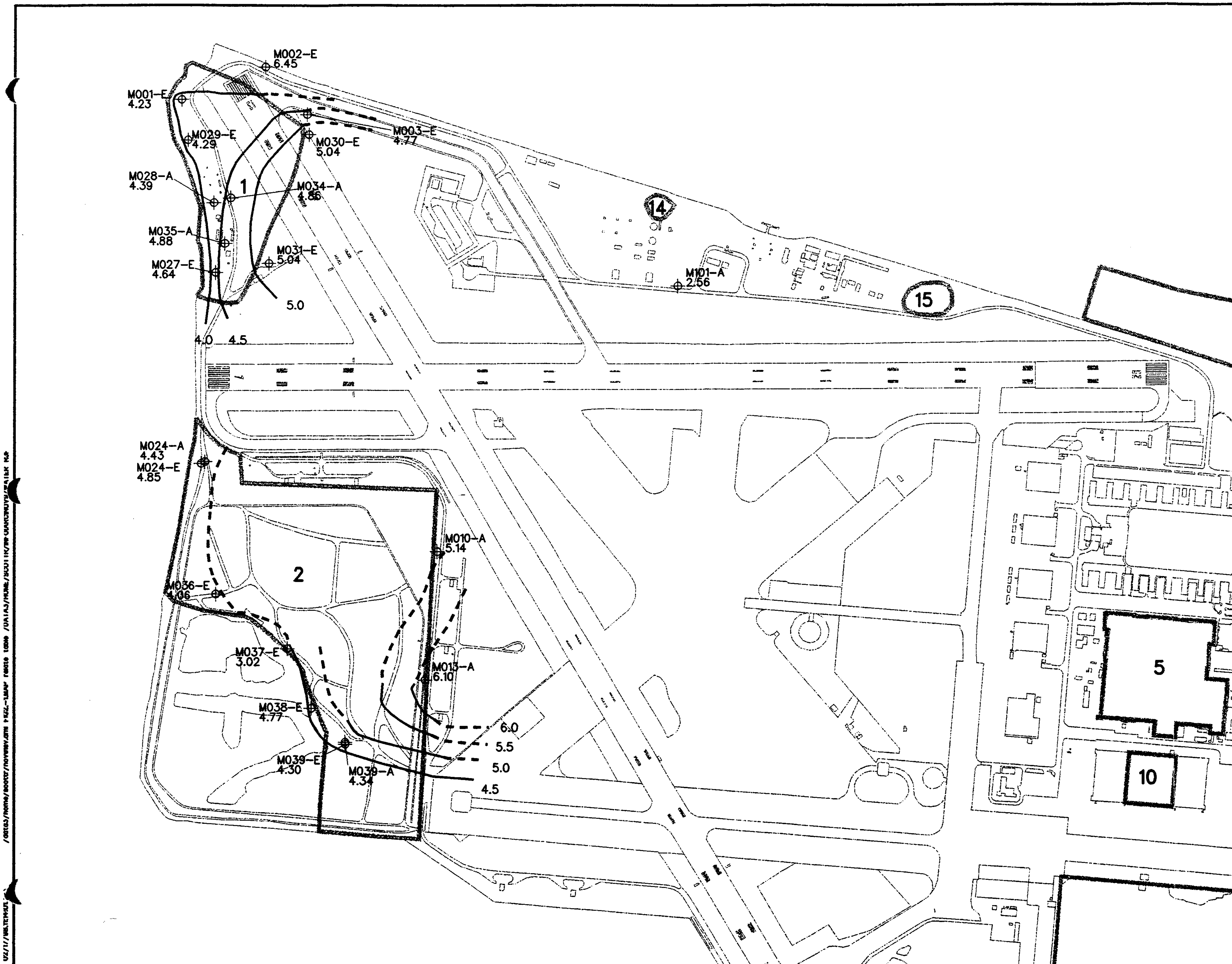
Definitive data, generated using rigorous analytical methods, provide defensible data usable for characterization and assessment purposes. The QA/QC elements required for definitive data, to assure that project objectives are met, include the following:

- Sample documentation (location, date and time collected, batch, etc.)
- COC
- Sampling design approach (systematic, simple or stratified random, judgmental, etc.)
- Initial and continuing calibration for all analytical methods

- Determination and documentation of detection limits
- Analyte(s) identification and quantitation
- QC blanks (trip, method, rinsate)
- Matrix spike recoveries
- Matrix duplicates
- Field duplicates

Analytical measurement parameters are the critical indicator of data quality. These data quality parameters are: precision, accuracy, representativeness, completeness, and comparability (known as PARCC [U.S. Environmental Protection Agency {EPA} 1987]). For this project, the PARCC parameters have been addressed with the following QA/QC procedures:

- The precision of chemical analyses and analytical methods was assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) samples and matrix duplicate samples.
- Sampling accuracy was evaluated based on the result of the analysis of field blanks, trip blanks, and equipment rinsate blanks.
- Representative data was obtained through the careful selection of sampling sites and analytical parameters, the proper collection and handling of samples to avoid interference and minimize sample contamination and loss of analytes, and the consistent application of standardized field and laboratory procedures. To aid in the evaluation of the representativeness of each sample, field- and laboratory-required blank samples were evaluated for the presence of contaminants. Method blank samples were considered in evaluating the validity of the data when problems with contamination in any samples occurred.
- Completeness, defined as the percentage of measurements that are judged valid, were evaluated as part of the data validation process. Completeness was calculated by dividing the number of complete, valid sample results by the total number of sample analyses generated.
- Comparability, the confidence with which one data set can be compared to another, was achieved through the use of standardized techniques to collect and analyze samples and the use of appropriate units to report analytical results. The laboratory that performed analytical work for this project complied with the Navy CLEAN II Laboratory SOW (PRC 1995).



LEGEND

⌖ MONITORING WELL
FIRST WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION
(FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET
(MEAN LOWER LOW WATER),
DASHED WHERE INFERRED

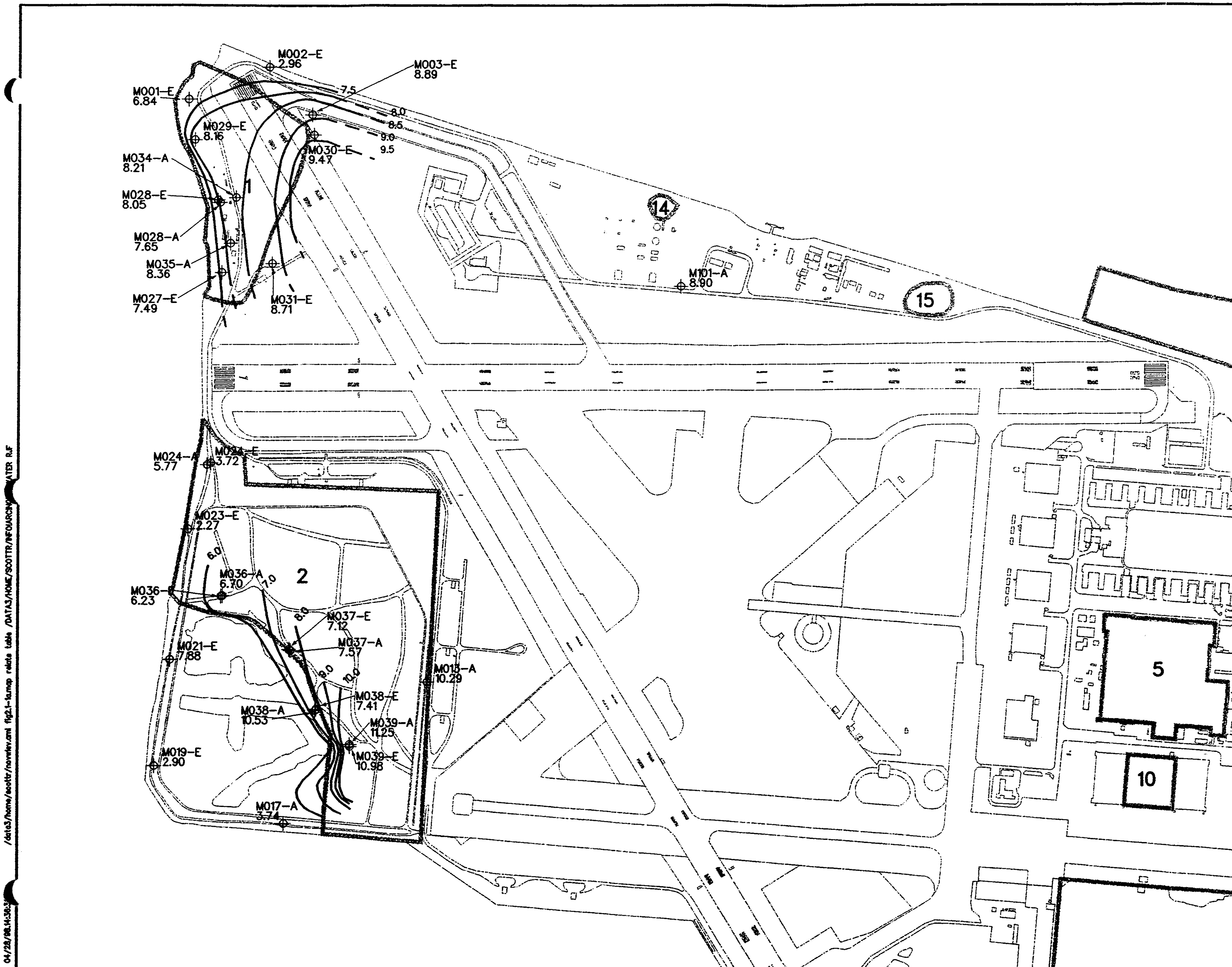
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON NOVEMBER 1997 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

350 0 350 700

SCALE: 1" = 700'

FIGURE 2.1-1 (Sheet 1)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
WESTERN REGION
QUARTER 1
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

⌖ MONITORING WELL FIRST WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

NOTE: POTENTIOMETRIC SURFACE MAP BASED ON FEBRUARY 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

350 0 350 700

SCALE: 1" = 700'

FIGURE 2.1-1 (Sheet 2)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
WESTERN REGION
QUARTER 2
ALAMEDA POINT
ALAMEDA, CALIFORNIA

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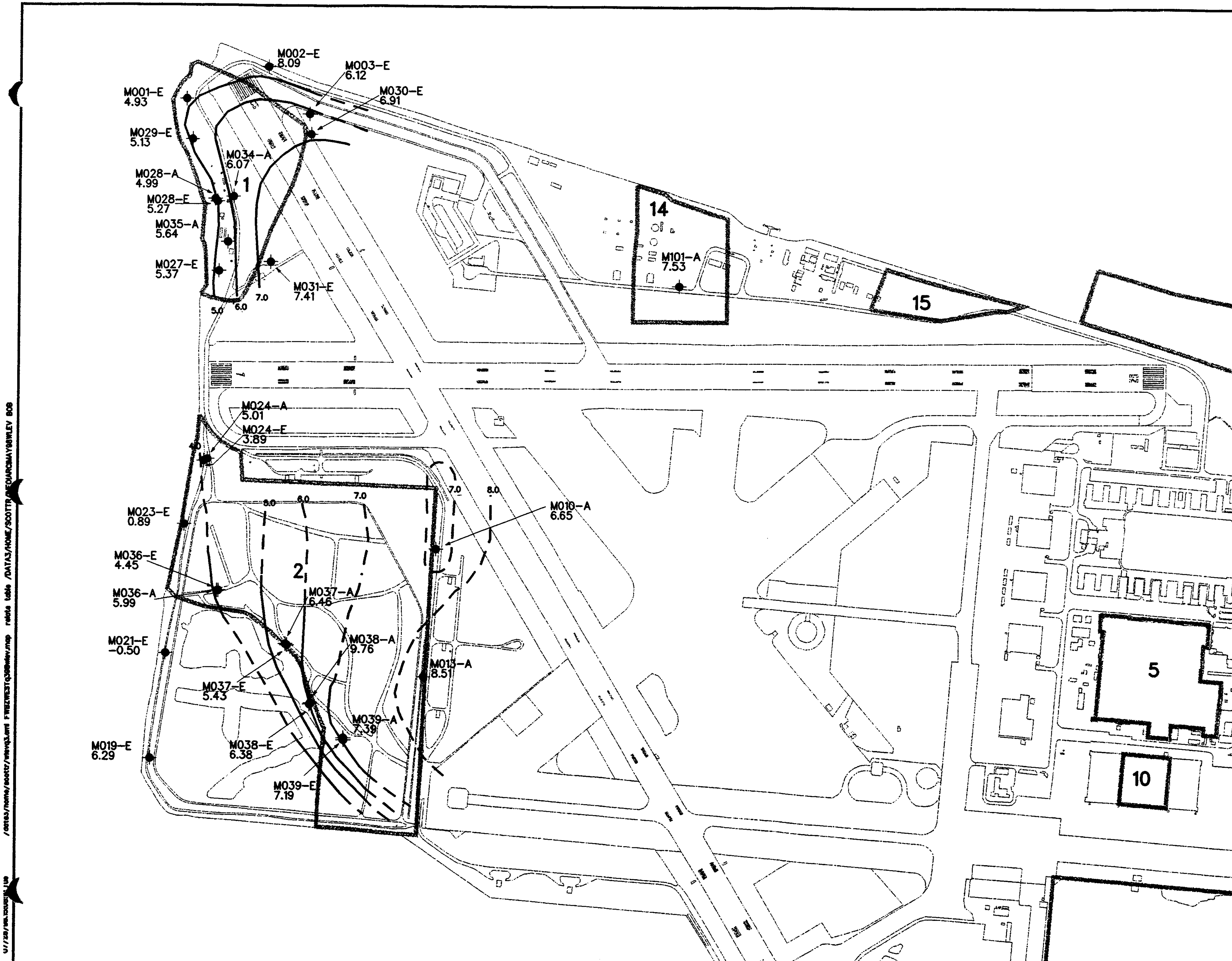


LEGEND

MONITORING WELL

PIEZOMETER

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

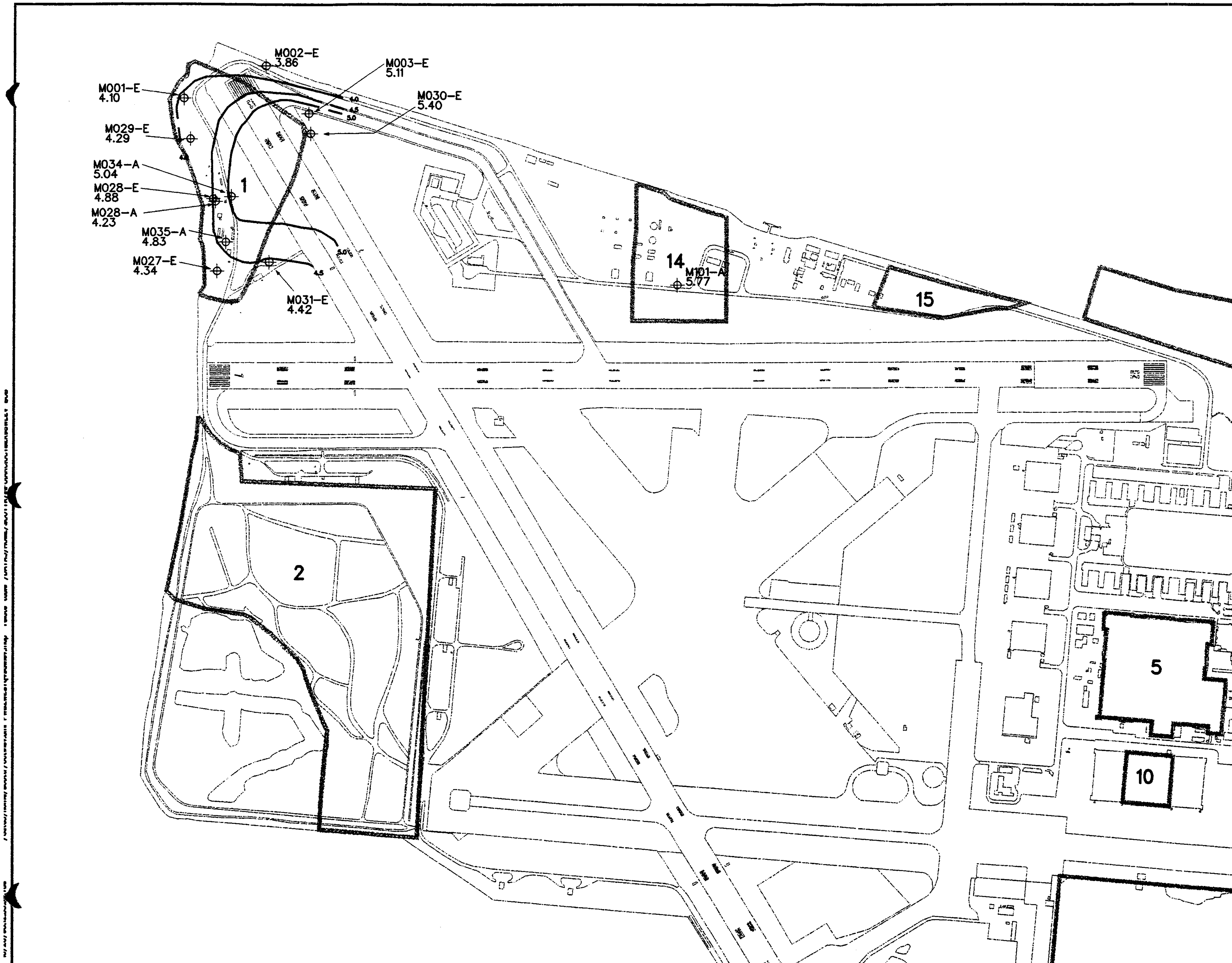
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON MAY 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

350 0 350 700

SCALE: 1" = 700'

FIGURE 2.1-1 (Sheet 3)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
WESTERN REGION
QUARTER 3
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

MONITORING WELL
FIRST WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION
(FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

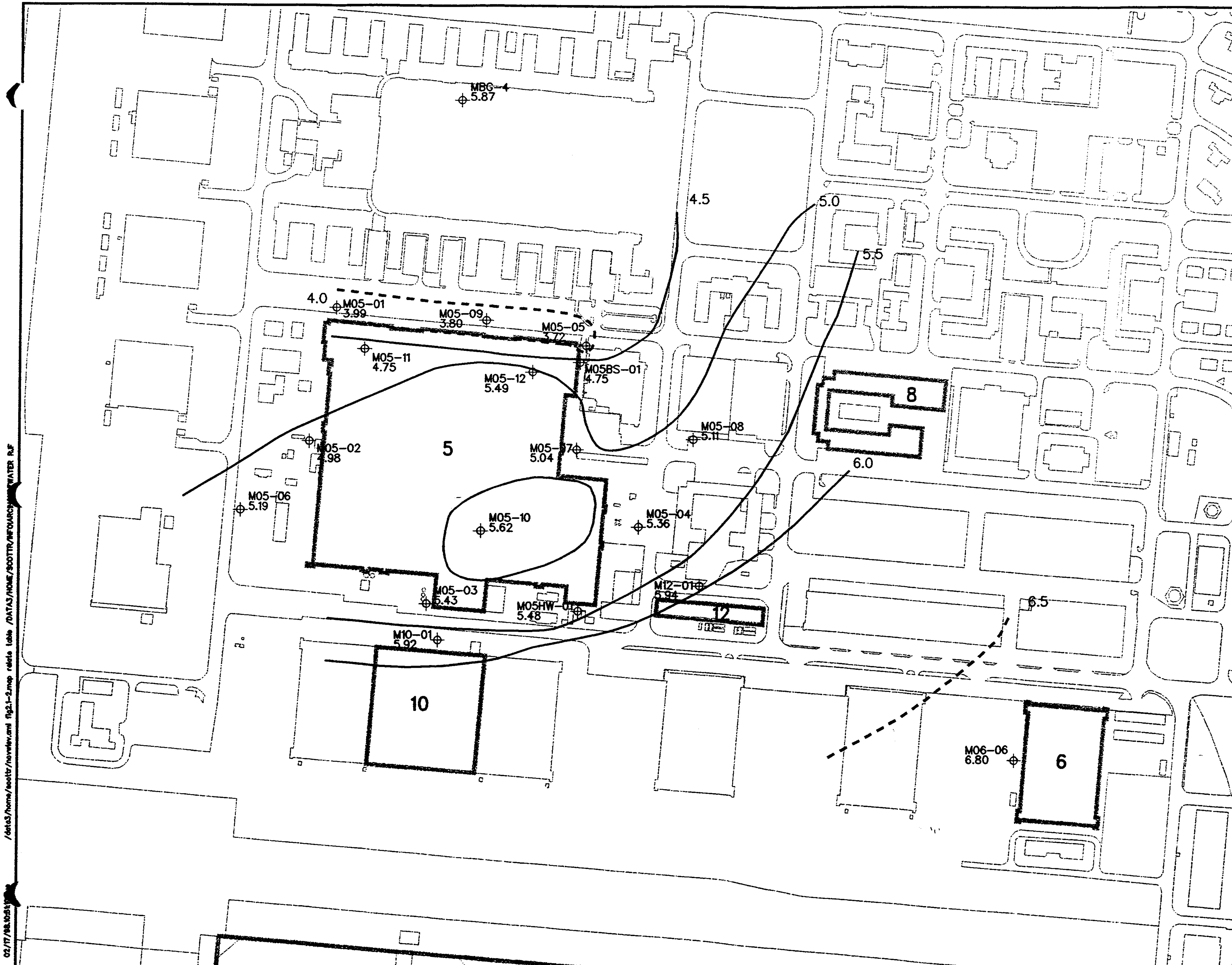
—4.5— WATER ELEVATION CONTOUR IN FEET
(MEAN LOWER LOW WATER),
DASHED WHERE INFERRED

NOTE: POTENTIOMETRIC SURFACE MAP BASED ON AUGUST 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

350 0 350 700
SCALE: 1" = 700'

FIGURE 2.1-1 (Sheet 4)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
WESTERN REGION
QUARTER 4
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

⊕ MONITORING WELL FIRST WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

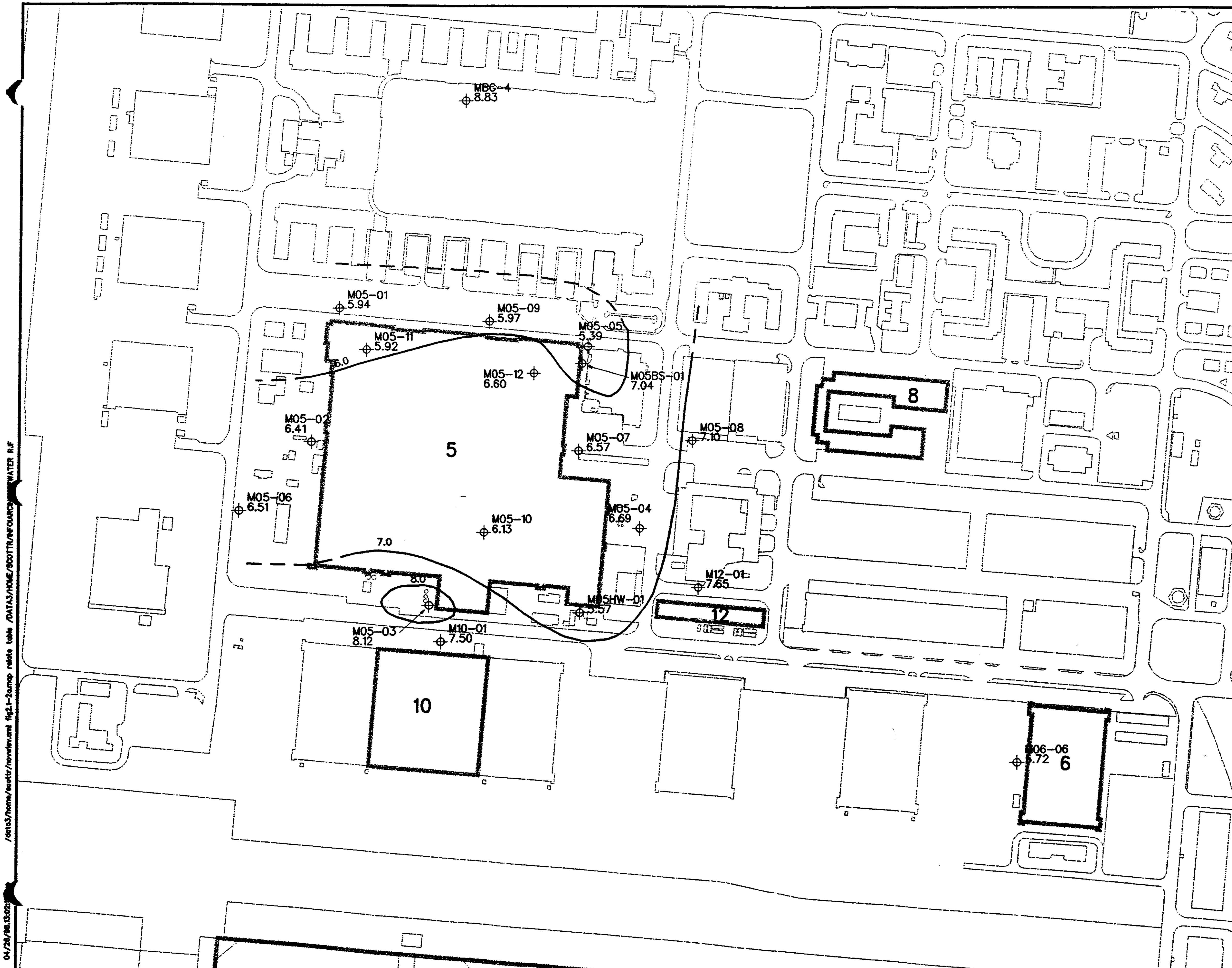
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON NOVEMBER 1997 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

150 0 150 300

SCALE: 1" = 300'

FIGURE 2.1-2 (Sheet 1)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
CENTRAL REGION
QUARTER 1
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

MONITORING WELL FIRST WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

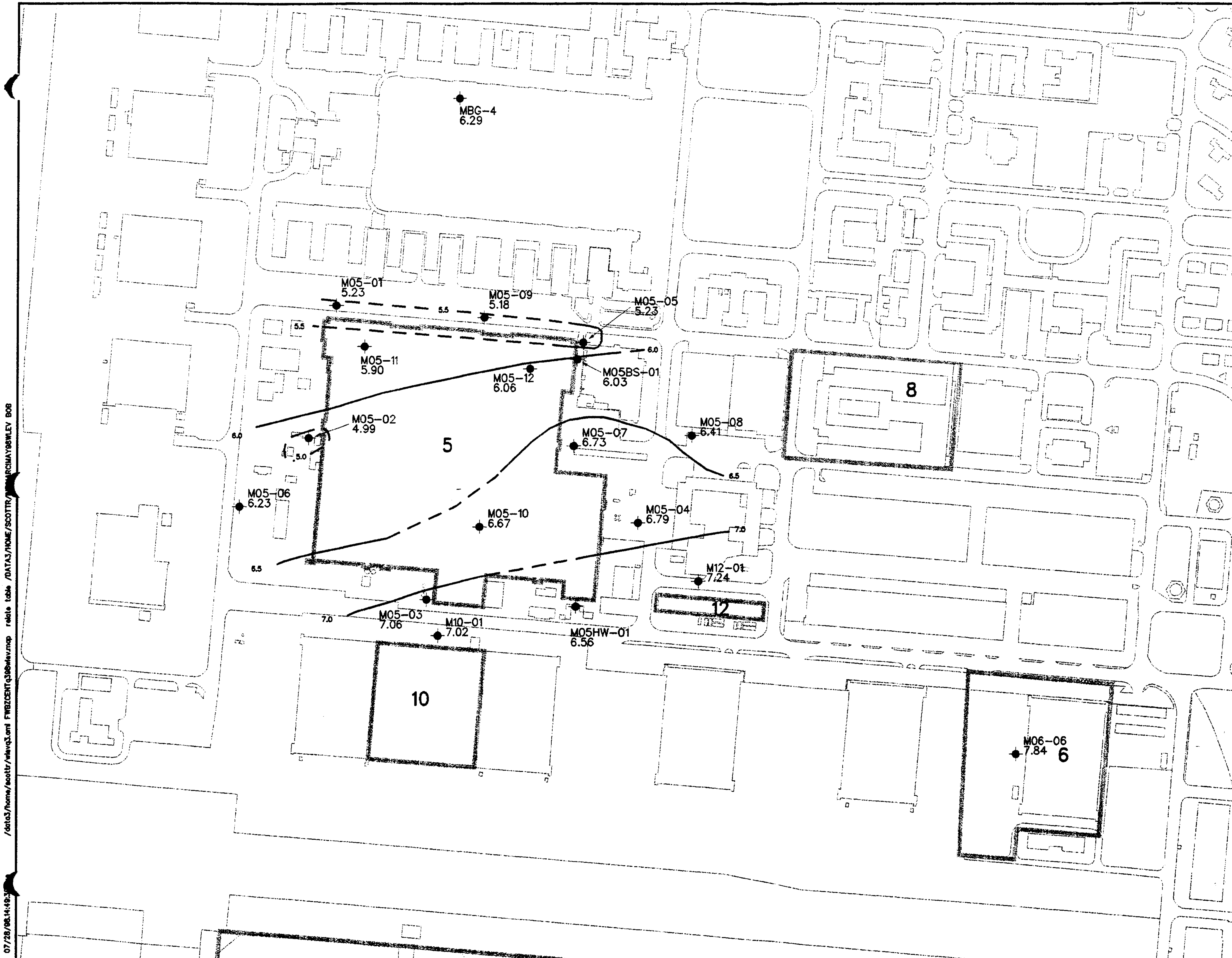
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON FEBRUARY 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

150 0 150 300

SCALE: 1" = 300'

FIGURE 2.1-2 (Sheet 2)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
CENTRAL REGION
QUARTER 2
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

- MONITORING WELL
- PIEZOMETER

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

NOTE: POTENTIOMETRIC SURFACE MAP BASED ON MAY 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

150 0 150 300

SCALE: 1" = 300'

FIGURE 2.1–2 (Sheet 3)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
CENTRAL REGION
QUARTER 3
ALAMEDA POINT
ALAMEDA, CALIFORNIA

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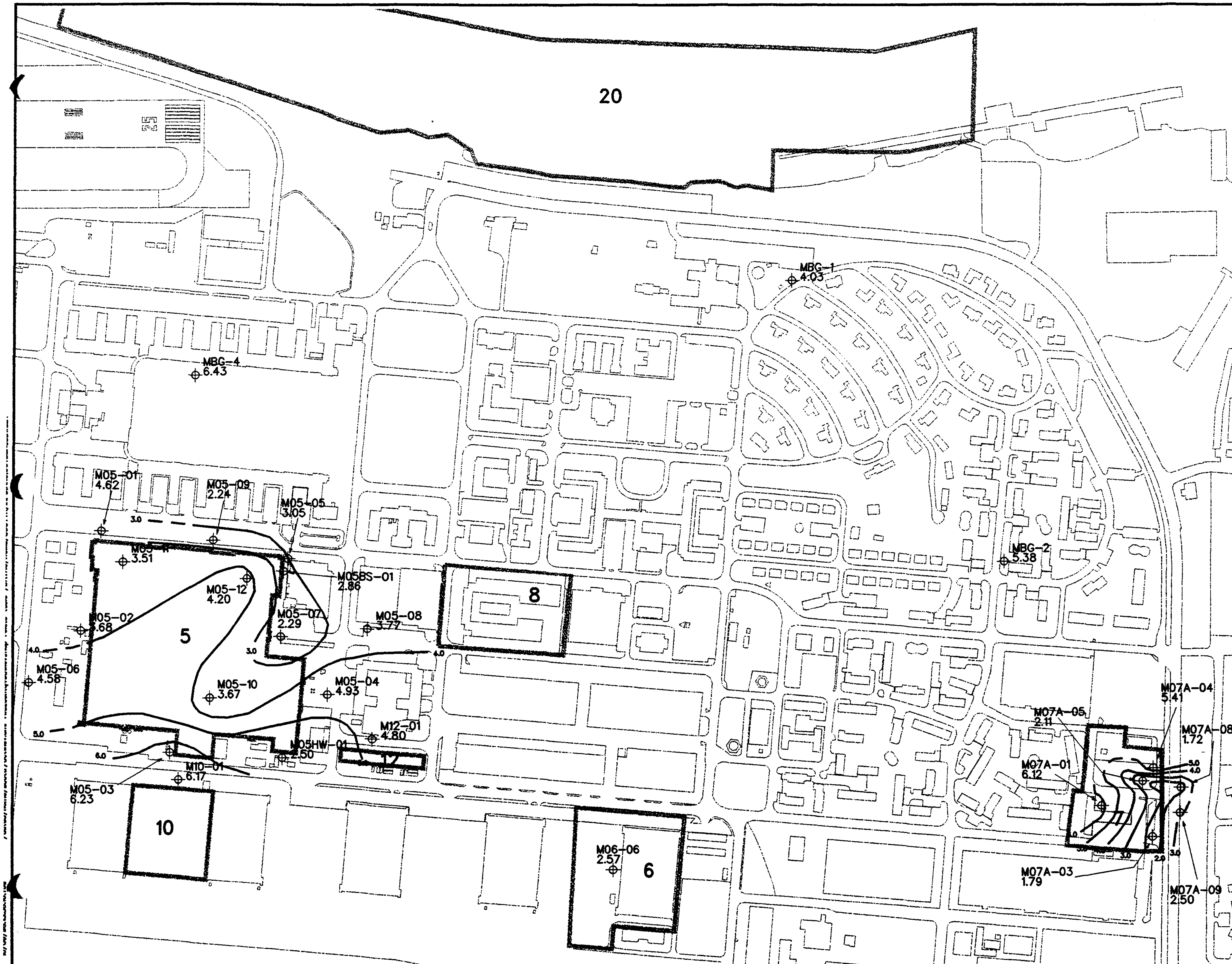


LEGEND

⌖ MONITORING WELL FIRST WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

[8] INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

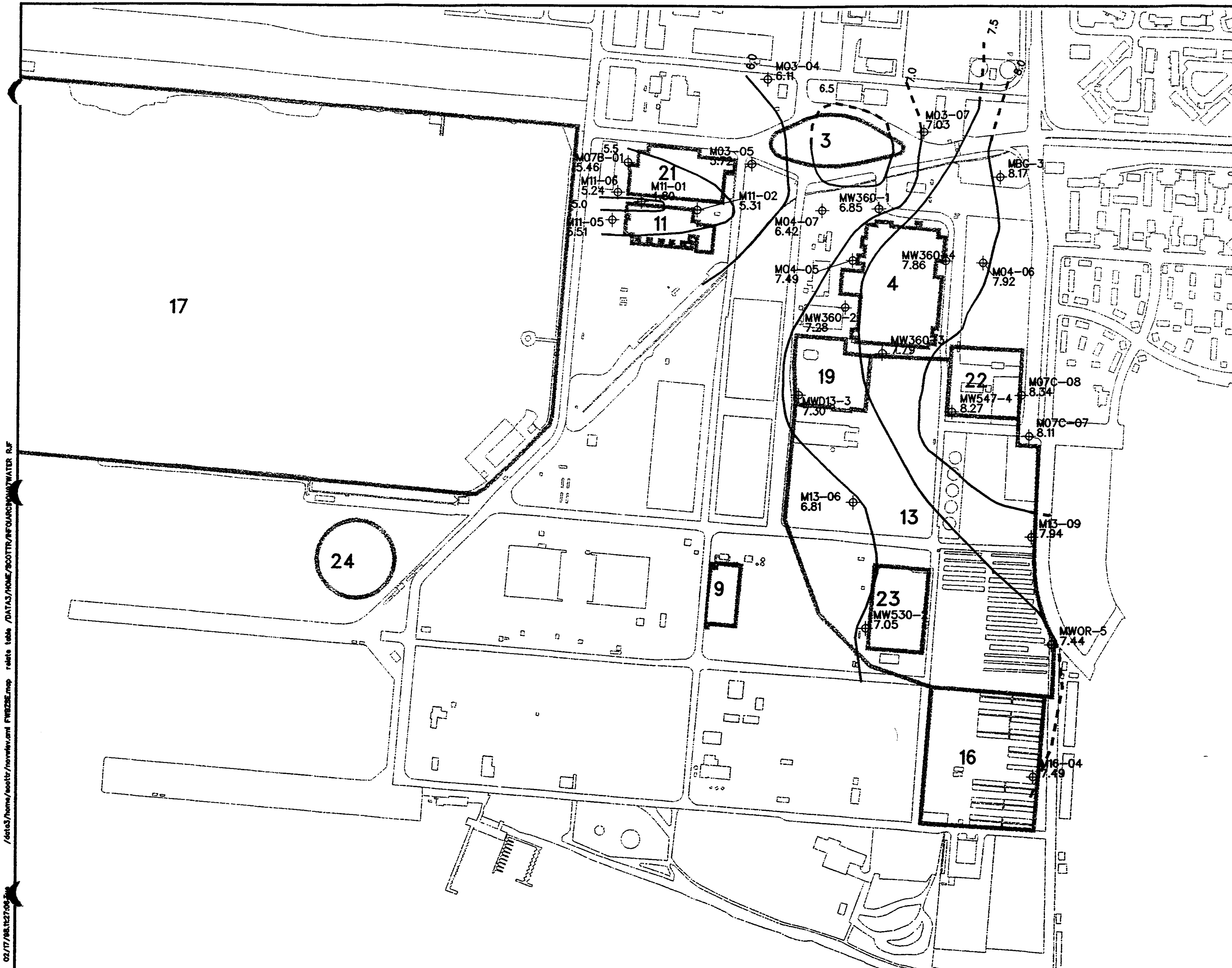
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON AUGUST 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

200 0 200 400

SCALE: 1" = 400'

FIGURE 2.1-2 (SHEET 4)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
CENTRAL REGION
QUARTER 4
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

⊕ MONITORING WELL FIRST WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

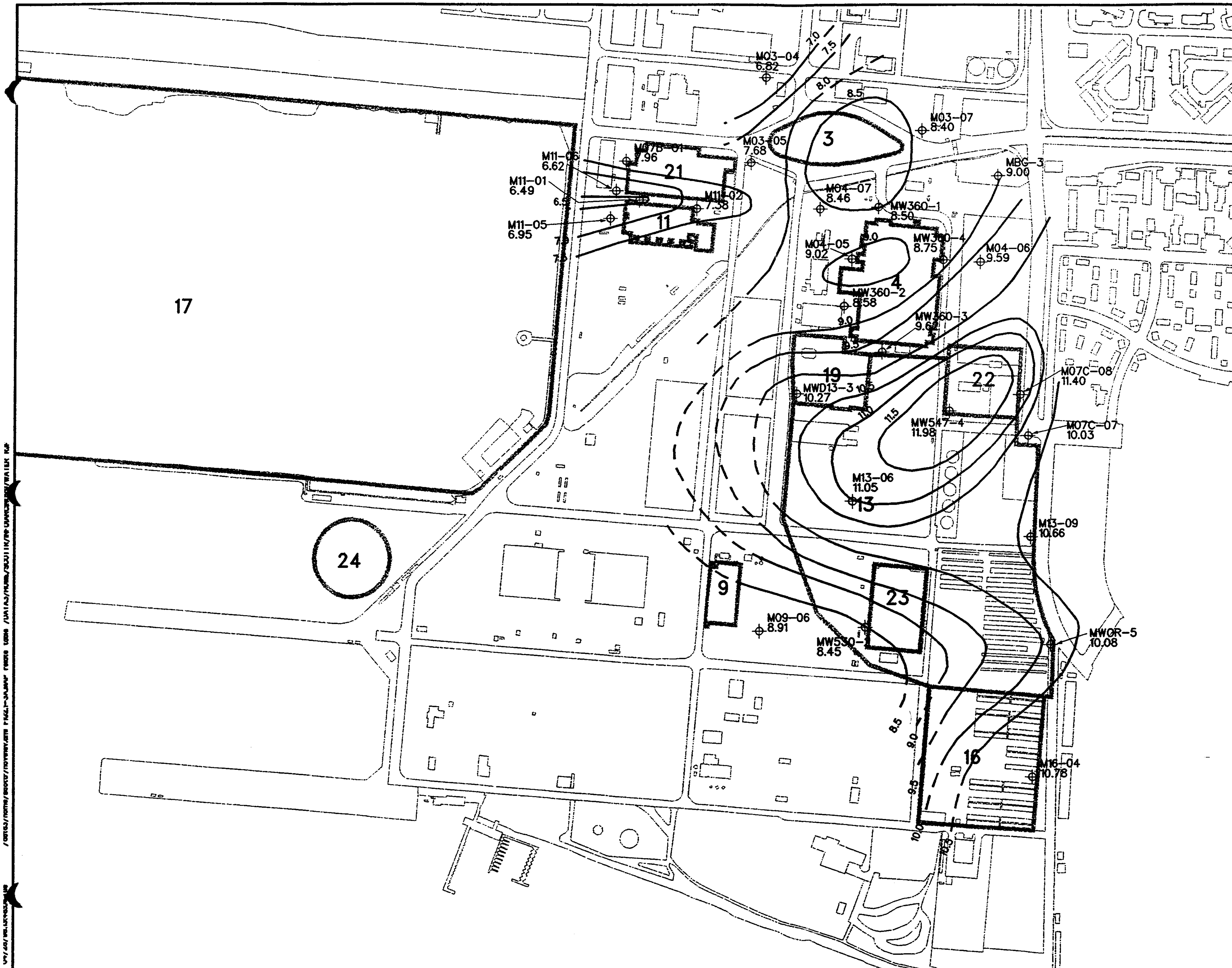
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON NOVEMBER 1997 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

200 0 200 400

SCALE: 1" = 400'

FIGURE 2.1-3 (Sheet 1)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
SOUTHEASTERN REGION
QUARTER 1
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

⌖ MONITORING WELL
FIRST WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION
(FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET
(MEAN LOWER LOW WATER),
DASHED WHERE INFERRED

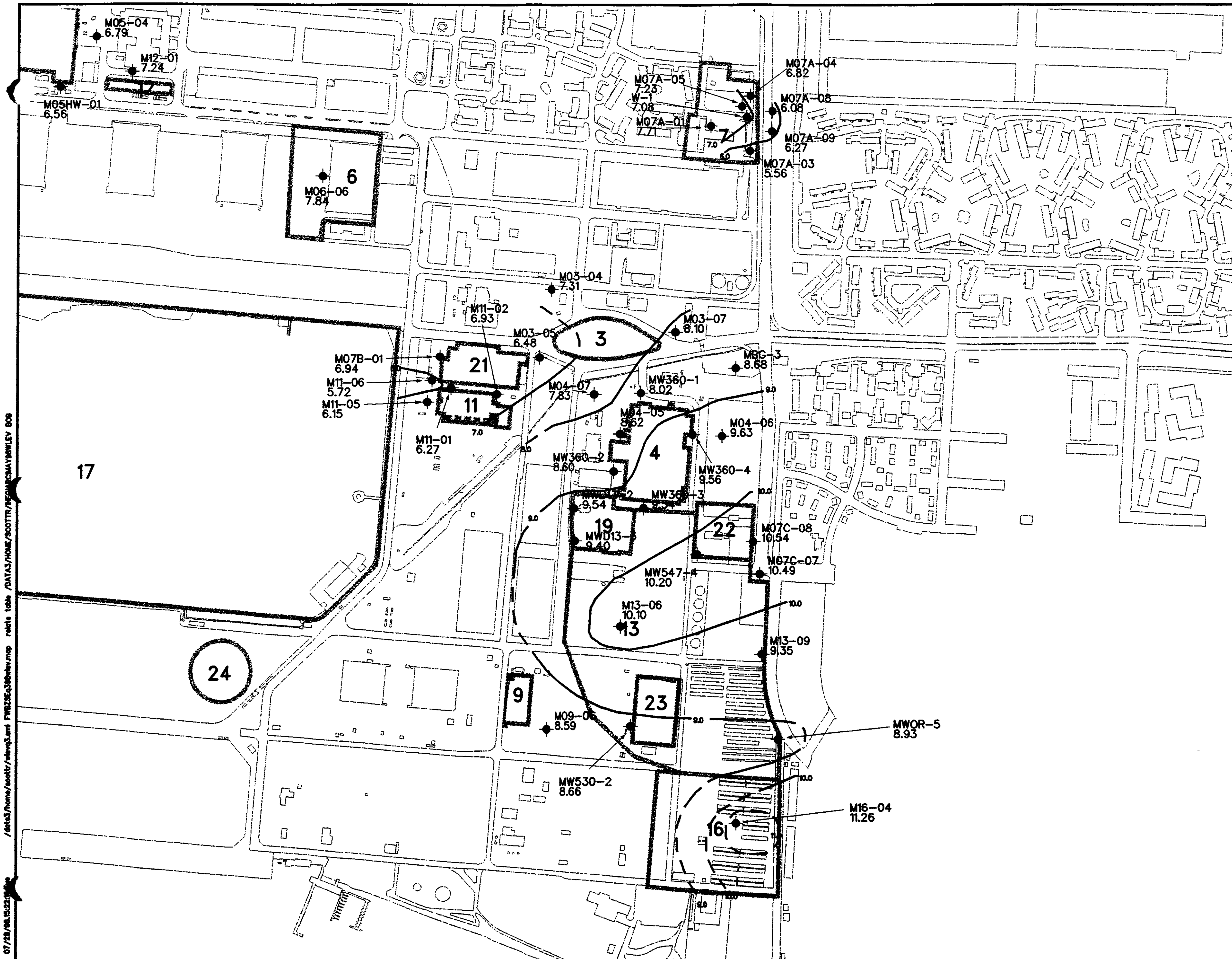
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON FEBRUARY 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

200 0 200 400

SCALE: 1" = 400'

FIGURE 2.1-3 (Sheet 2)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
SOUTHEASTERN REGION
QUARTER 2
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

- MONITORING WELL
- PIEZOMETER
- 4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)
- 8 INSTALLATION RESTORATION SITE
- —4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

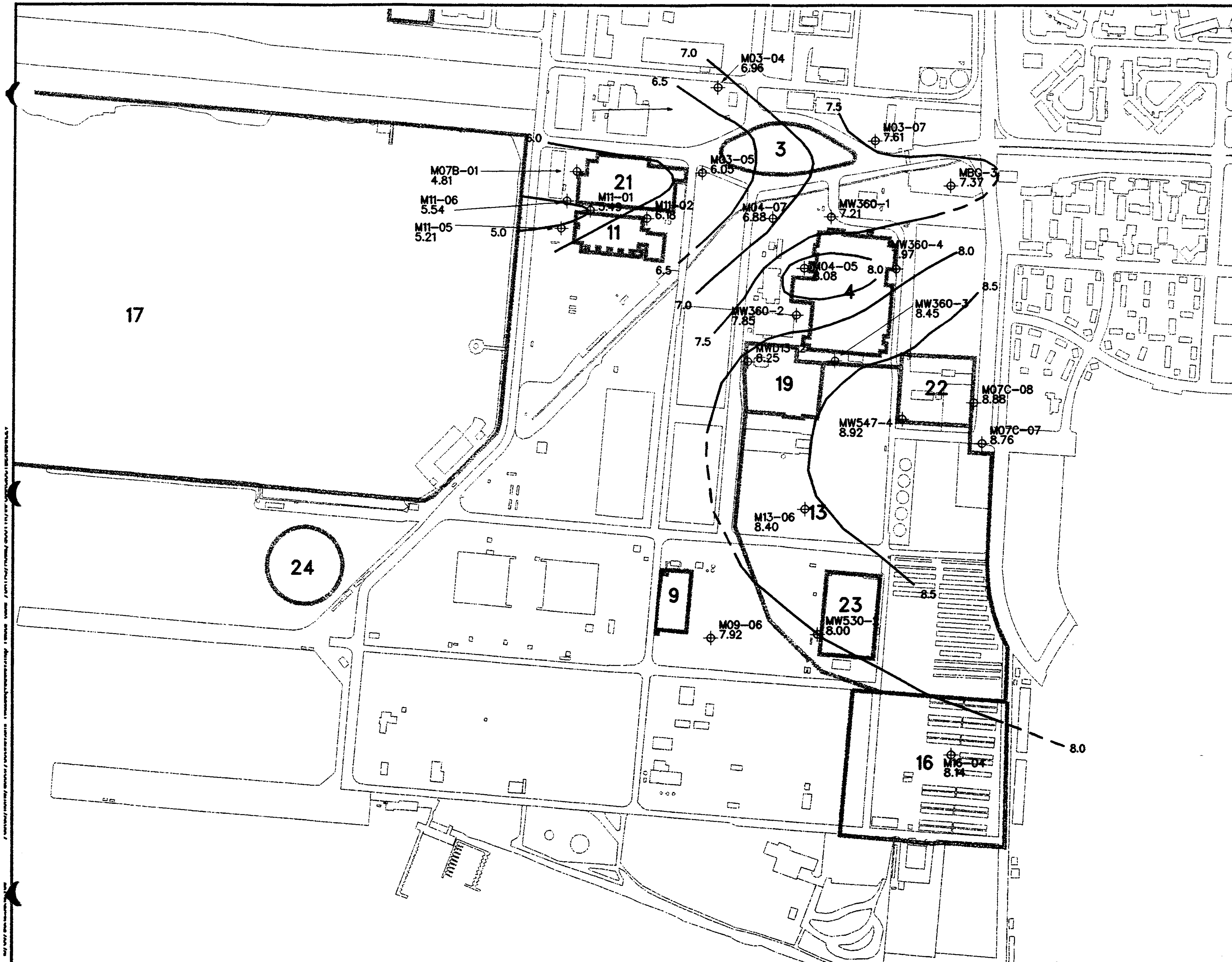
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON MAY 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

250 0 250 500

SCALE: 1" = 500'

FIGURE 2.1-3 (Sheet 3)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
SOUTHEASTERN REGION
QUARTER 3
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

- ⌖ MONITORING WELL FIRST WATER-BEARING ZONE
- 4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)
- **8** INSTALLATION RESTORATION SITE
- —4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

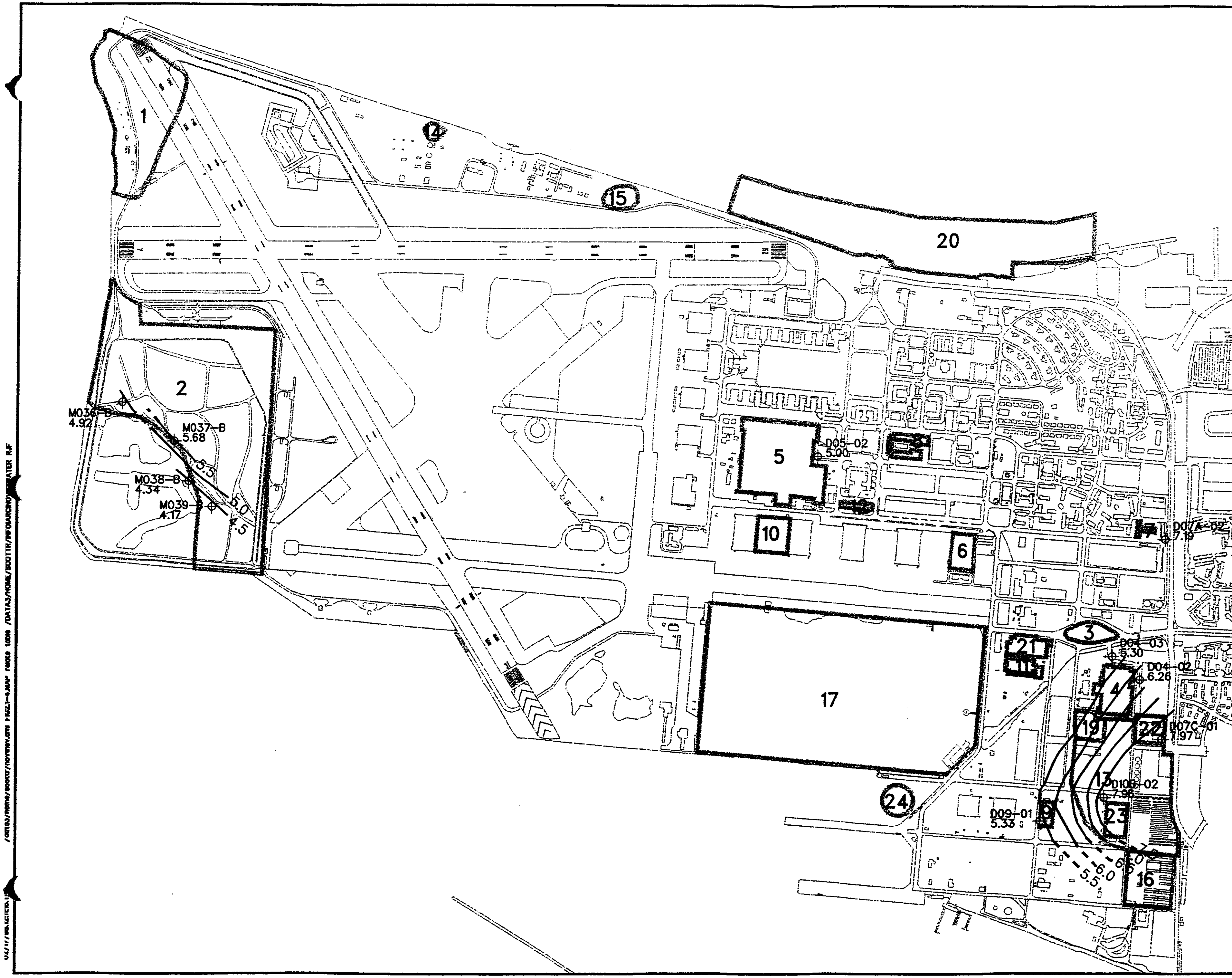
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON AUGUST 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

200 0 200 400

SCALE: 1" = 400'

FIGURE 2.1-3 (SHEET 4)
POTENTIOMETRIC SURFACE MAP
FIRST WATER BEARING ZONE
SOUTHEASTERN REGION
QUARTER 4
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

MONITORING WELL
SECOND WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION
(FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET
(MEAN LOWER LOW WATER),
DASHED WHERE INFERRED

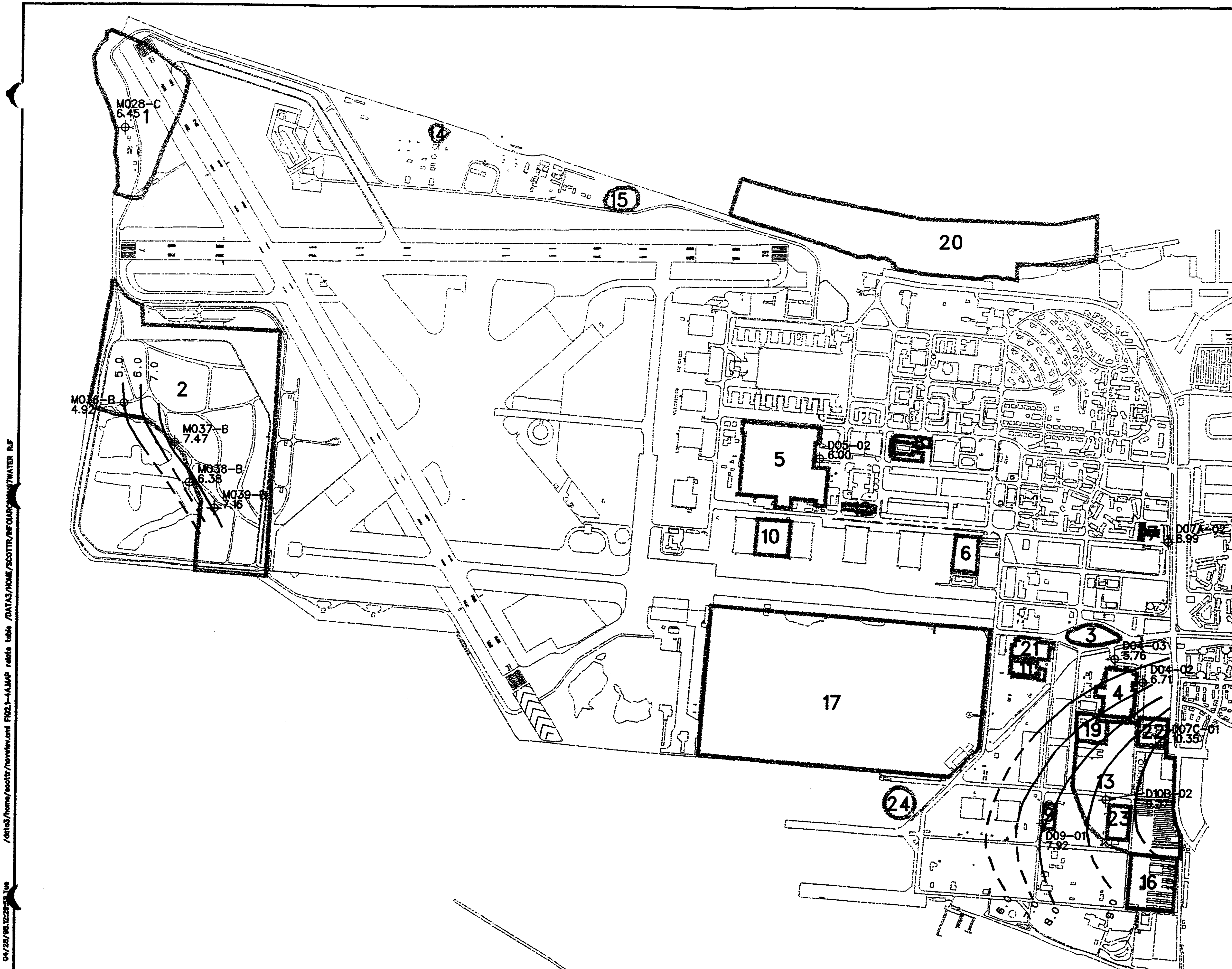
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON NOVEMBER 1997 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

500 0 500 1000

SCALE: 1" = 1000'

FIGURE 2.1-4 (Sheet 1)
POTENTIOMETRIC SURFACE MAP
SECOND WATER BEARING ZONE
QUARTER 1
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

MONITORING WELL
SECOND WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION
(FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET
(MEAN LOWER LOW WATER),
DASHED WHERE INFERRED

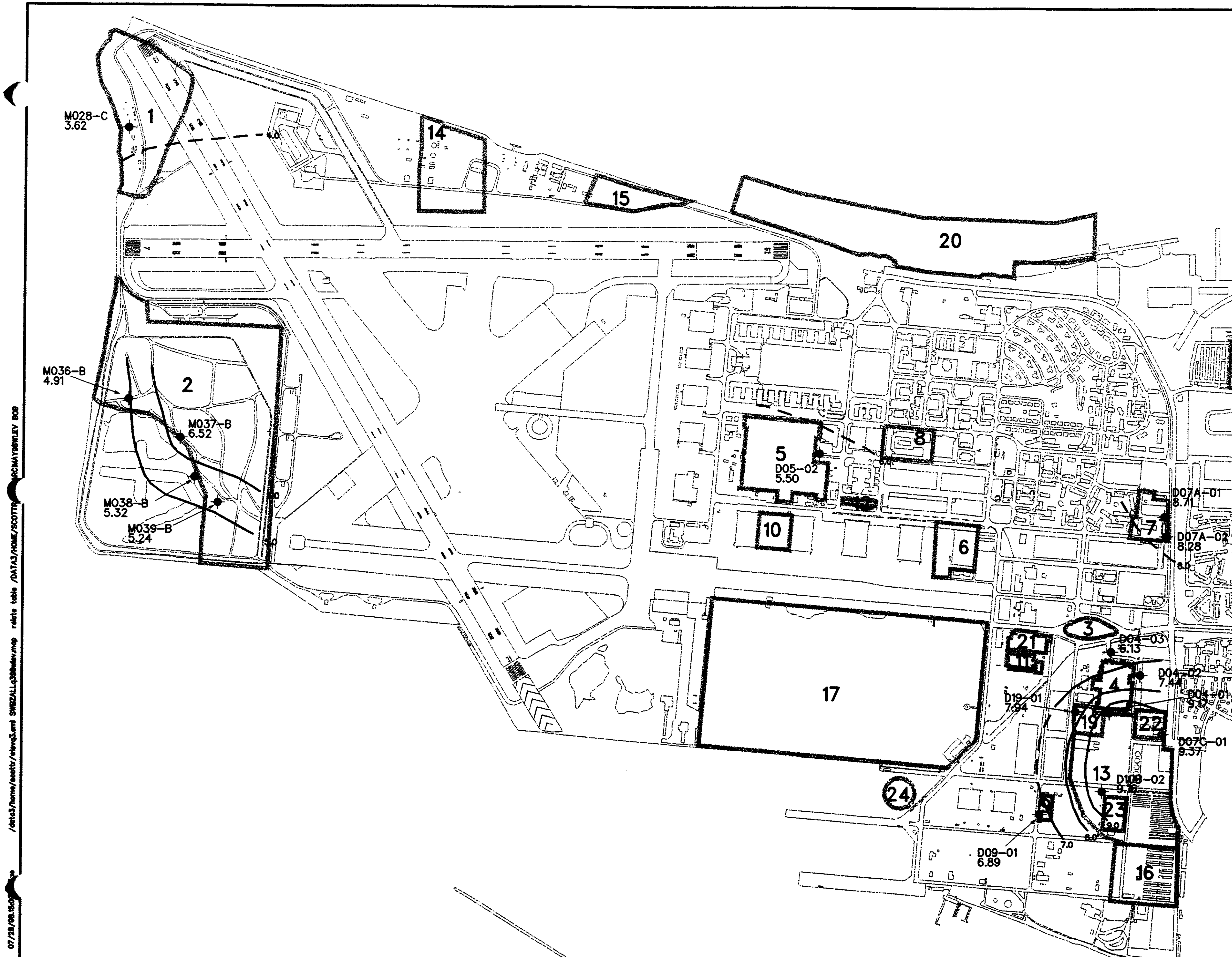
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON FEBRUARY 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

500 0 500 1000

SCALE: 1" = 1000'

FIGURE 2.1-4 (Sheet 2)
POTENTIOMETRIC SURFACE MAP
SECOND WATER BEARING ZONE
QUARTER 2
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

- MONITORING WELL
- PIEZOMETER

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

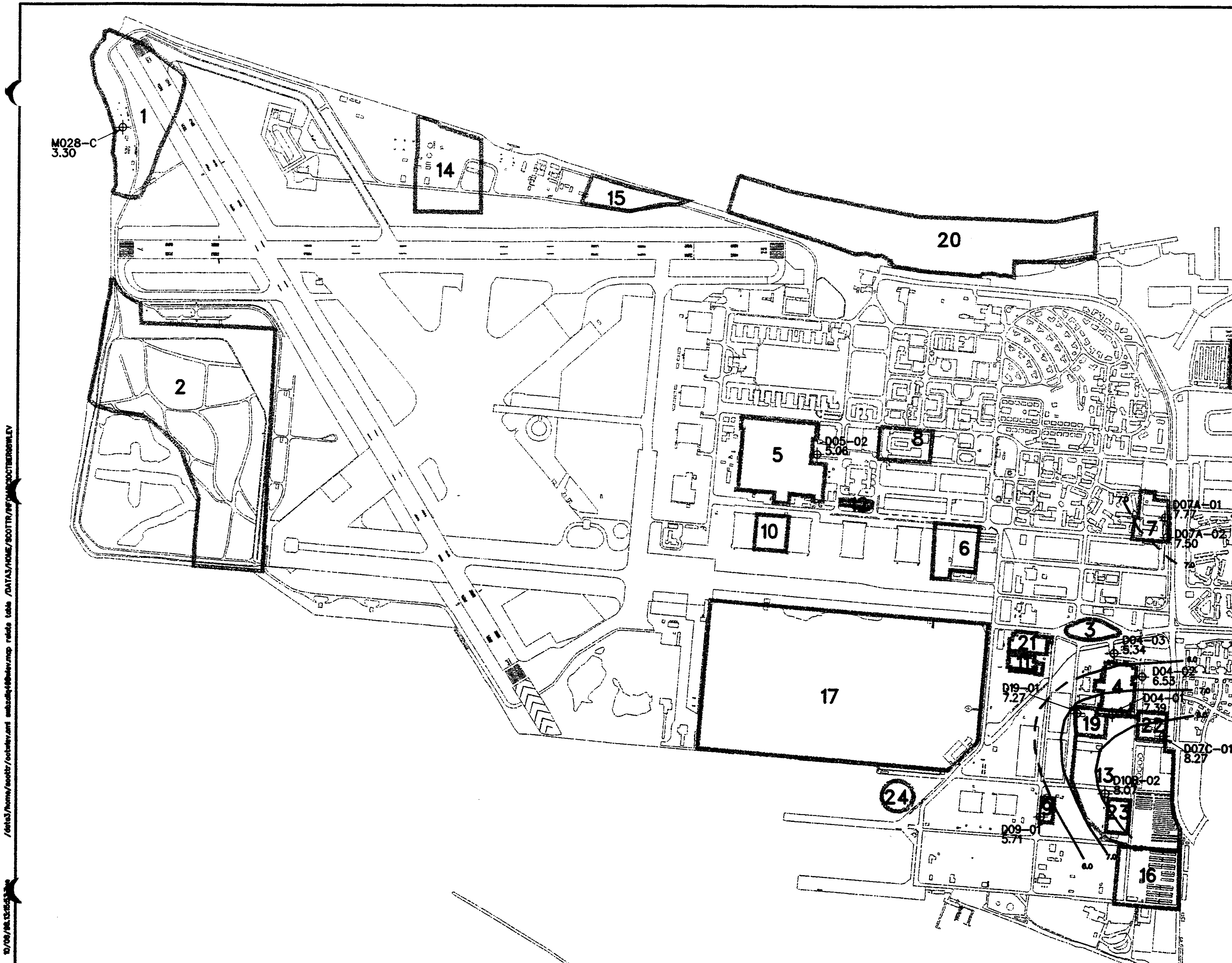
NOTE: POTENTIOMETRIC SURFACE MAP BASED ON MAY 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

500 0 500 1000

SCALE: 1" = 1000'

FIGURE 2.1-4 (Sheet 3)
POTENTIOMETRIC SURFACE MAP
SECOND WATER BEARING ZONE
BASEWIDE REGION
QUARTER 3
ALAMEDA POINT
ALAMEDA, CALIFORNIA



LEGEND

⌖ MONITORING WELL SECOND WATER-BEARING ZONE

4.21 GROUNDWATER ELEVATION (FEET ABOVE MEAN LOWER LOW WATER)

8 INSTALLATION RESTORATION SITE

—4.5— WATER ELEVATION CONTOUR IN FEET (MEAN LOWER LOW WATER), DASHED WHERE INFERRED

NOTE: POTENTIOMETRIC SURFACE MAP BASED ON AUGUST 1998 TIDALLY CORRECTED GROUNDWATER ELEVATION DATA.

N

500 0 500 1000

SCALE: 1" = 1000'

FIGURE 2.1-4 (SHEET 4)
POTENTIOMETRIC SURFACE MAP
SECOND WATER BEARING ZONE

QUARTER 4

ALAMEDA POINT

ALAMEDA, CALIFORNIA

3.0 REGIONAL AND LOCAL GEOLOGY AND HYDROGEOLOGY

This section provides information on the geographic, geologic, hydrogeologic, and hydrostratigraphic features of Alameda Point.

3.1 GEOGRAPHIC SETTING

Alameda Point is located at the western end of the Island of Alameda, which lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley hills on the east to the shore of San Francisco Bay. Originally a peninsula, the Island of Alameda was detached from the mainland in 1902 when a channel was cut linking San Leandro Bay with the San Francisco Bay. The northern portion of the Island of Alameda was formerly tidelands, marshlands, and sloughs adjacent to the historical San Antonio Channel, now known as the Oakland Inner Harbor. Most of the land that is now Alameda Point was created by filling the natural tidelands, marshlands, and sloughs with dredge spoils from the surrounding San Francisco Bay, the Sea Plane Lagoon, and Oakland Inner Harbor, and deposited hydraulically in the late 1930s and early 1940s.

The San Francisco Bay Area (Bay Area) experiences a maritime climate with mild summer and winter temperatures. Prevailing winds in the Bay Area are from the west. Because of the varied topography of the Bay Area, climatic conditions vary considerably throughout the region. Heavy fogs occur on an average of 21 days per year. Rainfall occurs primarily during the months of October through April. According to air traffic controllers at the Alameda Point, the area averages approximately 18 inches of rainfall a year. There are no naturally occurring surface streams or ponds at Alameda Point, so precipitation either returns to the atmosphere by evapotranspiration, runs off in the storm drain system that discharges to San Francisco Bay, or infiltrates to the groundwater.

3.2 GEOLOGY AND HYDROGEOLOGY

The following subsections provide an overview of the geology of the San Francisco Bay region, as well as the local geology of the western, central, and southeastern regions of Alameda Point.

3.2.1 Regional Geology

Alameda Point is located in the central portion of the eastern side of the San Francisco Bay and occupies a depression between two uplifted areas: the Berkeley Hills on the east and the Montara and other mountains on the west. The depression and uplifted areas are formed by two subparallel active faults: the San Andreas Fault to the west and the Hayward Fault to the east of the Bay Area.

Alameda Point and the San Francisco Bay are underlain by metamorphosed sandstone, siltstone, shale, graywacke, and igneous bedrock of Jurassic age, which form the Franciscan Formation. Late Quaternary sediments unconformably overlie the bedrock. The Quaternary sediments consist of five units, from top to bottom: the Bay Mud Formation, the Merritt Sand Formation, the upper and lower units of the San Antonio Formation, and the Alameda Formation (Lawson 1914). Due to its depth, the Alameda Formation was not encountered during installation of the quarterly sampling wells or during other activities in the RI and feasibility study (FS). Figure 3.2-1 conceptually illustrates the regional geology of Alameda Point and the surrounding area.

The lower unit of the San Antonio Formation (the Yerba Buena Mud) is believed to be an effective and locally continuous hydraulic barrier to the underlying deep aquifers. Therefore, the basewide geology presented in this report will consist of the upper four Quaternary units, plus a surficial layer of artificial fill material. Also, because the Bay Mud Formation locally consists of silt and clay with laterally discontinuous layers of silty and clayey sands, the formation is referred to as the bay sediments in this report (Figure 3.2-1).

3.2.2 Alameda Point Geology

Three regions of Alameda Point have been defined for ease of discussion based on geologic and hydrogeologic similarities: western, central, and southeastern (Figure 3.2-2). Further, the large distances between sites in the runway and administrative areas necessitate separation of otherwise physically similar sites into either the western or central regions to preserve graphical scale for data presentation. The residential area in the northeastern portion of Alameda Point is not included in any of the defined regions because no IR sites occur in this area. The geology in the residential area is similar to the geology of the central region; however, the artificial fill material and Merritt Sand Formation tend to thin and the bay sediments tend to thicken toward the east. The following sections describe the general Alameda Point geology, as well as the geology in the western, central, and southeastern regions of Alameda Point.

Artificial fill is present throughout most of Alameda Point and overlies all other late Quaternary sediments. The artificial fill material is composed of various soil and sediment types. The dominant fill type is poorly graded, fine- to medium-grained sand with silt and clay. The artificial fill layer thickness ranges from a few feet at the eastern portion of Alameda Point to 20 feet at the western edge of Alameda Point. The artificial fill materials are believed to be dredge spoils from the surrounding San Francisco Bay, the Seaplane Lagoon, and the Oakland Inner Harbor.

The bay sediments (young Bay Mud) consist of silt and gray to black clay with laterally discontinuous, poorly graded, silty and clayey sand layers. The thickness of the bay sediments ranges from 10 to 110 feet throughout Alameda Point. However, the bay sediments are thin or absent in the southeastern region of Alameda Point. The bay sediments were likely deposited in an estuarine environment during the Holocene epoch.

Over most of Alameda Point, the Merritt Sand Formation underlies the bay sediments. The Merritt Sand outcrops or underlies a thin artificial fill layer in the southeastern region. The Merritt Sand is composed of brown, fine- to medium-grained, poorly graded sand. The formation is up to 60 feet thick and is thickest at the southern and eastern portions of Alameda Point. The Merritt Sand Formation is believed to be eolian in origin and was deposited during the late Pleistocene and Holocene epochs (Sloan 1992). The Merritt Sand Formation is absent at a major paleochannel that crosses Alameda Point from the northeast to west. A paleochannel is a stream channel that has eroded through preexisting sediments and has been backfilled with sediments of a different type and age. Therefore, channel erosion appears to be the reason for the missing Merritt Sand unit. The trend of the paleochannel is shown on Figure 3.2-3. The paleochannel was filled with low permeability silts and clays with discontinuous layers of poorly graded sands associated with the bay sediment unit. The poorly graded sands become more continuous and thicker in the western region of Alameda Point. The northeast to west-trending paleochannel is believed to be a barrier to groundwater flow between the northern and southern portions of the central region of Alameda Point.

The upper unit of the San Antonio Formation generally underlies the Merritt Sand Unit and consists of interbedded layers of sand and clay with a thickness of up to 70 feet. The upper unit of the San Antonio Formation is present over most of Alameda Point, but absent at the paleochannel located in portions of the western and central regions of Alameda Point. The upper unit of the San Antonio Formation appears to have been deposited in a deltaic environment during the late Pleistocene to Holocene epochs.

The lower unit of the San Antonio Formation is the Yerba Buena Mud (old Bay Mud), which consists of gray silty clay and clay. This layer of clay deposits was encountered consistently throughout Alameda Point. The total thickness of the Yerba Buena Mud is reported to range from 55 to 90 feet. The aforementioned paleochannel partially eroded into the Yerba Buena Mud, but does not bisect the unit. The paleochannel was backfilled with clays and silts of the young Bay Mud. The Yerba Buena Mud is believed to have formed in a low energy estuarine environment during the late Pleistocene epoch (Sloan 1992).

3.2.2.1 Western and Central Region Geology

The western region of Alameda Point is bound by San Francisco Bay to the west and south and by the Oakland Inner Harbor to the north (Figure 3.2-2). Figure 3.2-4 provides schematic cross sections of the western region. All five geologic units described in the previous section were encountered in this region during the RI/FS investigation. The fill layer is continuous throughout the region and appears to be approximately 15 to 20 feet thick along the western boundary of Alameda Point. This layer is thicker in the western portion of the western region. Thickness of fill decreases progressively in the northern direction. The second layer, the bay sediments, is a widespread unit that ranges in thickness from 30 to 110 feet. The upper 10 to 50 feet of the bay sediments unit is composed mainly of fine-grained clay and silt. Near the western boundary of Alameda Point, the lower portion of the unit consists predominantly of sand. The third and fourth layers, the Merritt Sand and upper unit of the San Antonio Formation, are also present throughout most of the western region with average thicknesses of 40 feet and 10 feet, respectively. Figure 3.2-4 shows an area where the Merritt Sand and interbedded clay and sand of the upper San Antonio Formation are absent. The absence of these two layers is attributed to the westward trending paleochannel discussed in Section 3.2.2. The fifth layer, the Yerba Buena Mud, was encountered at 80 to 120 feet below ground surface (bgs) throughout the region and is 70 to 90 feet thick.

The central region is defined as the area between the Oakland Inner Harbor and Seaplane Lagoon, excluding the northeastern residential area (Figure 3.2-2). Figure 3.2-5 shows schematic cross sections of the central region. All five geologic units were encountered in this region during the RI/FS. Each unit exhibits little variation in thickness in most portions of the central region, with the exception of the eastern end of the central region and in immediate proximity to the paleochannel. The artificial fill layer is 10 to 20 feet thick in the central region. The bay sediments range in thickness from 10 to 35 feet with the thinnest area at the northern boundary near the Oakland Inner Harbor except in immediate proximity to the paleochannel. In the central industrial areas, the upper portion of the bay sediment consists of interbedded silt and sand layers. The Merritt Sand ranges in thickness from 20 to 35 feet. The upper unit of the San Antonio Formation is found at a depth of 50 feet bgs in the southern portion of the region and at approximately 60 feet bgs in the eastern portion. The upper unit of the San Antonio Formation is approximately 15 feet thick. The fifth layer, the Yerba Buena Mud, is located at 80 to 120 feet bgs and is 50 to 90 feet thick. The Merritt Sand and upper unit of the San Antonio Formation thin in the central portion of the region due to the presence of the westward trending paleochannel discussed in Section 3.2.2.

3.2.2.2 Southeastern Region Geology

The southeastern region includes the area east of the Seaplane Lagoon (Figure 3.2-2). Figure 3.2-6 shows schematic cross sections of the southeastern region. Geology in this region is significantly different than the rest of Alameda Point. All five geologic units were encountered in the region during the RI/FS. However, the artificial fill layer is absent or thinner (generally less than 10 feet thick) compared to other regions of Alameda Point. Also, the bay sediment unit is thin or absent throughout most of the southeastern region and consists of poorly graded sand where present. The Merritt Sand unit is encountered at depths ranging between 0 to 10 feet bgs and is up to 60 feet thick. Underlying the Merritt Sand, the upper unit of the San Antonio Formation is approximately 20 feet thick. The Yerba Buena Mud was encountered at a depth of 90 to 115 feet bgs and is 55 to 80 feet thick.

3.2.3 Alameda Point Hydrogeology

As described in Section 3.2.2, Alameda Point has been divided into three regions (western, central, and southeastern) based on geologic and hydrogeologic similarities. Further, the great distances between sites in the runway and administrative areas necessitate separation of otherwise physically similar sites into either the western or central regions to preserve graphical scale for data presentation. In the western and central regions of Alameda Point, the five geologic units form four hydrogeologic units (from top to bottom): the FWBZ in the artificial fill layer, the bay sediment aquitard (BSA), the SWBZ in the Merritt Sand unit and upper San Antonio Formation, and the Yerba Buena Mud aquitard (Figure 3.2-7). In the southeastern region, only two hydrogeologic units are identified because of the discontinuous nature or absence of the confining BSA: the FWBZ in the Merritt Sand unit and the Yerba Buena Mud aquitard.

The FWBZ in the western and central regions is found in the artificial fill overlying the BSA. It is connected to the FWBZ in the southeastern region by a thin layer of artificial fill overlying the BSA. The BSA pinches out along an east to west-trending line under Site 3 along Atlantic Avenue. The FWBZ in the southeastern region is found in both the thin layer of artificial fill and Merritt Sand unit. The SWBZ, identified in the western and central regions, is not present in the southeastern region due to the absence of the confining BSA. In the absence of a confining layer, the entire Merritt Sand unit in the southeastern region is identified as the FWBZ. Figure 3.2-8 provides a hydrogeological conceptual model for the western and central regions, while Figure 3.2-9 provides a hydrogeological conceptual model for the southeastern region. Hydrogeology specific to the western, central, and southeastern regions is discussed below.

During past groundwater monitoring events, the groundwater piezometric surface measured in wells screened in the upper and lower intervals of the FWBZ differed by up to 2 feet in some areas. This difference was noted in all three regions of Alameda Point. Due to this irregularity in the piezometric surfaces between wells screened in the upper and lower portions of the FWBZ and the absence of a discernible confining layer, the FWBZ has been formally divided into two separate hydrogeologic intervals, the first water-bearing zone upper (FWBZU) and the first water-bearing zone lower (FWBZL). In the western and central regions, the majority of the FWBZ is in the artificial fill layer; however, the FWBZL may extend into the bay sediments layer where a silty or clayey sand layer is present. Similarly, the SWBZ has been divided into two separate hydrogeologic intervals, the second water-bearing zone upper (SWBZU) and the second water-bearing zone lower (SWBZL). Most of the SWBZ is in the Merritt Sand unit, while the SWBZL extends into the interbedded silty and clayey sands of the upper San Antonio Formation. In the southeastern region, the FWBZU is composed of artificial fill and poorly graded upper Merrit Sand unit, while the FWBZL is composed of the well-graded lower Merritt Sand unit and the upper San Antonio Formation.

The use of the phrase "hydrogeologic intervals" does not mean that a barrier to flow is present, only that the potentiometric heads of the "interval" are different. This difference in potentiometric head may be related to a local restriction of flow related to compression of sediments or alternating grading sequences of sediments during deposition. Therefore, the division of the FWBZ and SWBZ into upper and lower intervals is only relevant to the discussion of groundwater hydraulics. The presentation and discussion of chemical data in later chapters assumes that sufficient communication (flow) exists between the upper and lower intervals (no confining layer) for contaminant migration to occur.

3.2.3.1 Western and Central Region Hydrogeology

Four hydrogeologic units are identified in the western and central regions (Figure 3.2-8). The FWBZ is an unconfined (water table) aquifer composed of artificial fill material. At locations in the runway and industrial areas of the central region, the upper portion of the BSA contains silty and clayey sand layers. Therefore, the FWBZL may extend into the sand layers of the upper BSA (Figure 3.2-8). The FWBZ is found at approximately 6 feet bgs. The saturated thickness of the FWBZ ranges from less than 10 feet in the central region to over 30 feet at the western region.

The BSA underlies the FWBZ and is generally composed of silt and clay. In the western region, the upper portion of the BSA consists entirely of silt and clay. The distinction between the FWBZ and the BSA is clear in these areas. The BSA appears to be less distinct in the central region where the upper portion of the BSA consists of interbedded silt and sand. In the northern portion of the central region, the BSA is 20 to 100 feet thick and consists mainly of silt and clay.

The SWBZ in the western and central regions is confined and composed of the lower portion of the BSA, the Merritt Sand Formation (where present), and the upper unit of the San Antonio Formation. In the western region, the Merritt Sand Formation and the upper unit of the San Antonio Formation are not laterally continuous. However, the lower portion of the BSA, which consists mainly of poorly graded sand, forms the SWBZ where the Merritt Sand and the upper unit of the San Antonio Formation are absent. The SWBZ varies in thickness from 0 to 50 feet as a result of erosion activity associated with the northeast to west-trending paleochannel.

The SWBZ is underlain by the Yerba Buena Mud aquitard, which appears to be thick and continuous throughout the entire installation. The Yerba Buena Mud aquitard is believed to be an effective hydraulic barrier between the SWBZ and the underlying Alameda Formation. The Yerba Buena Mud aquitard is 50 to 90 feet thick.

3.2.3.2 Southeastern Region Hydrogeology

Two hydrogeologic units have been identified in the southeastern region of Alameda Point; the FWBZ and the Yerba Buena Mud. The FWBZ is composed of artificial fill material, the Merritt Sand, and the upper unit of the San Antonio Formation. Because the BSA is absent in most of the southeastern region, the FWBZ is unconfined (Figure 3.2-9). The FWBZ is found at approximately 6 feet bgs. The FWBZ is up to 100 feet thick in the southeastern region. The Yerba Buena Mud aquitard, underlying the FWBZ, is believed to be an effective hydraulic barrier between the FWBZ and the underlying Alameda Formation. The Yerba Buena Mud aquitard is 55 to 80 feet thick.

3.2.4 Groundwater Hydraulics

Groundwater hydraulics for the western, central, and southeastern regions are discussed below. Approximate groundwater flow directions for Alameda Point are presented on Figure 3.2-10.

3.2.4.1 Western and Central Region Hydraulics

The FWBZ in the western and central regions is an unconfined (water table) aquifer composed of artificial fill. The depth to groundwater ranges from 2 to 8 feet bgs and is typically 3 to 5 feet bgs. The elevation of the water table in the FWBZ ranges from 3 to 12 feet mean lower low water (MLLW) and is typically 6 to 9 feet MLLW.

Hydraulic conductivity in the FWBZ varies throughout the western and central regions. Aquifer testing in the western and central regions has yielded hydraulic conductivity value ranges of 7.45×10^{-3} to 2.2×10^{-2} centimeters per second (cm/s) and 3.56×10^{-3} to 8.13×10^{-3} cm/s, respectively. Hydraulic conductivity is also believed to vary across the depth of the unconfined aquifer due to the stratification of the sedimentary deposits.

Groundwater flow in the FWBZ is horizontal and generally flows radially from the central portions of each region toward San Francisco Bay, the Oakland Inner Harbor, and the Seaplane Lagoon (Figure 3.2-10). Groundwater flow immediately adjacent to the north side of the Seaplane Lagoon is altered by a sheet pile wall located along the north edge of the Seaplane Lagoon. The presence of the sheet pile wall has resulted in mounding of groundwater north of the Seaplane Lagoon. Groundwater flow is impacted locally near industrial buildings by preferential flow paths such as storm water drains and underground utility conveyance structures. Water levels in the vicinity of industrial buildings indicate localized regions of groundwater mounding or groundwater sinks. Groundwater recharge to the FWBZ is attributed to vertical infiltration from precipitation, horticultural irrigation, and leaking water supply, sewer, and stormwater pipes. Tidal inundation of wetland areas and storm water conveyance lines may also contribute recharge to the FWBZ.

The FWBZ is tidally influenced on the north, west, and south sides of Alameda Point. Tidal influence studies indicate the region of influence extends approximately 250 to 300 feet inland on the north and south sides, and approximately 1,000 to 1,500 feet on the west side. Diurnal tidal fluctuations measured in the FWBZ range from 0.1 to 4 feet (TtEMI 1997).

Vertical hydraulic communication between the FWBZ and SWBZ through the BSA is believed to be minimal. The BSA behaves as a hydraulic barrier between the FWBZ and SWBZ, because the low hydraulic conductivity of the silty sands and silty clays which make up the BSA restricts the flux of groundwater. Furthermore, the flow is predominantly in the horizontal direction. Water level data collected from clustered wells generally show a difference of 1 to 2 feet in water levels between the two water-bearing zones. Clustered wells consist of monitoring wells located in close proximity to one another and screened in different water-bearing zones or intervals within a water-bearing zone. Local vertical hydraulic gradients determined at various locations in the western and central regions ranged from 0.01 to 0.02 foot/foot. Local horizontal gradients calculated at similar locations ranged from 0.001 to 0.003 foot/foot. Hydraulic conductivity values determined for the silty clays of the BSA are typically on the order of 10^{-5} cm/s, while hydraulic conductivity values for the FWBZ and SWBZ are on the order of 10^{-3} cm/s. Darcy's Law then implies that the horizontal component of flow is generally an order-of-magnitude greater than the vertical component. Therefore, flow is generally dominated by the horizontal component.

The SWBZ appears to be a confined or semiconfined aquifer and is composed of the lower portion of the BSA, Merritt Sand unit, and upper unit of the San Antonio Formation. The potentiometric elevation of the SWBZ ranges from 3 to 9 feet MLLW.

Multiple slug tests performed in wells screened in the SWBZ of the western region indicate that the hydraulic conductivity of the SWBZ ranges from 5.2×10^{-5} to 2.3×10^{-3} cm/s.

The recharge in the SWBZ is mainly by lateral flow (through the Merritt Sand) from upgradient areas on Alameda Island. The sources of recharge water for the Merritt Sand unit are precipitation, irrigation, and water supply, sewer, and stormwater pipe leakage. The SWBZ is believed to discharge through lateral groundwater flow to San Francisco Bay, the Oakland Inner Harbor, and the Seaplane Lagoon.

3.2.4.2 Southeastern Region Hydraulics

The shallow aquifer system in the southeastern region consists of only the unconfined FWBZ. The FWBZ is up to 100 feet thick and is composed of artificial fill and the Merritt Sand unit, a much more substantial hydrogeologic unit than the FWBZ in other regions of Alameda Point. The depth to groundwater in the FWBZ is approximately 2 to 8 feet bgs, similar to that of the FWBZ in the other regions of Alameda Point. As discussed in Section 3.2.3, the FWBZ (Merritt Sand unit) in the southeastern region is hydraulically connected both to the FWBZ (artificial fill layer) and SWBZ (Merritt Sand unit) in the central region by a thin layer of artificial fill along an east to west-trending line under Site 3. The elevation of the water table in the FWBZ ranges from 3 to 12 feet MLLW and is typically 6 to 9 feet MLLW.

Hydraulic conductivity in the FWBZ varies throughout the southeastern region. Aquifer testing has yielded hydraulic conductivity value ranges of 1.22×10^{-3} to 3.86×10^{-3} cm/s. Hydraulic conductivity is also believed to vary across the depth of the unconfined aquifer due to the stratification of the sedimentary deposits.

Groundwater in the FWBZ generally flows from the east or northeast inland areas to the west, or southwest towards the Seaplane Lagoon and San Francisco Bay. Groundwater flow is impacted locally near industrial buildings by preferential flow paths such as storm water drains and underground utility trenches. Water levels in the vicinity of industrial buildings indicate localized regions of groundwater mounding or groundwater sinks. Groundwater recharge to the FWBZ is mainly attributed to vertical infiltration from precipitation, horticultural irrigation, and leaking water supply, sewer, and stormwater pipes both at Alameda Point and upgradient on Alameda Island. Tidal inundation of storm water conveyance lines may also contribute recharge to the FWBZ. The storm water lines act as potential groundwater "sinks" at low tides when the gradient would be towards the storm lines.

The FWBZ is tidally influenced immediately adjacent to the Seaplane Lagoon and San Francisco Bay. Tidal influence studies indicate the region of influence extends approximately 1,300 feet inland on the western side of the region, adjacent to the Seaplane Lagoon. Diurnal tidal fluctuations measured in the FWBZ range from 0.25 to 1 foot (PRC and U&A 1997a).

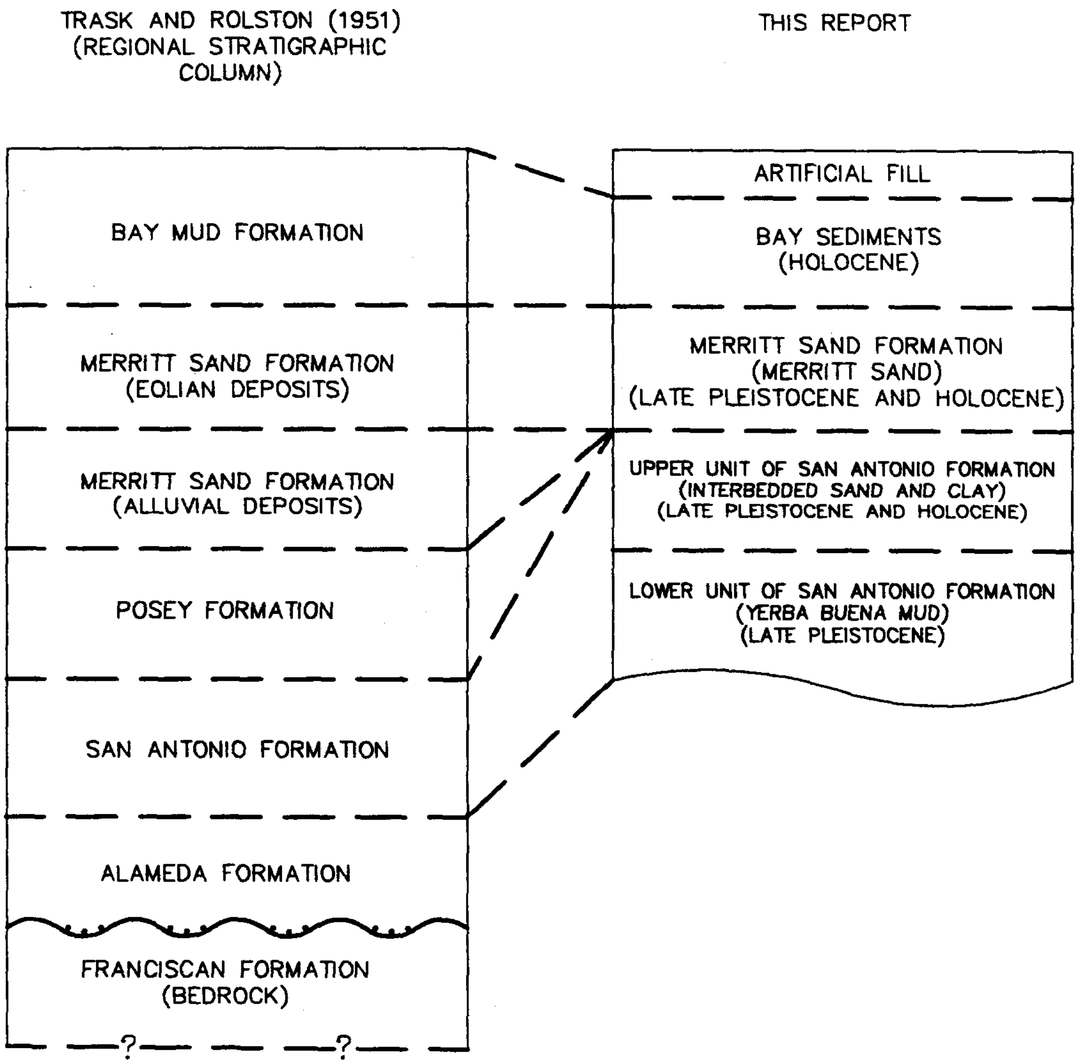


FIGURE 3.2-1
CONCEPTUAL
REGIONAL GEOLOGY
ALAMEDA POINT
ALAMEDA, CALIFORNIA

STRATCO2.DWG - 03/19/96 - CFR - 044-0316IRRIRP

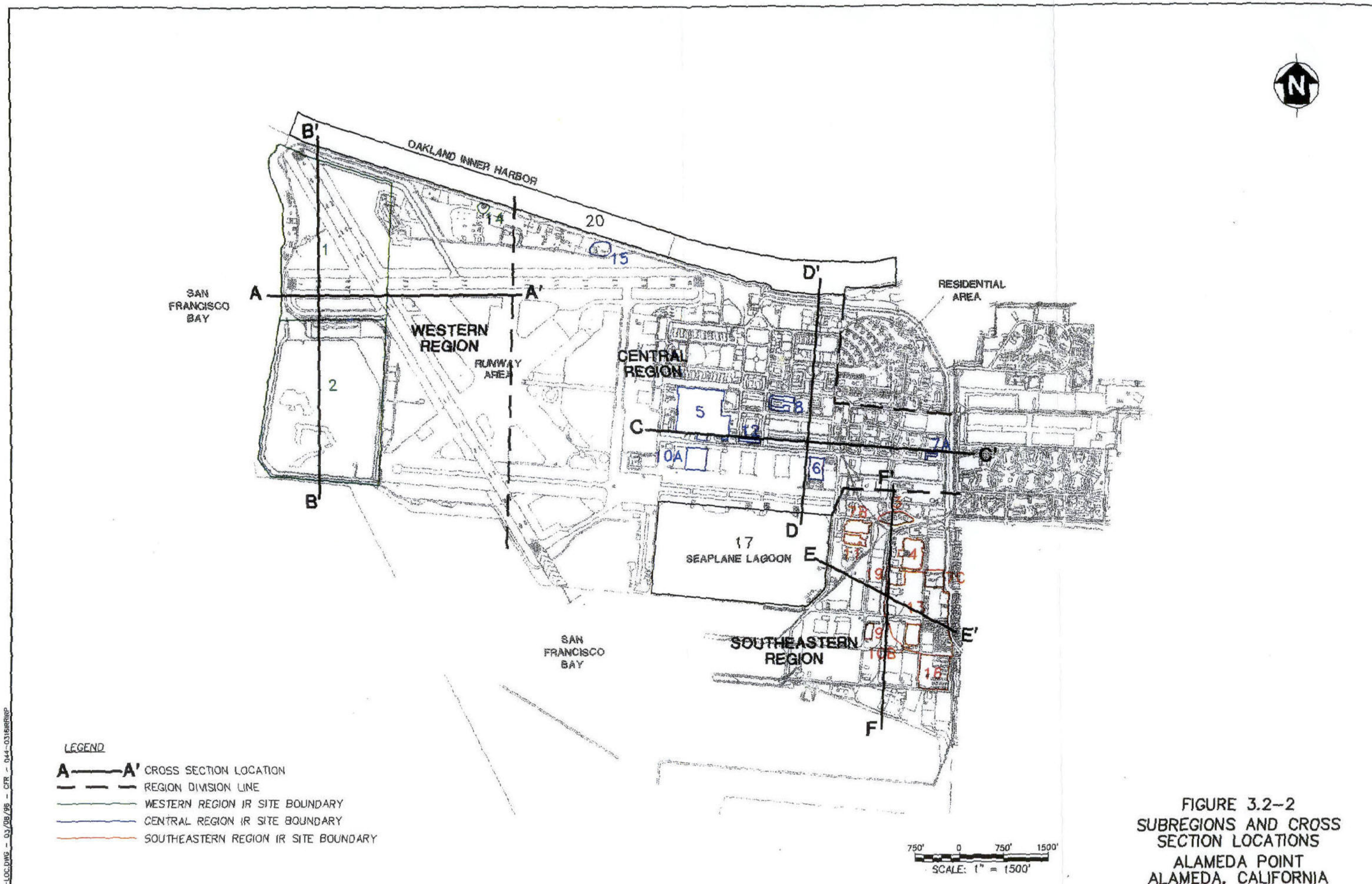
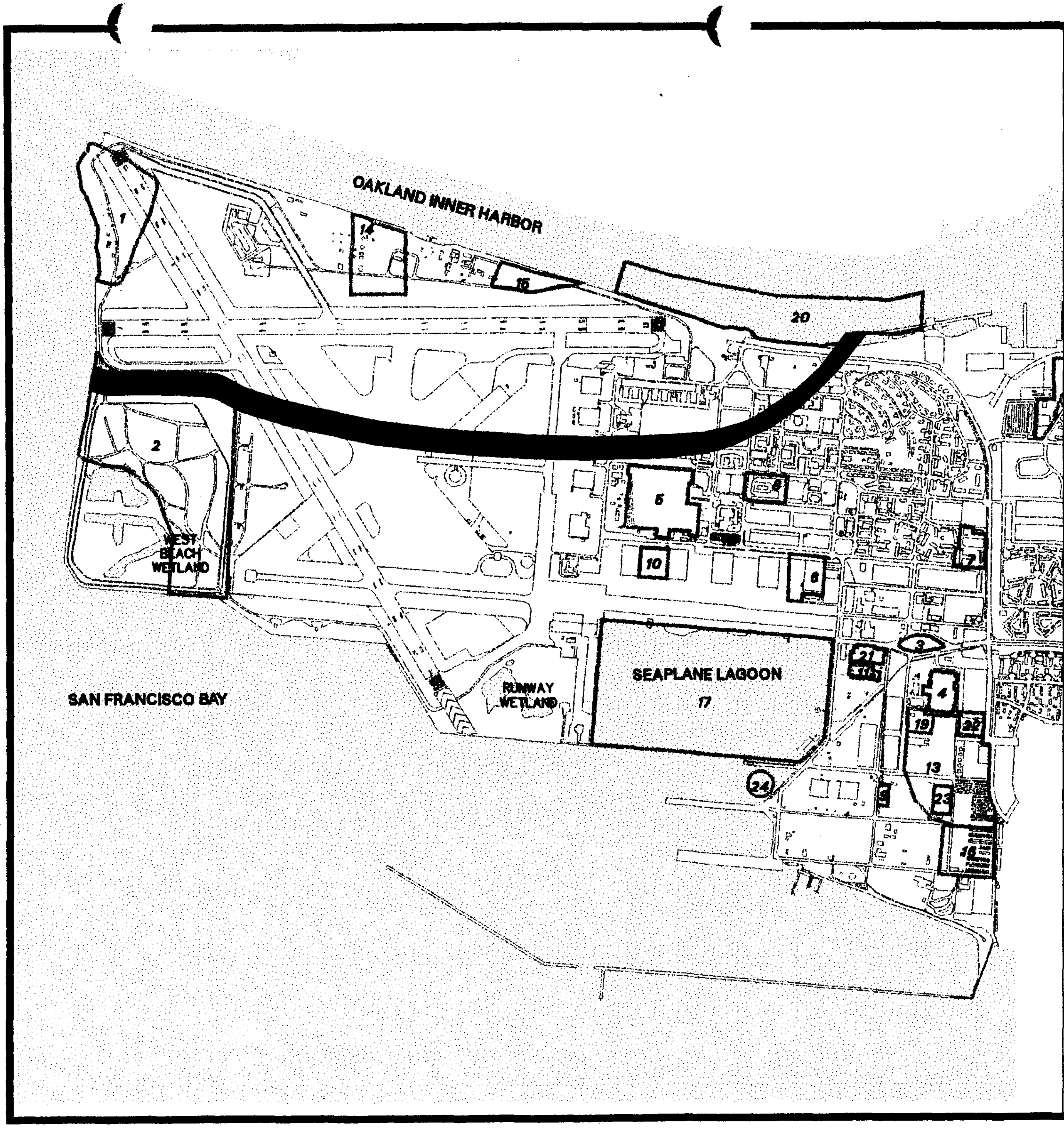


FIGURE 3.2-2
SUBREGIONS AND CROSS SECTION LOCATIONS
ALAMEDA POINT
ALAMEDA, CALIFORNIA

CS-LOC.DWG - 03/08/96 - CFR - 044-0316IRRIP



LEGEND

FORMER PALEOCHANNEL LOCATION

5 INSTALLATION RESTORATION SITE

900 0 900 1800

SCALE: 1" = 1800'

FIGURE 3.2-3
FORMER
PALEOCHANNEL LOCATION
ALAMEDA POINT
ALAMEDA, CALIFORNIA

08/29/98 /data3/alameda/amls/palechan3.map palechan3.aml AML

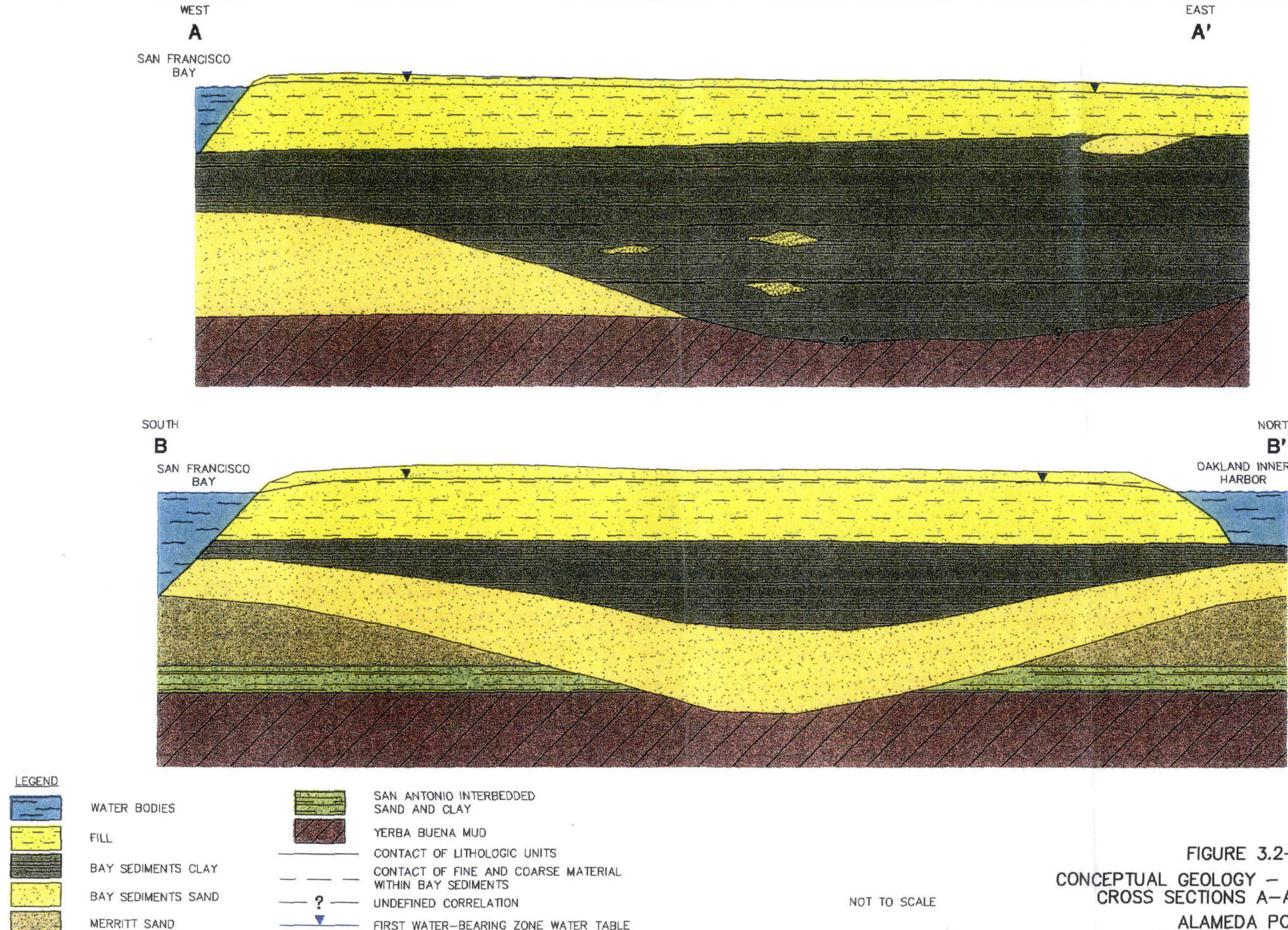
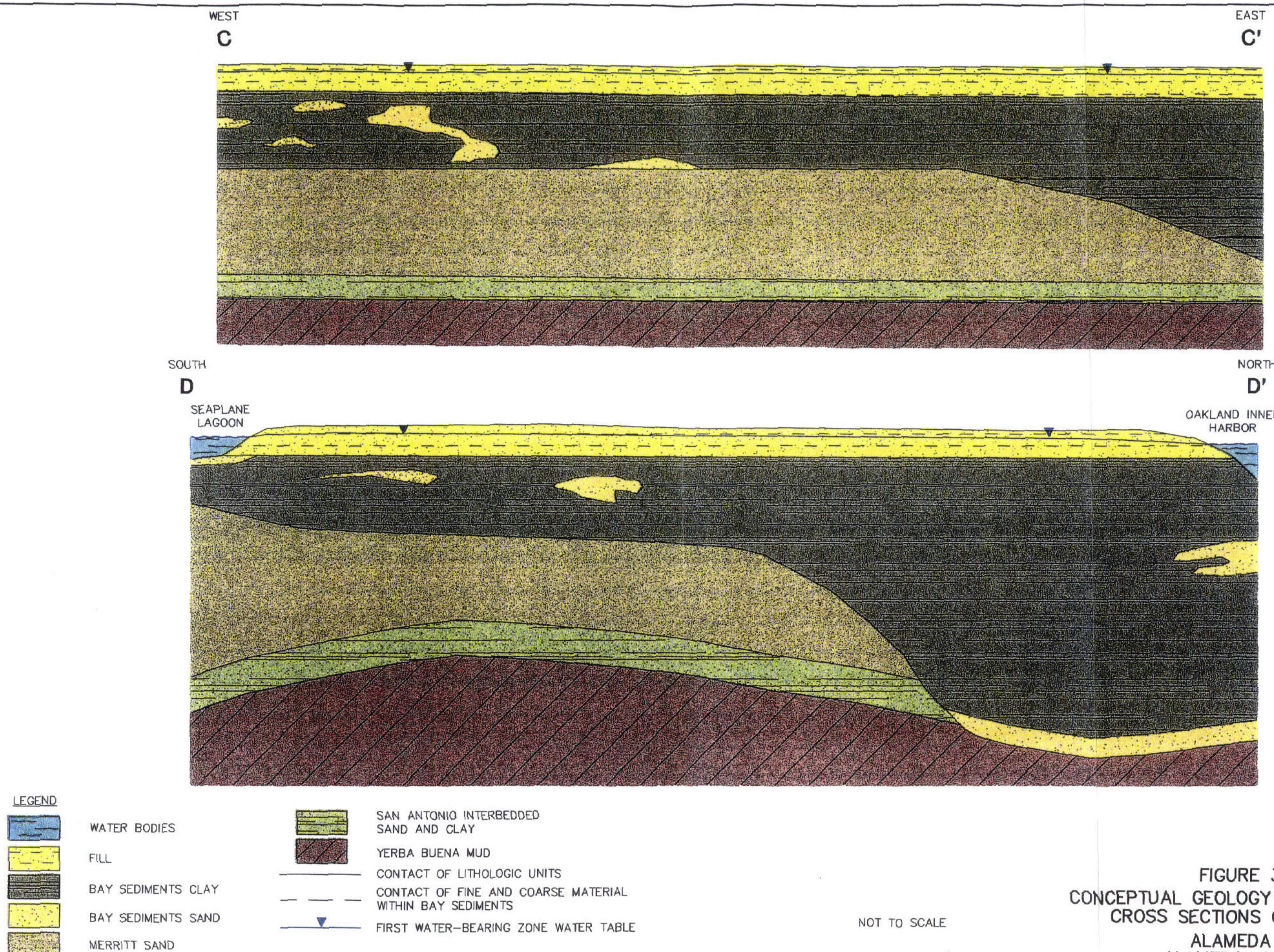


FIGURE 3.2–4

CONCEPTUAL GEOLOGY – WESTERN REGION CROSS SECTIONS A–A' AND B–B'

ALAMEDA POINT
ALAMEDA, CALIFORNIA

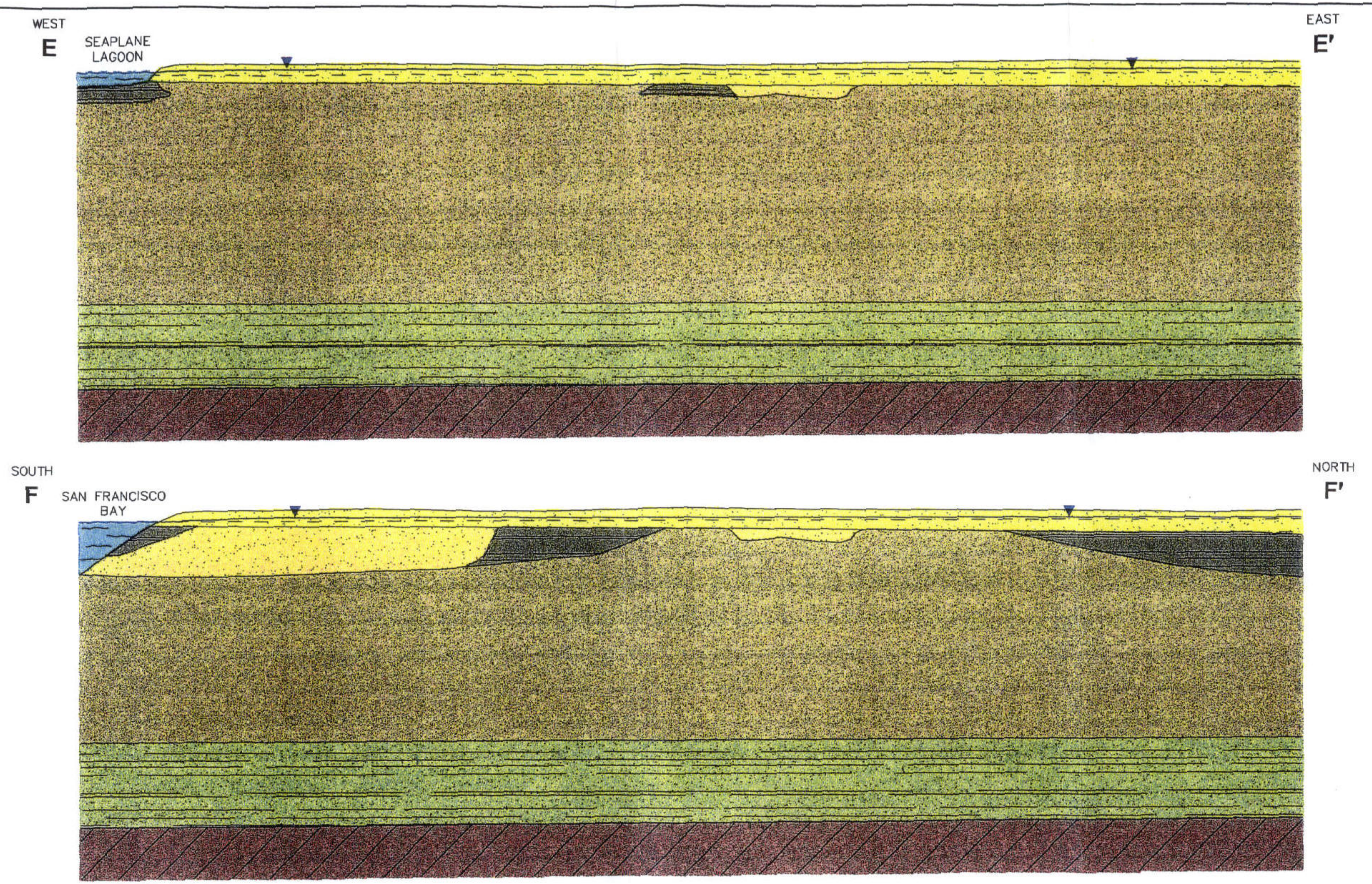
CS-AB2.DWG – 03/25/96 – CFR – 044-0316IRIRP



NOT TO SCALE

FIGURE 3.2-5
CONCEPTUAL GEOLOGY – CENTRAL REGION
CROSS SECTIONS C-C' AND D-D'
ALAMEDA POINT
ALAMEDA, CALIFORNIA

CS-CD.DWG – 03/19/96 – CFR – 044-0316IRRIRP



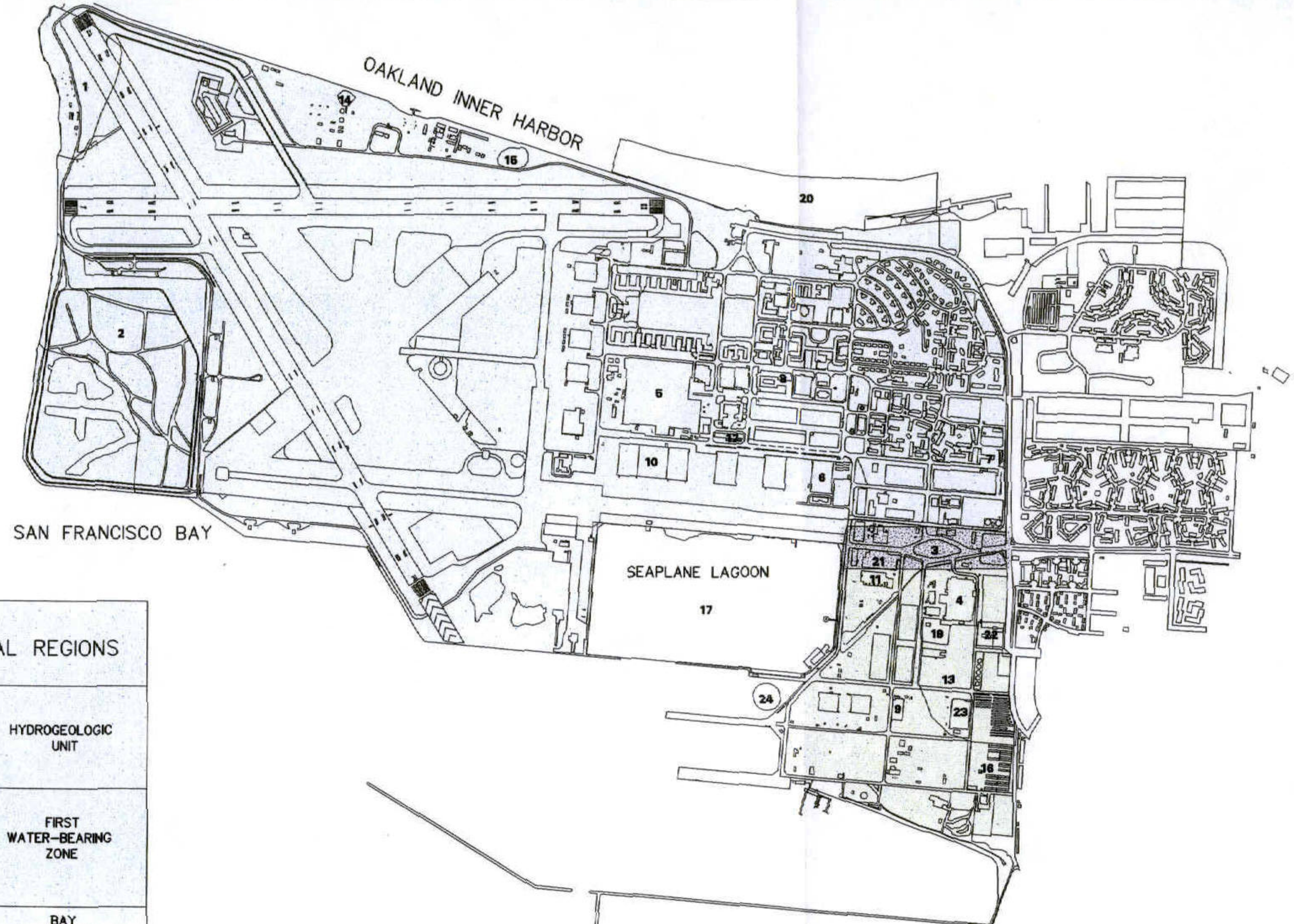
LEGEND

- WATER BODIES
- FILL
- BAY SEDIMENTS CLAY
- BAY SEDIMENTS SAND
- MERRITT SAND
- SAN ANTONIO INTERBEDDED SAND AND CLAY
- YERBA BUENA MUD
- CONTACT OF LITHOLOGIC UNITS
- CONTACT OF FINE AND COARSE MATERIAL WITHIN BAY SEDIMENTS
- SHALLOW WATER-BEARING ZONE WATER TABLE

NOT TO SCALE

FIGURE 3.2–6
CONCEPTUAL GEOLOGY – SOUTHEASTERN REGION
CROSS SECTIONS E–E' AND F–F'
ALAMEDA POINT
ALAMEDA, CALIFORNIA

CS-EF.DWG - 03/08/96 - CFR - 044-0316IRRIRP



WESTERN/CENTRAL REGIONS

LITHOSTRATIGRAPHIC UNIT		HYDROGEOLOGIC UNIT
FILL		FIRST WATER-BEARING ZONE
BAY SEDIMENTS		BAY SEDIMENT AQUITARD
MERRITT SAND		SECOND WATER-BEARING ZONE
SAN ANTONIO FORMATION	UPPER SAN ANTONIO UNIT	SECOND WATER-BEARING ZONE
SAN ANTONIO FORMATION	YERBA BUENA MUD	YERBA BUENA MUD AQUITARD

SOUTHEASTERN REGION

LITHOSTRATIGRAPHIC UNIT		HYDROGEOLOGIC UNIT
FILL		FIRST WATER-BEARING ZONE
BAY SEDIMENTS		FIRST WATER-BEARING ZONE
MERRITT SAND		FIRST WATER-BEARING ZONE
SAN ANTONIO FORMATION	UPPER SAN ANTONIO UNIT	FIRST WATER-BEARING ZONE
SAN ANTONIO FORMATION	YERBA BUENA MUD	YERBA BUENA MUD AQUITARD

NOTE:
THE FWBZU IN THE SOUTHEASTERN REGION COMMUNICATES WITH THE FWBZU IN THE CENTRAL REGION WHERE THE YOUNG BAY MUD (BAY SEDIMENT AQUITARD) PINCHES OUT NEAR SITE 3 (REFER TO FIGURES 4-9a, 4-9b, and 4-9c). THE FWBZL IN THE SOUTHEASTERN REGION BECOMES AND COMMUNICATES WITH WITH THE SWBZU IN THE CENTRAL REGION NORTH AND WEST OF SITE 3.

LEGEND

- WESTERN/CENTRAL REGIONS
- SOUTHEASTERN REGION
- SOUTHERN EXTENT OF THE BAY SEDIMENT AQUITARD

N

750 0 750 1500
SCALE: 1" = 1500'

FIGURE 3.2-7
CORRELATION BETWEEN GEOLOGY AND HYDROGEOLOGY
ALAMEDA POINT
ALAMEDA, CALIFORNIA

/data/alameda/amis/hygeo.aml ben3.2-7.map

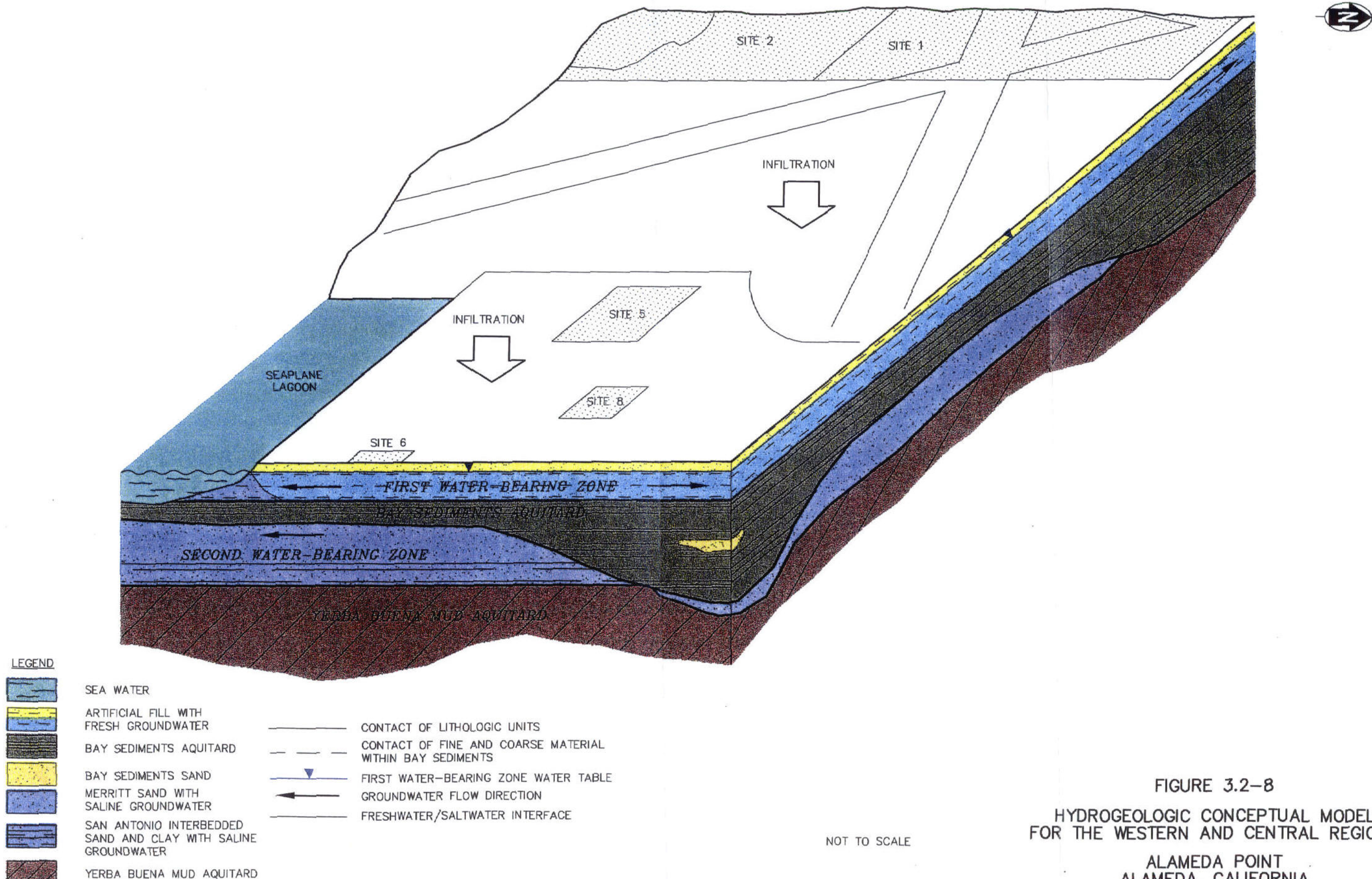
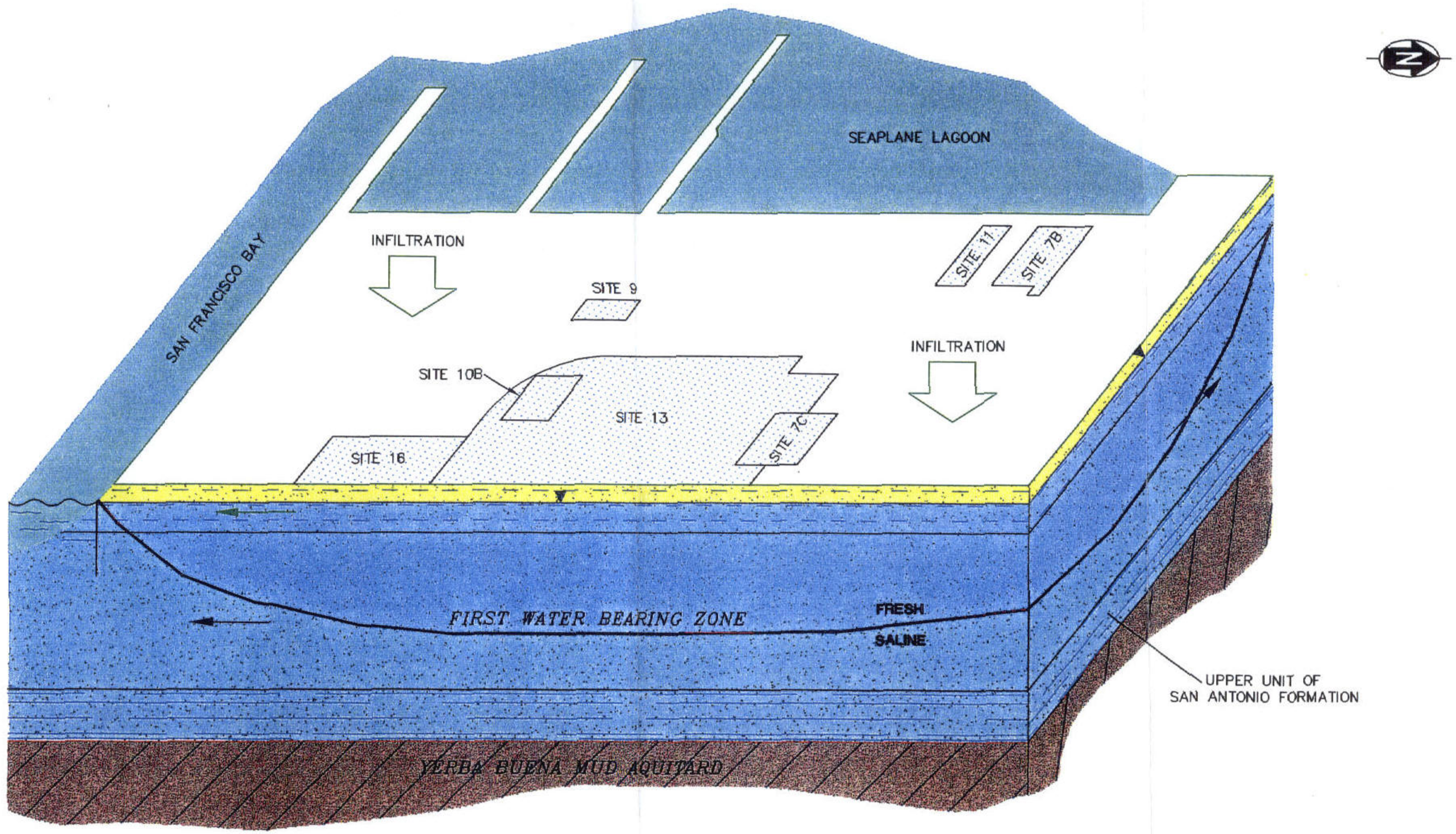


FIGURE 3.2-8

HYDROGEOLOGIC CONCEPTUAL MODEL FOR THE WESTERN AND CENTRAL REGIONS

ALAMEDA POINT
ALAMEDA, CALIFORNIA

MOD-WEST.DWG - 03/13/96 - CFR - 044-0316RRRP



LEGEND

- SEA WATER
- ARTIFICIAL FILL WITH FRESH WATER
- MERRITT SAND WITH FRESH WATER
- MERRITT WITH SALINE WATER
- UPPER UNIT OF SAN ANTONIO FORMATION WITH SALINE WATER
- YERBA BUENA MUD AQUITARD

- CONTACT OF LITHOLOGIC UNITS
- FIRST WATER-BEARING ZONE WATER TABLE
- GROUNDWATER FLOW DIRECTION
- FRESHWATER/SALTWATER INTERFACE

NOT TO SCALE

FIGURE 3.2-9
HYDROGEOLOGIC CONCEPTUAL MODEL FOR THE SOUTHEASTERN REGION
ALAMEDA POINT
ALAMEDA, CALIFORNIA

02/10/98 – RJF DN – O:\ALAMEDA\BEN4-17.DWG

LEGEND

- INSTALLATION RESTORATION SITES
- APPROXIMATE WETLANDS AREAS
- ESTIMATED GROUNDWATER FLOW FIRST WATER BEARING ZONE
- ESTIMATED GROUNDWATER FLOW SECOND WATER BEARING ZONE

NOTE: GENERAL GROUNDWATER FLOW DIRECTIONS BASED ON MAY 2, 1997 GROUNDWATER ELEVATION MEASUREMENTS

N

600 0 600 1200

SCALE: 1" = 1200'

FIGURE 3.2-10
INSTALLATION RESTORATION SITES AND GROUNDWATER FLOW DIRECTIONS
ALAMEDA POINT
ALAMEDA, CALIFORNIA

4.0 GROUNDWATER SAMPLING RESULTS

Ninety wells were selected for sampling in the groundwater monitoring program at Alameda Point. The following subsections provide a site description, the rationale for selecting wells to sample, the analytical parameters selected, and the analytical results for each site. Previous groundwater data were used to establish the sampling rationale for specific sites and have been summarized from the results appearing in several reports. A list of these reports appears in Volume I, Section 2.0 of the "Groundwater Monitoring Plan" (PRC and U&A 1997b).

Also, the direction of groundwater flow was used to predict the movement of contaminant plumes and was considered in rationale for selecting the quarterly sampling wells at each site. Figure 1.2-2 shows the direction of groundwater flow based on groundwater measurements conducted on May 2, 1997, under CTO 0108. The analytical parameters for each well are summarized, by quarter, for all four quarters, in Table 4.0-1.

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT
(Sheet 1 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
QUARTER 1													
Site 1 - Quarter 1													
M001-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M002-E	BSA	X	X	--	X	--	--	X	X	X	X	X	--
M003-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M027-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M028-A	FWBZU	X	X	--	X	X	X	X	X	X	X	X	X
M028-C	SWBZL	Well damaged, repaired, developed, but not sampled (will be sampled in future quarters).											
M028-E	FWBZL	X	X	--	X	X	X	X	X	X	X	X	X
M028-E Dup	FWBZL	X	X	--	X	X	X	--	--	--	--	--	--
M029-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M030-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M031-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M033-A	FWBZU	Well not found, presumed destroyed, not sampled											
M034-A	FWBZU	X	X	--	X	X	X	X	X	X	X	X	X
M035-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 2 - Quarter 1													
M010-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M013-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M017-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M019-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M019-E Dup	FWBZL	X	X	--	X	--	--	--	--	--	--	--	--
M021-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M023-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M024-A	FWBZU	X	X	--	X	--	--	X	X	X	--	X	--
M024-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M036-A	FWBZU	X	X	X	X	--	--	X	X	X	X	X	--
M036-B	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M036-E	FWBZU	X	X	--	X	--	--	X	X	X	X	X	--
M037-A	FWBZU	X	X	X	X	--	--	X	X	X	--	X	--
M037-B	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M037-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M038-A	FWBZU	X	X	X	X	--	--	X	X	X	X	X	--
M038-B	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M038-B Dup	SWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M038-E	FWBZU	X	X	--	X	--	--	X	X	X	X	X	--
M039-A	FWBZU	X	X	X	X	--	--	X	X	X	X	X	--
M039-B	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M039-E	FWBZU	X	X	--	X	--	--	X	X	X	X	X	--
Site 3 - Quarter 1													
M03-04	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
M03-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M03-07	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
Site 4 - Quarter 1													
D04-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
D04-03	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M04-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Site 4 (Continued) - Quarter 1													
M04-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M04-07	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
MW360-1	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
MW360-2	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
MW360-3	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
MW360-4	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
MW360-4 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
Sites 5 and 10 - Quarter 1													
D05-02	SWBZU	X	--	--	X	--	--	X	X	X	X	X	X
D05-02 Dup	SWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M05-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05-03	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05-04	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M05-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M05-06	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05-07	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05-08	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05-09	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M05-10	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M05-11	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05-12	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05BS-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M05HW-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M10-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
Site 6 - Quarter 1													
M06-06	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
Site 7 - Quarter 1													
D07A-02	SWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M07A-03	BSA	X	--	--	X	X	X	X	X	X	X	X	X
M07A-04	FWBZL	X	--	--	X	X	X	X	X	X	X	X	X
M07A-09	BSA	X	--	--	X	--	--	X	X	X	X	X	X
W-1	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
W-1 Dup	FWBZU	X	--	--	X	X	X	--	--	--	--	--	--
Site 9 - Quarter 1													
D09-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
M09-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M09-06 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
Sites 11 and 21 - Quarter 1													
M11-01	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M11-02	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M11-02 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M11-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M11-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M07B-01	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT
(Sheet 3 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Site 12 - Quarter 1													
M12-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
Sites 13 and 19 - Quarter 1													
M13-06	FWBZU	X	X	--	X	X	X	X	X	X	X	X	X
M13-09	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
MWOR-5	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
MWOR-5 Dup	FWBZU	X	--	--	X	X	X	--	--	--	--	--	--
MWD13-3	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
Site 14 - Quarter 1													
M101-A	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
Site 16 - Quarter 1													
M16-04	FWBZU	X	--	--	X	--	--	X	X	X	X	X	X
M16-04 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
Site 22 - Quarter 1													
D07C-01	FWBZL	X	--	--	X	X	X	X	X	X	X	X	X
M07C-07	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
M07C-08	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
MW547-4	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
Site 23 - Quarter 1													
D10B-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	X
MW530-2	FWBZU	X	--	--	X	X	X	X	X	X	X	X	X
Background Wells - Quarter 1													
MBG-1	FWBZU	X	X	X	X	X	X	X	X	X	X	X	X
MBG-2	FWBZL	X	X	X	X	X	X	X	X	X	X	X	X
MBG-3	FWBZL	X	X	X	X	X	X	X	X	X	X	X	X
MBG-4	FWBZL	X	X	X	X	X	X	X	X	X	X	X	X
QUARTER 2													
Site 1 - Quarter 2													
M001-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M002-E	BSA	X	X	--	X	--	--	X	X	X	X	X	--
M003-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M027-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M028-A	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M028-C	SWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M028-E	FWBZL	X	X	--	X	X	X	X	X	X	X	X	--
M029-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M030-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M030-E Dup	FWBZL	X	--	--	X	--	--	--	--	--	--	--	--
M031-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M034-A	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M035-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 2 - Quarter 2													
M010-A	FWBZU	Well not sampled due to the presence of standing water around well location											
M013-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M017-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M019-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M021-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT
(Sheet 4 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Site 2 (continued) - Quarter 2													
M021-E Dup	FWBZL	X	--	--	X	--	--	--	--	--	--	--	--
M023-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M024-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M024-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M036-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M036-B	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M036-E	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M037-A	FWBZU	X	--	X	X	--	--	X	X	X	X	X	--
M037-B	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M037-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M038-A	FWBZU	X	--	X	X	--	--	X	X	X	X	X	--
M038-B	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M038-B Dup	SWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M038-E	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M039-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M039-B	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M039-E	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 3 - Quarter 2													
M03-04	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
M03-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M03-07	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 4 - Quarter 2													
D04-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
D04-03	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
D04-03 Dup	FWBZL	X	--	--	X	--	--	--	--	--	--	--	--
M04-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 4 - Quarter 2													
M04-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M04-07	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-1	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-2	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-3	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-4	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Sites 5 and 10 - Quarter 2													
D05-02	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
D05-02 Dup	SWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M05-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-03	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-04	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-06	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-07	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-08	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-09	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-10	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-11	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT
(Sheet 5 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Sites 5 and 10 (continued) - Quarter 2													
M05-12	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05BS-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05HW-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M10-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Site 6 - Quarter 2													
M06-06	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Site 7 - Quarter 2													
D07A-02	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M07A-03	BSA	X	--	--	X	X	X	X	X	X	X	X	--
M07A-04	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M07A-04 Dup	FWBZL	X	--	--	X	X	X	--	--	--	--	--	--
M07A-09	BSA	X	--	--	X	--	--	X	X	X	X	X	--
W-1	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 9 - Quarter 2													
D09-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M09-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M09-06 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
Sites 11 and 21 - Quarter 2													
M11-01	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-02	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-05 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M11-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M07B-01	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 12 - Quarter 2													
M12-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Sites 13 and 19 - Quarter 2													
M13-06	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M13-09	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWOR-5	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWOR-5 Dup	FWBZU	X	--	--	X	X	X	--	--	--	--	--	--
MWD13-3	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 14 - Quarter 2													
M101-A	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 16 - Quarter 2													
M16-04	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M16-04 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
Site 22 - Quarter 2													
D07C-01	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M07C-07	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
M07C-08	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MW547-4	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 23 - Quarter 2													
D10B-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
MW530-2	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT
(Sheet 6 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Background Wells - Quarter 2													
MBG-1	FWBZU	X	X	X	X	X	X	X	X	X	X	X	--
MBG-2	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--
MBG-3	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--
MBG-4	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--
QUARTER 3													
Site 01 - Quarter 3													
M001-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M003-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M027-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M028-A	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M028-C	SWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M028-E	FWBZL	X	X	--	X	X	X	X	X	X	X	X	--
M029-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M029-E Dup	FWBZL	X	X	--	X	--	--	--	--	--	--	--	--
M034-A	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M035-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 02 - Quarter 3													
M010-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M013-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M021-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M023-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M024-A	FWBZU	X	X	--	X	--	--	X	X	X	X	X	--
M024-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M036-A	FWBZU	X	X	X	X	--	--	X	X	X	X	X	--
M036-B	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M036-E	FWBZU	X	X	--	X	--	--	X	X	X	X	X	--
M037-A	FWBZU	X	X	X	X	--	--	X	X	X	X	X	--
M037-B	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M037-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M038-A	FWBZU	X	X	X	X	--	--	X	X	X	X	X	--
M038-B	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M038-B Dup	SWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M038-E	FWBZU	X	X	--	X	--	--	X	X	X	X	X	--
M039-A	FWBZU	X	X	X	X	--	--	X	X	X	X	X	--
M039-B	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M039-E	FWBZU	X	X	--	X	--	--	X	X	X	X	X	--
Site 03 - Quarter 3													
M03-04	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
M03-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M03-07	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 4 - Quarter 3													
D04-01	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
D04-01 Dup	FWBZL	X	--	--	X	X	X	--	--	--	--	--	--
D04-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
D04-03	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M04-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT
(Sheet 7 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Site 4 (Continued) - Quarter 3													
M04-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M04-07	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-1	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-2	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-3	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-3 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
MW360-4	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Sites 5 and 10 - Quarter 3													
D05-02	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
D05-02 Dup	SWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M05-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-03	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-04	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-06	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-07	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-08	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-09	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-10	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-11	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-12	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05BS-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05HW-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M10-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Site 6 - Quarter 3													
M06-06	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Site 7 - Quarter 3													
D07A-01	SWBZL	X	--	--	X	X	X	X	X	X	X	X	--
D07A-02	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
D07A-02 Dup	SWBZL	X	--	--	X	--	--	--	--	--	--	--	--
M07A-01	SWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M07A-01 Dup	SWBZL	X	--	--	X	X	X	--	--	--	--	--	--
M07A-03	BSA	X	--	--	X	X	X	X	X	X	X	X	--
M07A-04	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M07A-05	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M07A-08	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M07A-09	BSA	X	--	--	X	--	--	X	X	X	X	X	--
W-1	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 9 - Quarter 3													
D09-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
D09-01 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M09-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Sites 11 and 21 - Quarter 3													
M11-01	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-02	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT
(Sheet 8 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Sites 11 and 21 (continued) - Quarter 3													
M11-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-06 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M07B-01	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 12 - Quarter 3													
M12-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Sites 13 and 19 - Quarter 3													
D19-01	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
M13-06	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M13-09	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWOR-5	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWOR-5 Dup	FWBZU	X	--	--	X	X	X	--	--	--	--	--	--
MWD13-2	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWD13-3	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 14 - Quarter 3													
M101-A	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 22 - Quarter 3													
D07C-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M07C-08	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MW547-4	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 23 - Quarter 3													
D10B-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
MW530-2	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Background Wells - Quarter 3													
MBG-1	FWBZU	X	X	X	X	X	X	X	X	X	X	X	--
MBG-2	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--
MBG-3	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--
MBG-4	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--
QUARTER 4													
Site 1 - Quarter 4													
M001-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M003-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M027-E	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M028-A	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M028-C	SWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M028-E	FWBZL	X	X	--	X	X	X	X	X	X	X	X	--
M029-E	FWBZL	X	X	--	X	--	--	X	X	X	X	X	--
M029-E Dup	FWBZL	X	X	--	X	--	--	--	--	--	--	--	--
M034-A	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M035-A	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 2 - Quarter 4													
Site 2 wells not sampled due to access restrictions (seasonal Least Tern nesting area).													
Site 3 - Quarter 4													
M03-04	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
M03-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M03-07	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS
BY QUARTER
ALAMEDA POINT
(Sheet 9 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Site 4 - Quarter 4													
D04-01	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
D04-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
D04-03	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M04-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M04-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M04-07	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-1	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-2	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-3	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
MW360-3 Dup	FWBZL	X	--	--	X	--	--	--	--	--	--	--	--
MW360-4	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Sites 5 and 10 - Quarter 4													
D05-02	SWBZU	X	--	--	X	--	--	X	X	X	X	X	--
D05-02 Dup	SWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M05-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-03	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-04	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-06	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-07	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-08	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-09	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-10	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M05-11	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05-12	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05BS-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M05HW-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
M10-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Site 6 - Quarter 4													
M06-06	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Site 7 - Quarter 4													
D07A-01	SWBZL	X	--	--	X	X	X	X	X	X	X	X	--
D07A-02	SWBZL	X	--	--	X	--	--	X	X	X	X	X	--
D07A-02 Dup	SWBZL	X	--	--	X	--	--	--	--	--	--	--	--
M07A-01	BSA	X	--	--	X	X	X	X	X	X	X	X	--
M07A-03	BSA	X	--	--	X	X	X	X	X	X	X	X	--
M07A-04	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M07A-05	BSA	X	--	--	X	X	X	X	X	X	X	X	--
M07A-08	BSA	X	--	--	X	X	X	X	X	X	X	X	--
M07A-09	BSA	X	--	--	X	--	--	X	X	X	X	X	--
W-1	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 9 - Quarter 4													
D09-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
D09-01 Dup	FWBZL	X	--	--	X	--	--	--	--	--	--	--	--
M09-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--

TABLE 4.0-1
MONITORING WELLS AND ANALYTICAL PARAMETERS BY QUARTER
ALAMEDA POINT
(Sheet 10 of 10)

Well ID	WBZ	VOC	SVOC	Pest/ PCB	Metals	TPPH	TEPH	Nitr-N	Anions	TDS	Sulfide	Alkalinity	TOC
Sites 11 and 21 - Quarter 4													
M11-01	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-02	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-05	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-06	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
M11-06 Dup	FWBZU	X	--	--	X	--	--	--	--	--	--	--	--
M07B-01	FWBZU	X	--	--	X	--	--	X	X	X	X	X	--
Site 12 - Quarter 4													
M12-01	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
Sites 13 and 19 - Quarter 4													
M13-06	FWBZU	X	X	--	X	X	X	X	X	X	X	X	--
M13-09	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWOR-5	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWOR-5 Dup	FWBZU	X	--	--	X	X	X	--	--	--	--	--	--
D19-01	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWD13-2	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MWD13-3	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 14 - Quarter 4													
M101-A	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 22 - Quarter 4													
D07C-01	FWBZL	X	--	--	X	X	X	X	X	X	X	X	--
M07C-08	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
MW547-4	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Site 23 - Quarter 4													
D10B-02	FWBZL	X	--	--	X	--	--	X	X	X	X	X	--
MW530-2	FWBZU	X	--	--	X	X	X	X	X	X	X	X	--
Background Wells - Quarter 4													
MBG-1	FWBZU	X	X	X	X	X	X	X	X	X	X	X	--
MBG-2	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--
MBG-3	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--
MBG-4	FWBZL	X	X	X	X	X	X	X	X	X	X	X	--

Notes:

BSA	Bay Sediment Aquitard
Dup	Duplicate groundwater sample
F'WBZL	First water-bearing zone lower
FWBZU	First water-bearing zone upper
ID	Identification
Nitr-N	Nitrate/Nitrite-N
PCB	Polychlorinated biphenyls
Pest	Pesticides
SWBZL	Second water-bearing zone lower
SWBZU	Second water-bearing zone upper
SVOC	Semivolatile organic compounds
TDS	Total dissolved solids
TEPH	Total extractable petroleum hydrocarbons
TOC	Total organic carbon
TPPH	Total purgable petroleum hydrocarbons
VOC	Volatile organic compounds
WBZ	Water-bearing zone
X	Analysis performed
--	Not analyzed

4.1 SITE 1 – 1943-1956 DISPOSAL AREA

The Site 1 Disposal Area is located in the northwestern portion of Alameda Point (Figure 1.2-2). Waste disposal operations at the site began in the early 1940s and continued through 1956, largely in the northern half of the site. Materials reported to have been disposed of at the site included aircraft engines, garbage, scrap metal, waste oil, paints, solvents, cleaning compounds, construction debris, and low-level radioactive material. Waste disposal at the site was discontinued by 1956 after Runway 13-31 was extended over the northern portion of the disposal area. A pistol range was also located in the western portion of the site (PRC and Montgomery Watson 1993c).

Currently, there are 40 active groundwater monitoring wells associated with Site 1, 13 of which were selected for quarterly sampling. During prior sampling of these wells, VOCs, SVOCs, petroleum hydrocarbons, and metals were detected in groundwater samples.

4.1.1 Sampling Plan Rationale

For each quarter, Table 4.0-1 lists the 13 proposed quarterly sampling wells at Site 1, the parameters for which the samples were analyzed, the duplicate samples that were collected, and any wells that were not sampled, and why. Well M033-A, which was proposed for quarterly sampling, was not sampled during this monitoring program because the well completion had been destroyed by earth-moving equipment and the well could not be located in the field. As shown on Table 4.0-1, 11 groundwater wells were sampled during Quarter 1, 12 wells were sampled during Quarter 2, and 9 wells were sampled during Quarters 3 and 4. Wells M002-E, M030-E, and M031-E were sampled during Quarters 1 and 2, but were removed from the sampling program for Quarters 3 and 4 due to the addition of seven wells to the facility-wide monitoring program at various sites and the desire to keep the total number of wells in the program the same. The selected quarterly groundwater sampling wells are shown on Figure 1.2-3.

Groundwater samples from the Site 1 wells were analyzed for VOCs. Data from six of these wells were collected to monitor water quality associated with a solvent plume in groundwater located in the southern portion of the site; the other five wells are not located near a VOC plume. During Quarter 1, VOC data were collected from 10 wells in the FWBZ and one well in the BSA. During Quarter 2, VOC data were collected from 10 wells in the FWBZ, one well in the SWBZ, and one well in the BSA. During Quarters 3 and 4, VOC data were collected from eight wells in the FWBZ, and one well in the SWBZ.

VOC data from monitoring wells M028-A, M028-E, and M034-A were collected to evaluate water quality within the plume. Wells M027-E, M031-E (Quarters 1 and 2 only), and M035-A are located near the edges of the plume. Groundwater was collected from these wells to monitor plume migration. Groundwater from well M028-C, screened in lower portion of the SWBZ, was collected in Quarters 2, 3, and 4 to monitor the potential vertical migration of VOCs; groundwater was not collected from this well during Quarter 1 because the well was damaged and required repair and subsequent redevelopment prior to sampling. Monitoring well M033-A was not sampled.

Samples from wells M001-E, M028-A, M028-E, M029-E, and M034-A, located in the northwestern portion of the site and screened in the upper or lower portions of the FWBZ, were analyzed for SVOCs. SVOCs were detected previously in some of these wells. These wells were selected for SVOC analysis in this quarterly monitoring program to evaluate the possible enhanced migration of SVOCs in the area of the solvent plume. The highest concentrations of SVOCs are typically found at the top of the BSA. Groundwater sampled from well M002-E (Quarters 1 and 2 only), screened in the upper surface of the BSA, was also analyzed for SVOCs for this reason.

Samples from each of the wells monitored at Site 1 were also analyzed for metals and general water quality parameters (anions, sulfide, alkalinity, and nitrate/nitrite as nitrogen). The data from these analyses were collected to provide information for (1) assessing potential impacts to groundwater from the disposal area, (2) a base-wide analysis of ambient water quality, and (3) an evaluation of the beneficial uses of groundwater at Alameda Point. Metals data for samples collected from well M035-A, located adjacent to the pistol range, will also be used to evaluate the potential impacts to the groundwater from activities at the pistol range.

Samples from wells M028-A, M028-C, M028-E, and M034-A were analyzed for total purgeable petroleum hydrocarbons (TPPH) and total extractable petroleum hydrocarbons (TEPH); petroleum hydrocarbons have been detected in these wells during previous sampling. Samples from these wells were analyzed for total organic carbon (TOC) during the first quarterly sampling event. The TOC data were collected to help evaluate the biodegradation potential for the petroleum hydrocarbons and solvents in the groundwater at Site 1; TOC is a necessary cometabolite in biodegradation because a high TOC concentration indicates a high potential for biodegradation.

Sections 4.1.2 through 4.1.5 present the analytical results for each quarter of sampling.

4.1.2 Quarter 1 Analytical Results

As a conservative screening criteria, the detected concentrations of organic and inorganic contaminants were compared to Title 22 maximum contaminant level (MCL) drinking water standards, where available. One or more organic compounds were detected at concentrations exceeding the MCLs in groundwater from six Site 1 FWBZ wells during Quarter 1 (M001-E, M028-A, M028-E, M029-E, M034-A, and M035-A). Wells with organic analytes detected above the screening criteria in the FWBZ and SWBZ are shown on Figures 4.1-1, Sheet 1, and 4.1-2, Sheet 1, respectively; the figures are organized by quarter. One or more inorganic analytes were detected at concentrations exceeding the MCLs in groundwater from nine FWBZ wells (M028-A, M034-A, M035-A, M002-E, M003-E, M027-E, M028-E, M030-E, and M031-E) during Quarter 1. Wells with inorganic analytes detected above the screening criteria in the FWBZ and the SWBZ are shown on Figures 4.1-3, Sheet 1, and 4.1-4, Sheet 1, respectively by quarter.

Organic analytical results for compounds detected in groundwater samples collected at Site 1 during Quarter 1 are presented on Table 4.1-1. Monitoring wells M028-A, M028-E, and M034-A, located within the solvent plume, exhibited detected concentrations of numerous VOCs. Among the VOCs detected were benzene, toluene, ethylbenzene, and total xylenes (BTEX) and volatile chlorinated solvents including chlorobenzene, 1,2-dichlorobenzene (DCB), 1,3-DCB, 1,4-DCB, 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride. Concentrations of these VOCs were often the highest in the groundwater sample collected from well M028-A screened in the FWBZU. Concentrations of VOCs were also relatively high in the groundwater sample collected from well M034-A, also screened in the FWBZU, and were lower in the groundwater sample collected from well M028-E (and its duplicate sample) screened in FWBZL. Vinyl chloride was detected at a concentration of 7,300 micrograms per liter (μg/L) in well M028-A, 1,700 μg/L in well M034-A and 250 μg/L in well M028-E (and 160 μg/L in the duplicate sample from well M028-E). Groundwater flow in the vicinity of the solvent plume at Site 1 is toward the San Francisco Bay in a northwesterly direction (Figure 1.2-2).

In the three wells sampled at the edge of the solvent plume, fewer VOCs were detected at much lower concentrations. VOCs detected in samples from either well M027-E or M035-A included cis-1,2-DCE, trans-1,2-DCE, toluene, trichloroethene (TCE), and total xylenes. Vinyl chloride was not detected in these wells. No VOCs were detected in samples from well M031-E at the edge of the plume.

VOCs were detected at relatively low concentrations in two of the remaining five Site 1 wells. The VOCs 1,2-DCB, benzene, chlorobenzene, ethylbenzene, and total xylenes were detected in well M001-E, and benzene was detected in well M029-E. No VOCs were detected in wells M002-E, M003-E, or M030-E.

Groundwater from six monitoring wells (and one duplicate) were analyzed for SVOCs; SVOCs were detected in four of these six wells including wells M028-E and M034-A within the solvent plume and wells M001-E and M029-E outside the plume. Although the highest concentrations of SVOCs are often found at the top of the BSA, SVOCs were not detected in M002-E (screened in the BSA). SVOCs were also not detected in well M028-A, where many of the highest concentrations of VOCs at Site 1 were detected during Quarter 1 sampling.

In the four wells where SVOCs were detected, either naphthalene or 2,4-dimethylphenol were detected at concentrations in excess of 100 μg/L. Other SVOCs detected at Site 1, but at lower concentrations, include 1,2-DCB, 1,4-DCB, 2,2'-oxybis, 2-methylnaphthalene, 2-methylphenol, 4-methylphenol, acenaphthene, carbazole, dibenzofuran, fluorene, and phenanthrene.

Groundwater samples from wells M028-A, M028-E, and M034-A were analyzed for TEPH and TPPH. Diesel-range organics (diesel) and gasoline-range organics (gasoline) were detected in all three wells (and one duplicate) and motor oil-range organics (motor oil) were also detected in two of the wells (and one duplicate). The sample from well M028-A exhibited the highest detected concentration of petroleum hydrocarbons at Site 1 during Quarter 1 (9 milligrams per liter [mg/L] of diesel).

Nine metals were detected in one or more groundwater samples from the 11 monitoring wells analyzed for metals during Quarter 1. The detected concentrations of arsenic (in five wells and one duplicate sample), barium (in all 11 wells and one duplicate sample), cadmium (in three wells and one duplicate sample), chromium (in two wells and one duplicate sample), cobalt (in six wells and one duplicate sample), copper (in one well), manganese (in 10 wells and one duplicate sample), nickel (in four wells and one duplicate sample), and zinc (in nine wells and one duplicate sample) are shown on Table 4.1-2. Lead was not detected in any of the groundwater samples, including the sample from well M035-A, which was collected closest to the pistol range.

All 11 wells at Site 1 were tested for anions, nitrate/nitrite as nitrogen, total dissolved solids (TDS), sulfide, and alkalinity. Three wells were also tested for TOC, M028-A, M028-E, and, M034-A, but only during the first quarter of sampling. Results are presented on Table 4.1-3.

4.1.3 Quarter 2 Analytical Results

One or more organic compounds were detected at concentrations exceeding the MCLs in groundwater from six FWBZ wells from Site 1 during Quarter 2 (M001-E, M028-A, M028-E, M029-E, M034-A, and M035-A). Wells with organic analytes detected above the screening criteria in the FWBZ and SWBZ are shown on Figures 4.1-1, Sheet 2, and 4.1-2, Sheet 2, respectively. One or more inorganic analytes were detected at concentrations exceeding the MCLs in groundwater from seven FWBZ wells (M003-E, M027-E, M028-A, M028-E, M031-E, M034-A, and M035-A) and one SWBZ well (M028-C) during Quarter 2 sampling. Wells with inorganic analytes detected above the screening criteria in the FWBZ and the SWBZ are shown on Figures 4.1-3, Sheet 2, and 4.1-4, Sheet 2, respectively.

Organic analytical results for compounds detected in groundwater samples collected at Site 1 during Quarter 2 are presented on Table 4.1-1. Monitoring wells M028-A, M028-E, and M034-A, located within the solvent plume, exhibited detected concentrations of numerous VOCs. Among the VOCs detected at Site 1 were BTEX compounds and volatile chlorinated solvents including TCE, tetrachloroethene (PCE), chlorobenzene, 1,2-DCB, 1,4-DCB, 1,1-DCA, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride. Concentrations of many of these VOCs were the highest in the groundwater samples collected from two wells (M028-E and M034-A, screened in the FWBZL and FWBZU, respectively). Vinyl chloride was detected in the three Site 1 wells located within the plume at concentrations ranging from 36 to 140 μg/L. These concentrations, and the detected concentrations of the other VOCs, are much lower than the concentrations of vinyl chloride and other VOCs detected in Quarter 1, possibly due to dilution effects of the winter rains.

M035-A, located at the edge of the plume exhibited detected concentrations of several VOCs, including cis-1,2-DCE, trans-1,2-DCE, and TCE. One VOC (cis-1,2-DCE) was detected in well M027-E, located near the edge of the plume. Nearby well M031-E exhibited no detected VOCs.

In addition, chlorobenzene, 1,2-DCB, and BTEX compounds were detected in M001-E and benzene was detected in M029-E, both located north of the solvent plume. No VOCs were detected in wells M002-E and M003-E, north and northeast of the plume. In well M028-C, screened in the SWBZL, no VOCs were detected, implying that vertical migration of VOC contamination to the SWBZ has not occurred. Groundwater flow in the vicinity of the solvent plume at Site 1 is toward the San Francisco Bay in a northwesterly direction (Figure 1.2-2).

Groundwater from six monitoring wells were analyzed for SVOCs; SVOCs were detected in four of these six wells including wells M028-E and M034-A within the solvent plume and wells M001-E and M029-E outside the plume. These are the same wells exhibiting detected concentrations of SVOCs during Quarter 1. Although the highest concentrations of SVOCs are often found at the top of the BSA (based on previous sampling), SVOCs were not detected in M002-E (screened in the BSA). SVOCs were also not detected in well M028-A, where several VOCs were detected.

In three of the four wells where SVOCs were detected, either naphthalene or 2,4-dimethylphenol were detected at concentrations in excess of 100 μg/L. Other SVOCs detected at Site 1, but at lower concentrations, include 1,2-DCB, 1,4-DCB, 2,2'-oxybis, 2-methylnaphthalene, 2-methylphenol, 4-methylphenol, acenaphthene, carbazole, fluorene, and phenanthrene.

Groundwater samples from wells M028-A, M028-C, M028-E, and M034-A were analyzed for TEPH and TPPH. Diesel and gasoline were detected in two wells and motor oil was detected in three of the wells. Hydrocarbons were not detected in M028-C, screened in the SWBZ. Detected concentrations of motor oil ranged from 0.13 to 0.67 mg/L. Diesel was detected at concentrations of 1.6 and 2.2 mg/L, while gasoline was detected at concentrations of 1.1 and 1.9 mg/L. Quarter 2 concentrations of petroleum hydrocarbons were much lower than Quarter 1 concentrations (Table 4.1-1), most likely due to dilution of groundwater from rainfall.

Nine metals were detected in one or more groundwater samples from the 12 monitoring wells analyzed for metals during Quarter 2. The detected concentrations of arsenic (in four wells), barium (in all 12 wells and one duplicate sample), cadmium (in five wells, including the duplicate sample only from one well), chromium (in one duplicate sample), cobalt (in five wells), manganese (in all 12 wells and one duplicate sample), nickel (in 10 wells and one duplicate sample), silver (in one well), and zinc (in two wells) are shown on Table 4.1-2. Lead was not detected in any of the groundwater samples, including the sample from well M035-A, which was collected closest to the pistol range.

All 12 wells at Site 1 were tested for anions, nitrate/nitrite as nitrogen, TDS, sulfide, and alkalinity. These results are presented on Table 4.1-3.

4.1.4 Quarter 3 Analytical Results

One or more organic compounds were detected at concentrations exceeding the MCLs in groundwater from five Site 1 FWBZ wells during Quarter 3 (M001-E, M028-A, M028-E, M034-A, and M035-A). Wells with organic analytes detected above the screening criteria in the FWBZ and SWBZ are shown on Figures 4.1-1, Sheet 3 and 4.1-2, Sheet 3, respectively. One or more inorganic analytes were detected at concentrations exceeding the MCLs in groundwater from seven FWBZ wells (M001-E, M003-E, M027-E, M028-A, M028-E, M034-A, and M035-A) and one SWBZ well (M028-C) during Quarter 3 sampling. Wells with inorganic analytes detected above the screening criteria in the FWBZ and the SWBZ are shown on Figures 4.1-3, Sheet 3, and 4.1-4, Sheet 3, respectively.

Organic analytical results for compounds detected in groundwater samples collected at Site 1 during Quarter 3 are presented on Table 4.1-1. Monitoring wells M028-A, M028-E, and M034-A, located within the solvent plume, exhibited detected concentrations of numerous VOCs. Among the VOCs detected were BTEX compounds and volatile chlorinated solvents including 1,2-DCB, 1,3-DCB, 1,4-DCB, 1,1-DCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, chlorobenzene, TCE, and vinyl chloride. Concentrations of many of these VOCs were the highest in the groundwater samples collected from well M028-E, screened in the FWBZL. Vinyl chloride was detected in two of the three Site 1 wells located within the plume. Vinyl chloride and cis-1,2-DCE were detected in well M028-E at elevated concentrations (20,000 μg/L for vinyl chloride and 22,000 μg/L for cis-1,2-DCE). Vinyl chloride was also detected, but at a much lower concentration, in groundwater from well M028-A (69 μg/L) and in two other wells located north (M001-E) and south (M035-A) of the plume at concentrations of 0.6 μg/L and 6.0 μg/L, respectively. In well M028-C, screened in the SWBZL, no VOCs were detected, implying that vertical migration of VOC contamination to the SWBZ has not occurred.

M035-A, located south of the plume, exhibited detected concentrations of several VOCs, including cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride. One VOC (cis-1,2-DCE) was detected at a concentration of 3 μg/L in well M027-E, also located south of the plume.

In addition, 1,2-DCB, cis-1,2-DCE, BTEX compounds, chlorobenzene, and vinyl chloride were detected in M001-E and benzene was detected in M029-E (and in its duplicate sample), both located north of the solvent plume. No VOCs were detected in well M003-E, northeast of the plume. Groundwater flow in the vicinity of the solvent plume at Site 1 is toward the San Francisco Bay in a northwesterly direction

(Figure 1.2-2), but may be regionally affected by a funnel and gate treatment system located within the solvent plume.

Groundwater from five monitoring wells were analyzed for SVOCs; SVOCs were detected in four of these five wells including wells M028-E and M034-A within the solvent plume and wells M001-E and M029-E (and its duplicate sample), outside the plume. These are the same wells exhibiting detected concentrations of SVOCs during Quarters 1 and 2. SVOCs were not detected in well M028-A, where several VOCs were detected.

In the four wells where SVOCs were detected, the highest concentrations were exhibited by well M028-E, where the highest concentrations of VOCs were also detected. SVOCs detected at concentrations in excess of 100 μg/L in this well include 2,4-dimethylphenol (1,800 μg/L), 2-methylphenol (380 μg/L), and 4-methylphenol (200 μg/L). Other SVOCs detected at Site 1, but at lower concentrations, include 1,2-DCB, 1,3-DCB, 1,4-DCB, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, acenaphthene, carbazole, dibenzofuran, fluorene, naphthalene and phenanthrene. Most of these SVOCs were detected in wells M028-E and M034-E.

Groundwater samples from wells M028-A, M028-C, M028-E, and M034-A were analyzed for TEPH and TPPH. Gasoline was detected in all four of these wells and diesel and motor oil were also detected in three out of four wells. Gasoline concentrations ranged from 0.062 to 12 mg/L. Motor oil concentrations ranged from 0.34 to 1.8 mg/L and diesel concentrations ranged from 0.28 to 16 mg/L.

Ten metals were detected in one or more groundwater samples from the nine monitoring wells analyzed for metals during Quarter 3. The detected concentrations of arsenic (in eight wells), barium (in four wells and one duplicate sample), cadmium (in four wells), chromium (in three wells), cobalt (in four wells), copper (in two wells), manganese (in all nine wells and one duplicate sample), molybdenum (in four wells), nickel (in all nine wells, but not in the duplicate sample), and zinc (in four wells) are shown on Table 4.1-2. Lead was not detected in any of the groundwater samples, including the sample from well M035-A, which was collected closest to the pistol range.

All nine wells at Site 1 were tested for anions, nitrate/nitrite as nitrogen, TDS, sulfide, and alkalinity. These results are presented on Table 4.1-3.

4.1.5 Quarter 4 Analytical Results

One or more organic compounds were detected at concentrations exceeding the MCLs in groundwater from five Site 1 FWBZ wells during Quarter 4 (M001-E, M028-A, M028-E, M034-A, and M035-A). Wells with organic analytes detected above the screening criteria in the FWBZ are shown on Figure 4.1-1, Sheet 4. One or more inorganic analytes were detected at concentrations exceeding the MCLs in groundwater from six FWBZ wells (M003-E, M027-E, M028-A, M028-E, M034-A, and M035-A) during Quarter 4. Wells with inorganic analytes detected above the screening criteria in the FWBZ is shown on Figure 4.1-3, Sheet 4. The SWBZ monitoring well did not exceed either organic or inorganic MCLs.

Organic analytical results for compounds detected in groundwater samples collected at Site 1 during Quarter 4 are presented in Table 4.1-1. Monitoring wells M028-A, M028-E, and M034-A, located within the solvent plume, exhibited detected concentrations of numerous VOCs. Among the VOCs detected in groundwater in these Site 1 wells were BTEX compounds and volatile chlorinated solvents including 1,2-DCB, 1,3-DCB, 1,4-DCB, 1,1-DCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, chlorobenzene, and vinyl chloride. Concentrations of many of these VOCs were the highest in the groundwater samples collected from well M028-E, screened in the FWBZL. Vinyl chloride was detected in two of the three Site 1 wells located within the plume. Vinyl chloride and cis-1,2-DCE were detected in well M028-E at elevated concentrations (12,000 μg/L for vinyl chloride and 16,000 μg/L for cis-1,2-DCE). Vinyl chloride was detected at much lower concentrations in groundwater from well M028-A (250 μg/L) and from well M035-A, located south of the plume (12 μg/L). In well M028-C, screened in the SWBZL, no VOCs were detected, implying that vertical migration of VOC contamination to the SWBZ has not occurred.

In addition to vinyl chloride, well M035-A, located south of the plume, exhibited detected concentrations of several VOCs, including cis-1,2-DCE, trans-1,2-DCE, and TCE. One VOC (cis-1,2-DCE) was detected at a concentration of 3 μg/L in well M027-E, also located south of the plume. BTEX compounds were also detected in well M034-A located in the northeastern portion of the plume.

In addition, 1,2-DCB, BTEX compounds, and chlorobenzene were detected in M001-E and benzene was detected in M029-E (and in its duplicate sample); both wells are located north of the solvent plume. No VOCs were detected in well M003-E, northeast of the plume. Groundwater flow in the vicinity of the solvent plume at Site 1 is toward the San Francisco Bay in a northwesterly direction (Figure 1.2-2), but may be locally affected by a funnel and gate treatment system located within the solvent plume.

Groundwater from five of the monitoring wells was analyzed for SVOCs; SVOCs were detected in all five wells including wells M028-A, M028-E, and M034-A within the solvent plume and wells M001-E and M029-E (and its duplicate sample), outside the plume. Four of these wells exhibiting detected concentrations of SVOCs during previous quarters; SVOCs were not detected in well M028-A during previous quarters.

The highest SVOC concentrations were detected in samples from well M028-E, where the highest concentrations of VOCs were also detected. SVOCs detected at concentrations in excess of 100 μg/L in this well include 2,4-dimethylphenol (630 μg/L), 2-methylphenol (270 μg/L), and 4-methylphenol (120 μg/L). Other SVOCs detected at Site 1, but generally at lower concentrations, include 1,2-DCB, 1,4-DCB, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, 2,2-oxybis(1-chloropropane), acenaphthene, carbazole, dibenzofuran, fluorene, naphthalene and phenanthrene. Most of these SVOCs were detected in wells M028-E and M034-E.

Groundwater samples from wells M028-A, M028-C, M028-E, and M034-A were analyzed for TEPH and TPPH. Gasoline and motor oil were detected in three of the four wells and diesel was also detected in all four wells. Gasoline concentrations ranged from 0.13 to 8.7 mg/L. Motor oil concentrations ranged from 0.14 to 1.2 mg/L and diesel concentrations ranged from 0.28 to 7.9 mg/L.

Seven metals were detected in one or more groundwater samples from the nine monitoring wells analyzed for metals during Quarter 4. The detected concentrations of arsenic (in one well), barium (in all nine wells and one duplicate sample), cadmium (in two wells), chromium (in one well), cobalt (in five wells), manganese (in all nine wells and one duplicate sample), and zinc (in nine wells, but not in the duplicate sample) are shown on Table 4.1-2. Lead was not detected in any of the groundwater samples, including the sample from well M035-A, which was collected closest to the pistol range.

All nine wells at Site 1 were tested for anions, nitrate/nitrite as nitrogen, TDS, sulfide, and alkalinity. These results are presented on Table 4.1-3.

4.1.6 Time-Series Plots

In order to track the progression of chemical degradation and movement in groundwater at Site 1, changes in chemical type and concentration were followed over a period from 1994 through 1998. Time-series plots were prepared for eight monitoring wells at Site 1, located within and adjacent to the groundwater contaminant plumes depicted in Figures 6-1 and 6-2. The time-series plots present a more diverse group of chemicals than the three representative chemicals shown in the contaminant plumes in Figures 6-1 and 6-2. Figures 4.1-5 through 4.1-9 depict time-series plots for a south to north transect of monitoring wells (M027-E, M035-A, M028-A, M028-E, and M034-A) associated with a chlorinated solvent and petroleum plume. Figures 4.1-10 through 4.1-12 depict time-series plots for a southwest to northeast transect of monitoring wells (M029-E, M001-E, and M002-A) associated with a separate chlorinated solvent and petroleum plume.

Monitoring wells M027-E and M035-A (Figures 4.1-5 and 4.1-6) are located within the southern margin of the chlorinated solvent plume. Chlorinated solvent concentrations have generally remained the same over the four year time frame, decreasing during periods of precipitation induced dilution. A slight reduction in the concentration of the parent compound (TCE) and an increase in the concentrations of the degradation products (DCE and vinyl chloride) has occurred.

Monitoring well M034-A (Figure 4.1-9) is located within the northeast portion of the co-mingled chlorinated solvent and petroleum plume. The concentration of chlorinated solvents has changed dramatically over the last four years, with both the parent chemical (PCE) and degradation products (DCA, DCE, and vinyl chloride) decreasing to chemical reporting limits in the summer of 1998. However, in the winter of 1997 and spring of 1998 during a period of precipitation, the concentration of chlorinated solvents increased 2 to 3 orders of magnitude. This behavior suggests that residual solvent may have been flushed from the overlying soil or capillary fringe in response to infiltrating rainwater. The concentration of benzene within monitoring well M034-A has remained fairly constant over the last three years, showing no response to precipitation events.

Monitoring wells M028-A and M028-E (Figure 4.1-7 and 4.1-8) are located in the down gradient reach of the co-mingled plume. The concentration of chlorinated solvents and petroleum compounds has changed marginally over the last four years, with both the parent chemicals (TCE and benzene) and degradation products (DCA, DCE, and vinyl chloride) showing a dilution response during precipitation events and concentrating response during the dry summer months. A funnel and gate with an iron curtain treatment wall was placed up gradient of the two monitoring wells in 1997. The pilot-scale treatment system has been in operation since early 1998. Both monitoring wells have shown a favorable response to the pilot-scale treatment system.

Monitoring wells M029-E, M001-E and M002-A (Figures 4.1-10 through 4.1-12) are located with a low concentration chlorinated solvent and petroleum plume in the northwest corner of Site 1. The concentration of chlorinated solvents and petroleum compounds has changed marginally over the last four years in wells M029-E and M001-E; however, the concentration of chlorinated solvents in well M002-A has decreased to chemical reporting limits. The plume appears to be stable, degrading slowly over time. No increases in the concentrations of parent compounds were observed.

TABLE 4.1-1
SITE 1
QUARTER 1
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (µg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (µg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M001-E	108-S01-010	10/29/97	1,2-DICHLOROBENZENE: 2 2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 4 CHLOROBENZENE: 6 ETHYLBENZENE: 2 XYLENE (TOTAL): 10	1,2-DICHLOROBENZENE: 1J 2,2'-OXYBIS(1-CHLOROPROPANE): 2J 2,4-DIMETHYLPHENOL: 5J 2-METHYLNAPHTHALENE: 4J ACENAPHTHENE: 3J CARBAZOLE: 3J FLUORENE: 1J NAPHTHALENE: 120 PHENANTHRENE: 2J	NA	NA	NA
M002-E	108-S01-011	10/29/97	2-BUTANONE: R 2-HEXANONE: R ACETONE: R	ND	NA	NA	NA
M003-E	108-S01-003	10/29/97	2-BUTANONE: R 2-HEXANONE: R ACETONE: R	NA	NA	NA	NA
M027-E	108-S01-012	10/30/97	2-BUTANONE: R ACETONE: R CIS-1,2-DICHLOROETHENE: 4 TOLUENE: 3 XYLENE (TOTAL): 1	NA	NA	NA	NA
M028-A	108-S01-013	11/07/97	1,1-DICHLOROETHANE: 26 1,2-DICHLOROBENZENE: 55 ACETONE: R BENZENE: 69 CHLOROBENZENE: 37 CIS-1,2-DICHLOROETHENE: 5600 ETHYLBENZENE: 58 TOLUENE: 1900 VINYL CHLORIDE: 7300 XYLENE (TOTAL): 290	ND	NA	DIESEL RANGE ORGANICS: 9J GASOLINE RANGE ORGANICS: 7.8J	NA
M028-E	108-S01-001	10/30/97	1,1-DICHLOROETHANE: 7 1,2-DICHLOROBENZENE: 24 1,3-DICHLOROBENZENE: 1 1,4-DICHLOROBENZENE: 10 2-BUTANONE: R ACETONE: R BENZENE: 54J CHLOROBENZENE: 160J CIS-1,2-DICHLOROETHENE: 46J ETHYLBENZENE: 110J	1,2-DICHLOROBENZENE: 18 1,4-DICHLOROBENZENE: 7 2,4-DIMETHYLPHENOL: 110 2-METHYLPHENOL: 6J 4-METHYLPHENOL: 1J NAPHTHALENE: 22	NA	DIESEL RANGE ORGANICS: 4J MOTOR OIL RANGE ORGANICS: 1J GASOLINE RANGE ORGANICS: 2.4J	NA

TABLE 4.1-1
SITE 1
QUARTER 1
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (µg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (µg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M028-E	108-S01-001 (Continued)	10/30/97	TOLUENE: 480J TRANS-1,2-DICHLOROETHENE: 1 VINYL CHLORIDE: 250J XYLENE (TOTAL): 400J				
M028-E	108-S01-002*	10/30/97	1,1-DICHLOROETHANE: 6 1,2-DICHLOROBENZENE: 22 1,4-DICHLOROBENZENE: 9 2-BUTANONE: R ACETONE: R BENZENE: 34J CHLOROBENZENE: 100J CIS-1,2-DICHLOROETHENE: 28J ETHYLBENZENE: 67J TOLUENE: 300J TRANS-1,2-DICHLOROETHENE: 1 VINYL CHLORIDE: 160J XYLENE (TOTAL): 240J	1,2-DICHLOROBENZENE: 14 1,4-DICHLOROBENZENE: 5 2,4-DIMETHYLPHENOL: 110 2-METHYLPHENOL: 6J 4-METHYLPHENOL: 1J NAPHTHALENE: 20	NA	DIESEL RANGE ORGANICS: 4J MOTOR OIL RANGE ORGANICS: 1J GASOLINE RANGE ORGANICS: 2.2J	NA
M029-E	108-S01-015	10/29/97	1,2-DIBROMO-3-CHLOROPROPANE: R 2-BUTANONE: R ACETONE: R BENZENE: 2	ACENAPHTHENE: 2J PHENANTHRENE: 1J	NA	NA	NA
M030-E	108-S01-005	10/29/97	1,2-DIBROMO-3-CHLOROPROPANE: R 2-BUTANONE: R ACETONE: R	NA	NA	NA	NA
M031-E	108-S01-004	10/29/97	2-BUTANONE: R 2-HEXANONE: R ACETONE: R	NA	NA	NA	NA
M034-A	108-S01-007	11/04/97	1,1-DICHLOROETHANE: 8 1,1-DICHLOROETHENE: 7 1,2-DICHLOROBENZENE: 15 1,3-DICHLOROBENZENE: 1 1,4-DICHLOROBENZENE: 9 2-BUTANONE: R ACETONE: R BENZENE: 37J CHLOROBENZENE: 36J CIS-1,2-DICHLOROETHENE: 2100J ETHYLBENZENE: 20J TOLUENE: 530J TRANS-1,2-DICHLOROETHENE: 6	1,2-DICHLOROBENZENE: 7 1,4-DICHLOROBENZENE: 4J 2,4-DIMETHYLPHENOL: 140 2-METHYLNAPHTHALENE: 8J 4-METHYLPHENOL: 2J ACENAPHTHENE: 2J CARBAZOLE: 1J DIBENZOFURAN: 1J NAPHTHALENE: 54	NA	DIESEL RANGE ORGANICS: 2J MOTOR OIL RANGE ORGANICS: 0.8J GASOLINE RANGE ORGANICS: 3.7J	NA

TABLE 4.1-1
SITE 1
QUARTER 1
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 3 of 3)

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (µg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (µg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M034-A	108-S01-007 (Continued)	11/04/97	VINYL CHLORIDE: 1700J XYLENE (TOTAL): 120J				
M035-A	108-S01-008	11/04/97	2-BUTANONE: R ACETONE: R TRANS-1,2-DICHLOROETHENE: 2 TRICHLOROETHENE: 5	NA	NA	NA	NA

Notes:
µg/L = Micrograms per liter
mg/L = Milligrams per liter
NA = Not analyzed
R = Rejected
PCBs = Polychlorinated biphenyls
J = Value estimated at reported concentration
ND = Not detected
* = Duplicate sample

TABLE 4.1-1
SITE 1
QUARTER 2
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (µg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (µg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M001-E	108-S01-016	02/04/98	1,2-DICHLOROBENZENE: 2 2-BUTANONE: R ACETONE: R BENZENE: 5 CHLOROBENZENE: 10 ETHYLBENZENE: 3 TOLUENE: 1 XYLENE (TOTAL): 13	2,2'-OXYBIS(1-CHLOROPROPANE): 2J 2,4-DIMETHYLPHENOL: 7J 2-METHYLNAPHTHALENE: 4J ACENAPHTHENE: 4J CARBAZOLE: 4J FLUORENE: 1J NAPHTHALENE: 120 PHENANTHRENE: 2J	NA	NA	NA
M002-E	108-S01-017	02/04/98	2-BUTANONE: R ACETONE: R	ND	NA	NA	NA
M003-E	108-S01-018	02/04/98	2-BUTANONE: R ACETONE: R	NA	NA	NA	NA
M027-E	108-S01-019	02/03/98	2-BUTANONE: R ACETONE: R CIS-1,2-DICHLOROETHENE: 4	NA	NA	NA	NA
M028-A	108-S01-020	02/03/98	2-BUTANONE: R ACETONE: R BENZENE: 0.6 CIS-1,2-DICHLOROETHENE: 61 TRICHLOROETHENE: 3 VINYL CHLORIDE: 36	ND	NA	MOTOR OIL RANGE ORGANICS: 0.13J	NA
M028-C	108-S01-021	02/03/98	2-BUTANONE: R	NA	NA	ND	NA
M028-E	108-S01-022	02/03/98	1,1-DICHLOROETHANE: 11J 1,2-DICHLOROBENZENE: 9J 1,4-DICHLOROBENZENE: 7J 2-BUTANONE: R ACETONE: R BENZENE: 38 CHLOROBENZENE: 55 CIS-1,2-DICHLOROETHENE: 49 ETHYLBENZENE: 43 TOLUENE: 180 VINYL CHLORIDE: 130 XYLENE (TOTAL): 100	1,2-DICHLOROBENZENE: 6 1,4-DICHLOROBENZENE: 5J 2,4-DIMETHYLPHENOL: 110 2-METHYLPHENOL: 27 4-METHYLPHENOL: 1J NAPHTHALENE: 16	NA	DIESEL RANGE ORGANICS: 2.2J MOTOR OIL RANGE ORGANICS: 0.67J GASOLINE RANGE ORGANICS: 1.1J	NA
M029-E	108-S01-023	02/04/98	2-BUTANONE: R ACETONE: R BENZENE: 1	2,4-DIMETHYLPHENOL: 1J ACENAPHTHENE: 2J PHENANTHRENE: 1J	NA	NA	NA
M030-E	108-S01-024	02/04/98	2-BUTANONE: R ACETONE: R	NA	NA	NA	NA
M030-E	108-S01-025	02/04/98	2-BUTANONE: R ACETONE: R	NA	NA	NA	NA

TABLE 4.1-1
SITE 1
QUARTER 2
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (µg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (µg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M031-E	108-S01-026	02/10/98	2-BUTANONE: R 2-HEXANONE: R ACETONE: R	NA	NA	NA	NA
M034-A	108-S01-027	02/04/98	1,2-DICHLOROBENZENE: 44 2-BUTANONE: R ACETONE: R BENZENE: 49 CHLOROBENZENE: 47 CIS-1,2-DICHLOROETHENE: 48 ETHYLBENZENE: 34 TETRACHLOROETHENE: 69 TOLUENE: 860 VINYL CHLORIDE: 140 XYLENE (TOTAL): 180	1,2-DICHLOROBENZENE: 9 1,4-DICHLOROBENZENE: 6 2,4-DIMETHYLPHENOL: 190 2-METHYLNAPHTHALENE: 4J 2-METHYLPHENOL: 8J 4-METHYLPHENOL: 2J NAPHTHALENE: 10J	NA	DIESEL RANGE ORGANICS: 1.6J MOTOR OIL RANGE ORGANICS: 0.29J GASOLINE RANGE ORGANICS: 1.9J	NA
M035-A	108-S01-028	02/03/98	2-BUTANONE: R ACETONE: R CIS-1,2-DICHLOROETHENE: 14 TRANS-1,2-DICHLOROETHENE: 2 TRICHLOROETHENE: 4	NA	NA	NA	NA

Notes:
µg/L = Micrograms per liter
mg/L = Milligrams per liter
NA = Not analyzed
R = Rejected
PCBs = Polychlorinated biphenyls
J = Value estimated at reported concentration
ND = Not detected

TABLE 4.1-1
SITE 1
QUARTER 3
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 2)

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (μg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (μg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (μg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M001-E	108-S01-029	05/04/98	1,2-DICHLOROBENZENE: 2 2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 5 CHLOROBENZENE: 13 CIS-1,2-DICHLOROETHENE: 1 ETHYLBENZENE: 4 TOLUENE: 1 VINYL CHLORIDE: 0.6 XYLENE (TOTAL): 15	2,2'-OXYBIS(1-CHLOROPROPANE): 1J CARBAZOLE: 1J	NA	NA	NA
M003-E	108-S01-031	05/04/98	2-BUTANONE: R 2-HEXANONE: R ACETONE: R	NA	NA	NA	NA
M027-E	108-S01-032	05/14/98	2-BUTANONE: R ACETONE: R CIS-1,2-DICHLOROETHENE: 3	NA	NA	NA	NA
M028-A	108-S01-033	05/04/98	1,1-DICHLOROETHANE: 2J 1,2-DICHLOROBENZENE: 2 2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 4 CHLOROBENZENE: 3 CIS-1,2-DICHLOROETHENE: 32 VINYL CHLORIDE: 69	ND	NA	DIESEL RANGE ORGANICS: 0.28J MOTOR OIL RANGE ORGANICS: 0.34J GASOLINE RANGE ORGANICS: 0.065J	NA
M028-C	108-S01-034	05/05/98	2-BUTANONE: R 2-HEXANONE: R ACETONE: R	NA	NA	GASOLINE RANGE ORGANICS: 0.025J	NA
M028-E	108-S01-035	05/04/98	1,1-DICHLOROETHANE: 38J 1,1-DICHLOROETHENE: 50 1,2-DICHLOROBENZENE: 75 2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 94 CHLOROBENZENE: 58 CIS-1,2-DICHLOROETHENE: 22000 ETHYLBENZENE: 88 TOLUENE: 2400	1,2-DICHLOROBENZENE: 32 1,3-DICHLOROBENZENE: 1J 1,4-DICHLOROBENZENE: 7 2,4-DIMETHYLPHENOL: 1800 2-METHYLPHENOL: 380J 4-METHYLPHENOL: 200J NAPHTHALENE: 17	NA	DIESEL RANGE ORGANICS: 16J MOTOR OIL RANGE ORGANICS: 1.8J GASOLINE RANGE ORGANICS: 12J	NA

TABLE 4.1-1
SITE 1
QUARTER 3
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (µg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (µg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M028-E	108-S01-035 (Continued)	05/04/98	TRANS-1,2-DICHLOROETHENE: 110 VINYL CHLORIDE: 20000 XYLENE (TOTAL): 340				
M029-E	108-S01-036	05/06/98	2-BUTANONE: R ACETONE: R BENZENE: 0.8	ACENAPHTHENE: 2J BIS(2-ETHYLHEXYL)PHTHALATE: 110J PHENANTHRENE: 1J	NA	NA	NA
M029-E	108-S01-037	05/06/98	2-BUTANONE: R ACETONE: R BENZENE: 0.7	ACENAPHTHENE: 2J PHENANTHRENE: 1J	NA	NA	NA
M034-A	108-S01-040	05/07/98	1,1-DICHLOROETHANE: 1 1,2-DICHLOROBENZENE: 7 1,3-DICHLOROBENZENE: 1 1,4-DICHLOROBENZENE: 7 2-BUTANONE: R ACETONE: R BENZENE: 42 CHLOROBENZENE: 34 ETHYLBENZENE: 20 TOLUENE: 4 XYLENE (TOTAL): 68	1,2-DICHLOROBENZENE: 4J 1,4-DICHLOROBENZENE: 4J 2,4-DIMETHYLPHENOL: 54 2-METHYLNAPHTHALENE: 10J ACENAPHTHENE: 3J CARBAZOLE: 2J DIBENZOFURAN: 2J FLUORENE: 1J NAPHTHALENE: 50	NA	DIESEL RANGE ORGANICS: 1.1J MOTOR OIL RANGE ORGANICS: 0.38J GASOLINE RANGE ORGANICS: 1.7J	NA
M035-A	108-S01-041	05/07/98	2-BUTANONE: R ACETONE: R CIS-1,2-DICHLOROETHENE: 5 TRANS-1,2-DICHLOROETHENE: 1 TRICHLOROETHENE: 5 VINYL CHLORIDE: 6	NA	NA	NA	NA

Notes:
µg/L = Micrograms per liter
mg/L = Milligrams per liter
NA = Not analyzed
R = Rejected
PCBs = Polychlorinated biphenyls
J = Value estimated at reported concentration
ND = Not detected

* Field duplicate samples: 108-S01-036 / 108-S01-037

TABLE 4.1-1
SITE 1
QUARTER 4
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 3)

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (µg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (µg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M001-E	108-S01-042	08/03/98	1,2-DICHLOROBENZENE: 2 2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 4 CHLOROBENZENE: 8 ETHYLBENZENE: 3 XYLENE (TOTAL): 10	2,2'-OXYBIS(1-CHLOROPROPANE): 3J ACENAPHTHENE: 4J CARBAZOLE: 3J FLUORENE: 2J PHENANTHRENE: 1J	NA	NA	NA
M003-E	108-S01-043	08/03/98	2-BUTANONE: R 2-HEXANONE: R ACETONE: R	NA	NA	NA	NA
M027-E	108-S01-044	08/03/98	2-BUTANONE: R 2-HEXANONE: R ACETONE: R CIS-1,2-DICHLOROETHENE: 3	NA	NA	NA	NA
M028-A	108-S01-045	08/03/98	1,1-DICHLOROETHANE: 3 1,2-DICHLOROBENZENE: 13 1,4-DICHLOROBENZENE: 4 2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 10 CHLOROBENZENE: 17 CIS-1,2-DICHLOROETHENE: 18 ETHYLBENZENE: 1 TOLUENE: 2 VINYL CHLORIDE: 250	1,2-DICHLOROBENZENE: 10	NA	DIESEL RANGE ORGANICS: 0.28J MOTOR OIL RANGE ORGANICS: 0.40J GASOLINE RANGE ORGANICS: 0.13J	NA
M028-C	108-S01-046	08/04/98	2-BUTANONE: R 2-HEXANONE: R ACETONE: R	NA	NA	MOTOR OIL RANGE ORGANICS: 0.14J	NA
M028-E	108-S01-047	08/03/98	1,1-DICHLOROETHANE: 20 1,1-DICHLOROETHENE: 31 1,2-DICHLOROBENZENE: 51 1,4-DICHLOROBENZENE: 10 2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 48 CHLOROBENZENE: 31 CIS-1,2-DICHLOROETHENE: 16000	1,2-DICHLOROBENZENE: 31 1,4-DICHLOROBENZENE: 8 2,4-DIMETHYLPHENOL: 630 2-METHYLPHENOL: 270 4-METHYLPHENOL: 120 NAPHTHALENE: 17	NA	DIESEL RANGE ORGANICS: 7.9J MOTOR OIL RANGE ORGANICS: 1.2J GASOLINE RANGE ORGANICS: 8.7J	NA

TABLE 4.1-1
SITE 1
QUARTER 4
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (µg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (µg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M028-E	108-S01-047 (Continued)	08/03/98	ETHYLBENZENE: 56 TOLUENE: 1200 TRANS-1,2-DICHLOROETHENE: 55 VINYL CHLORIDE: 12000 XYLENE (TOTAL): 210				
M029-E	108-S01-048	08/03/98	2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 0.9	2,4-DIMETHYLPHENOL: 1J ACENAPHTHENE: 2J BIS(2-ETHYLHEXYL)PHTHALATE: 100J PHENANTHRENE: 1J	NA	NA	NA
M029-E	108-S01-049	08/03/98	2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 0.8	2,4-DIMETHYLPHENOL: 1J ACENAPHTHENE: 2J PHENANTHRENE: 1J	NA	NA	NA
M034-A	108-S01-050	08/03/98	1,2-DICHLOROBENZENE: 2 1,4-DICHLOROBENZENE: 3 2-BUTANONE: R 2-HEXANONE: R ACETONE: R BENZENE: 36 CHLOROBENZENE: 18 ETHYLBENZENE: 8 TOLUENE: 2 XYLENE (TOTAL): 22	1,2-DICHLOROBENZENE: 2J 1,4-DICHLOROBENZENE: 3J 2,2'-OXYBIS(1-CHLOROPROPANE): 4J 2,4-DIMETHYLPHENOL: 4J 2-METHYLNAPHTHALENE: 10 ACENAPHTHENE: 6J CARBAZOLE: 5J DIBENZOFURAN: 2J FLUORENE: 2J NAPHTHALENE: 61	NA	DIESEL RANGE ORGANICS: 0.99J MOTOR OIL RANGE ORGANICS: 0.63J GASOLINE RANGE ORGANICS: 0.73J	NA
M035-A	108-S01-051	08/03/98	1,1,1-TRICHLOROETHANE: R 1,1,2,2-TETRACHLOROETHANE: R 1,1,2-TRICHLOROETHANE: R 1,1-DICHLOROETHANE: R 1,1-DICHLOROETHENE: R 1,2,4-TRICHLOROBENZENE: R 1,2-DIBROMO-3-CHLOROPROPANE: R 1,2-DIBROMOETHANE: R 1,2-DICHLOROBENZENE: R 1,2-DICHLOROETHANE: R 1,2-DICHLOROPROPANE: R 1,3-DICHLOROBENZENE: R 1,4-DICHLOROBENZENE: R 2-BUTANONE: R 2-HEXANONE: R 4-METHYL-2-PENTANONE: R ACETONE: R BENZENE: R	NA	NA	NA	NA

TABLE 4.1-1
SITE 1
QUARTER 4
ORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	VOLATILE ORGANIC COMPOUNDS (μg/L)	SEMIVOLATILE ORGANIC COMPOUNDS (μg/L)	ORGANOCHLORINE PESTICIDES AND PCBs (μg/L)	TOTAL PETROLEUM HYDROCARBONS (mg/L)	OIL AND GREASE (mg/L)
M035-A	108-S01-051 (Continued)	08/03/98	BROMOCHLOROMETHANE: R BROMODICHLOROMETHANE: R BROMOFORM: R BROMOMETHANE: R CARBON DISULFIDE: R CARBON TETRACHLORIDE: R CHLOROBENZENE: R CHLOROETHANE: R CHLOROFORM: R CHLOROMETHANE: R CIS-1,2-DICHLOROETHENE: 11J CIS-1,3-DICHLOROPROPENE: R DIBROMOCHLOROMETHANE: R ETHYLBENZENE: R METHYLENE CHLORIDE: R STYRENE: R TETRACHLOROETHENE: R TOLUENE: R TRANS-1,2-DICHLOROETHENE: 3J TRANS-1,3-DICHLOROPROPENE: R TRICHLOROETHENE: 5J VINYL CHLORIDE: 12J XYLENE (TOTAL): R				

Notes:
μg/L = Micrograms per liter
mg/L = Milligrams per liter
NA = Not analyzed
PCBs = Polychlorinated biphenyls
J = Value estimated at reported concentration
R = Rejected

TABLE 4.1-2
SITE 1
QUARTER 1
INORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 1)

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CHROMIUM	COBALT	COPPER	LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	SELENIUM	SILVER	THALLIUM	VANADIUM	ZINC
			(µg/L)																	
M001-E	108-S01-010	10/29/97	<3.1	<2.2	97.6J	<0.15	<0.15	0.68J	0.42J	<0.65	<1.2	27.7J	<0.10	<5.8	<1.7	<1.0	<0.35	<0.90	<1.9	9.9J
M002-E	108-S01-011	10/29/97	<0.92	<3.4	140	<0.15	0.36J	<0.30	1.1J	<0.65	R	<2.7	<0.10	<3.4	<2.5	<1.0	<0.35	<18.0	<0.40	12.2
M003-E	108-S01-003	10/29/97	<0.65	<4.0	137	<0.15	<0.15	<0.30	<0.40	<0.65	R	83.3J	<0.10	<2.4	<1.3	<1.0	<0.35	<0.90	<0.40	9.4J
M027-E	108-S01-012	10/30/97	<0.65	9.3	485	<0.15	1.1J	<0.30	0.80J	<0.65	<0.65	2220	<0.10	<1.7	2.8J	<1.0	<0.35	<1.2	<0.40	19.2
M028-A	108-S01-013	11/07/97	<1.9	19.3	224	<0.15	0.27J	<0.84	0.58J	<0.65	<0.65	1070	<0.10	<0.30	<1.7	<1.0	<0.35	<0.90	<0.40	<6.9
M028-E	108-S01-001	10/30/97	<0.65	40.1	186	<0.15	<0.15	0.72J	1.4J	<0.65	<0.65	979	<0.10	<0.30	1.6J	<1.0	<0.35	<1.2	<0.40	3.5J
M028-E	108-S01-002*	10/30/97	<1.2	36.8	154	<0.15	0.16J	0.58J	1.3J	<0.65	<0.65	933	<0.10	<0.30	2.1J	<1.0	<0.35	<1.2	<0.40	9.0J
M029-E	108-S01-015	10/29/97	<3.0	<1.5	355	<0.15	<0.15	<0.30	<0.40	<0.65	R	28.1J	<0.10	<1.2	<1.0	<1.0	<0.35	<0.90	<0.40	4.3J
M030-E	108-S01-005	10/29/97	<1.7	<2.3	121	<0.15	<0.15	<0.30	<0.40	1.1J	R	199J	<0.10	<2.2	<1.7	<1.3	<0.35	<0.90	<5.8	7.5
M031-E	108-S01-004	10/29/97	<0.86	<3.7	99.2	<0.15	<0.15	<0.30	<0.40	<0.65	R	339J	<0.10	<1.9	<2.8	<1.0	<0.35	<0.90	<0.40	8.0J
M034-A	108-S01-007	11/04/97	<0.65	19.4	141	<0.15	<0.28	<0.84	0.68J	<0.65	<0.65	745	<0.10	<0.65	3.1J	<1.0	<0.35	<1.2	<0.40	<6.5
M035-A	108-S01-008	11/04/97	<1.0	13.2	42.9J	<0.15	<0.32	<0.66	<0.40	<0.65	<0.65	516	<0.10	<2.9	2.6J	<1.0	<0.35	<1.2	<0.54	12.2

Notes:
µg/L = Micrograms per liter
J = Value estimated at reported concentration
* = Duplicate sample
< = Parameter reported below reporting limit
R = Rejected

TABLE 4.1-2
SITE 1
QUARTER 2
INORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 1)

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CHROMIUM	COBALT	COPPER	LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	SELENIUM	SILVER	THALLIUM	VANADIUM	ZINC
			(µg/L)																	
M001-E	108-S01-016	02/04/98	<2.4	<1.9	100	<0.10	<0.20	<0.45	<0.25	<0.63	<0.84	31.8	<0.10	5.8	2.0J	<0.90	<0.15	<1.3	<0.98	<7.7
M002-E	108-S01-017	02/04/98	<0.70	<0.80	60.8J	<0.10	0.54J	<0.20	<0.25	<0.90	<4.3	35.3	<0.10	2.6J	2.2J	<0.90	<0.15	<1.3	<0.30	<11.4
M003-E	108-S01-018	02/04/98	<0.70	<3.2	102	<0.10	<0.20	<0.20	<0.25	<0.35	<0.60	79.4	<0.10	2.0J	0.84J	<0.90	<0.15	<1.3	<0.30	<7.7
M027-E	108-S01-019	02/03/98	<0.70	7.5	604	<0.10	0.24J	<0.20	0.56J	<0.35	<0.60	1220	<0.10	2.5J	1.5J	<0.90	<0.15	<1.3	<0.30	<8.4
M028-A	108-S01-020	02/03/98	<9.7	<0.80	70.3J	<0.10	4.4	<0.51	<0.25	<17.8	<2.4	30.6	<0.10	2.4J	9.5	<0.90	<0.15	<1.3	<0.94	141
M028-C	108-S01-021	02/03/98	<0.92	<5.6	320	<0.10	<0.20	<0.20	2.2J	<0.40	<3.0	5150	<0.10	3.1J	5.5J	<1.5	0.40J	<6.5	<0.30	<15.1
M028-E	108-S01-022	02/03/98	<0.70	11.3	77.9J	<0.10	<0.20	<0.72	0.54J	<0.35	<0.60	796	<0.10	<0.25	0.57J	<0.90	<0.15	<1.3	<0.30	<6.8
M029-E	108-S01-023	02/04/98	<1.4	<0.80	305	<0.10	<0.20	<0.20	<0.25	<0.35	<0.60	27.1	<0.10	0.83J	<0.30	<0.90	<0.15	<1.3	<0.30	<3.5
M030-E	108-S01-024	02/04/98	<1.5	<1.0	36.0J	<0.10	<0.20	<0.20	<0.25	<1.6	<0.60	34.5	<0.10	1.3J	1.5J	<0.90	<0.15	<1.4	<2.9	<4.1
M030-E	108-S01-025	02/04/98	<0.70	<0.86	38.5J	<0.10	0.27J	0.32J	<0.25	<2.2	<0.60	40.5	<0.10	0.83J	4.4J	<0.90	<0.15	<1.4	<3.2	<7.2
M031-E	108-S01-026	02/10/98	<0.70	<2.2	101	<0.10	0.22J	<0.37	<0.25	<0.35	<2.4	307	<0.10	<2.3	<2.2	<0.80	<0.15	<1.3	<0.30	14.0
M034-A	108-S01-027	02/04/98	<0.70	13.7	98.3J	<0.10	<0.20	<0.52	0.54J	<0.35	<0.60	530	<0.10	0.34J	0.92J	<0.90	<0.15	<1.3	<0.30	<5.9
M035-A	108-S01-028	02/03/98	<0.89	7.8	43.2J	<0.10	<0.20	<0.34	0.63J	<4.8	<0.60	385	<0.10	2.5J	3.1J	<0.90	<0.15	<1.3	<1.3	<8.2

Notes:
µg/L = Micrograms per liter
J = Value estimated at reported concentration
< = Parameter reported below reporting limit
NA = Not analyzed

TABLE 4.1-2
SITE 1
QUARTER 3
INORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 1)

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CHROMIUM	COBALT	COPPER	LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	SELENIUM	SILVER	THALLIUM	VANADIUM	ZINC
			(µg/L)																	
M001-E	108-S01-029	05/04/98	<3.3	1.8J	<371	<0.10	0.38J	0.75J	<0.30	<3.5	<1.8	29.8	<0.10	5.7	1.2J	R	<0.30	<1.4	<1.5	<29.9
M003-E	108-S01-031	05/04/98	<0.86	3.9J	<340	<0.10	0.19J	<0.35	<0.30	<2.0	<0.90	71.9	<0.10	1.7J	0.70J	R	<0.30	<1.4	<0.25	<81.8
M027-E	108-S01-032	05/14/98	<0.85	6.1	564	<0.10	0.18J	<0.35	<0.30	1.6J	<0.50	814	<0.10	<2.2	1.4J	R	<0.30	<1.4	<0.25	89.4
M028-A	108-S01-033	05/04/98	<0.85	3.0J	<318	<0.10	0.32J	<0.35	<0.30	<3.0	<0.90	120	<0.10	0.84J	1.8J	R	<0.30	<1.4	<0.25	<97.1
M028-C	108-S01-034	05/05/98	<0.85	3.7J	<288	<0.10	<0.15	<0.35	1.5J	<2.4	<0.90	4470	<0.10	2.7J	4.5J	R	<0.30	<7.0	<0.25	<51.4
M028-E	108-S01-035	05/04/98	<0.85	21.5	<382	<0.10	<0.15	0.82J	0.71J	<1.6	<0.90	1260	<0.10	<0.50	1.7J	R	<0.30	<1.4	<0.25	<98.1
M029-E	108-S01-036	05/06/98	<1.7	<1.0	624	<0.10	<0.15	<0.35	<0.30	<2.5	<1.5	35.9	<0.10	<1.4	9.5	R	<0.30	<1.4	<0.25	61.1
M029-E	108-S01-037	05/06/98	<1.4	<1.0	418	<0.10	<0.15	<0.35	<0.30	<0.60	<0.50	34.5	<0.10	<1.3	<0.50	R	<0.30	<1.4	<0.25	<4.2
M034-A	108-S01-040	05/07/98	<0.85	11.4	300	<0.10	<0.15	0.86J	0.76J	4.3	<0.68	641	<0.10	<1.2	2.2J	R	<0.30	<1.4	<0.59	99.8
M035-A	108-S01-041	05/07/98	<1.4	6.9	309	<0.10	<0.15	<0.35	0.47J	<2.6	<0.50	410	<0.10	<2.6	3.0J	R	<0.30	<1.4	<0.56	110

Notes:
µg/L = Micrograms per liter
J = Value estimated at reported concentration
< = Parameter reported below reporting limit
R = Rejected

* Field duplicate samples: 108-S01-036 / 108-S01-037

TABLE 4.1-2
SITE 1
QUARTER 4
INORGANIC COMPOUNDS DETECTED IN GROUNDWATER
ALAMEDA POINT

WELL NO.	SAMPLE NUMBER	SAMPLE DATE	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CHROMIUM	COBALT	COPPER	LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	SELENIUM	SILVER	THALLIUM	VANADIUM	ZINC
			(µg/L)																	
M001-E	108-S01-042	08/03/98	<3.6	<4.2	77.4J	<0.20	0.40J	<0.80	<2.4	<2.8	<1.1	31.6	<0.10	<4.4	<1.5	<1.6	<0.70	<1.1	<1.3	6.1J
M003-E	108-S01-043	08/03/98	<2.0	<4.4	123J	<0.20	<0.30	<0.80	<2.0	<2.4	<1.1	92.4	<0.10	<1.8	<1.5	<1.6	<0.70	<1.1	<0.60	9.6J
M027-E	108-S01-044	08/03/98	<3.4	<10.3	334J	<0.20	<0.30	<0.80	2.9J	<1.6	<1.7	1700	<0.10	<3.4	<2.7	<1.6	<0.70	<1.1	<0.60	10.1J
M028-A	108-S01-045	08/03/98	<1.8	<8.0	107J	<0.20	<0.30	<0.80	2.6J	<1.7	<1.2	439	<0.10	<1.6	<1.4	<1.6	<0.70	<1.1	<0.60	10.8J
M028-C	108-S01-046	08/04/98	<1.8	<3.2	172J	<0.20	0.41J	<0.80	<2.2	<2.2	<1.1	21.4	<0.10	<2.9	<1.9	<1.6	<0.70	<5.5	<0.60	11.8J
M028-E	108-S01-047	08/03/98	<1.8	26.4J	185J	<0.20	<0.30	<0.80	3.6J	<2.0	<1.7	1540	<0.10	<1.0	<1.8	<1.6	<0.70	<1.1	<0.60	14.7J
M029-E	108-S01-048	08/03/98	<2.5	<2.8	466	<0.20	<0.30	<0.80	<1.4	<2.4	<1.7	45.1	<0.10	<1.0	<0.60	<1.6	<0.70	<1.1	<0.60	3.8J
M029-E	108-S01-049	08/03/98	<2.8	<2.1	476	<0.20	<0.30	<0.80	<0.40	<2.6	<1.7	42.1	<0.10	<1.0	<0.60	<1.6	<0.70	<1.1	<0.60	<0.79
M034-A	108-S01-050	08/03/98	<1.8	<14.5	125J	<0.20	<0.30	11.5	3.2J	<2.8	<1.7	934	<0.10	<1.0	<6.2	<1.6	<0.70	<1.1	<0.60	5.3J
M035-A	108-S01-051	08/03/98	<1.8	<13.2	56.0J	<0.20	<0.30	<0.80	2.9J	<3.0	<1.7	848	<0.10	<1.9	<2.5	<1.6	<0.70	<1.1	<0.60	2.9J

Notes:
µg/L = Micrograms per liter
J = Value estimated at reported concentration
< = Parameter reported below reporting limit

TABLE 4.1-3
SITE 1
QUARTER 1
GENERAL CHEMICALS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 2)

Well Number	Sample Number	Sample Date	Alkalinity (mg/L)	Anions (mg/L)	Total Dissolved Solids (mg/L)	Total Sulfide (mg/L)	Total Organic Carbon (mg/L)
M001-E	108-S01-010	10/29/97	Alkalinity: 521 Bicarbonate: 438 Carbonate: 82.9	Bromide: 2.8 Chloride: 555 Sulfate: 0.62	Total Dissolved Solids: 1600	ND	NA
M002-E	108-S01-011	10/29/97	Alkalinity: 302 Bicarbonate: 302	Bromide: 45.3 Chloride: 10300 Sulfate: 1420	Total Dissolved Solids: 24000	ND	NA
M003-E	108-S01-003	10/29/97	Alkalinity: 284 Bicarbonate: 284	Bromide: 0.52 Chloride: 109 Fluoride: 0.34 Sulfate: 38.2	Total Dissolved Solids: 590	ND	NA
M027-E	108-S01-012	10/30/97	Alkalinity: 864 Bicarbonate: 864	Bromide: 20.7 J Chloride: 4020 Sulfate: 212	Total Dissolved Solids: 8700	ND	NA
M028-A	108-S01-013	11/07/97	Alkalinity: 389 Bicarbonate: 389	Bromide: R Chloride: 222 J Fluoride: 0.56	Total Dissolved Solids: 2000	ND	Total Organic Carbon: 42 J TOC Test 2: 41
M028-E	108-S01-001	10/30/97	Alkalinity: 391 Bicarbonate: 391	Bromide: 1.9 J Chloride: 557 Sulfate: 0.38	Total Dissolved Solids: 1400	ND	Total Organic Carbon: 23 TOC Test 2: 22
M029-E	108-S01-015	10/29/97	Alkalinity: 373 Bicarbonate: 361 Carbonate: 11.8	Bromide: 1.8 J Chloride: 333 Sulfate: 10.7	Total Dissolved Solids: 930	ND	NA
M030-E	108-S01-005	10/29/97	Alkalinity: 349 Bicarbonate: 349	Bromide: 1.6 Chloride: 368 Sulfate: 58.4	Total Dissolved Solids: 550	ND	NA
M031-E	108-S01-004	10/29/97	Alkalinity: 320 Bicarbonate: 320	Bromide: 1.4 Chloride: 365 Sulfate: 82.8	Total Dissolved Solids: 1100	ND	NA

TABLE 4.1-3
SITE 1
QUARTER 1
GENERAL CHEMICALS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 2 of 2)

Well Number	Sample Number	Sample Date	Alkalinity (mg/L)	Anions (mg/L)	Total Dissolved Solids (mg/L)	Total Sulfide (mg/L)	Total Organic Carbon (mg/L)
M034-A	108-S01-007	11/04/97	Alkalinity: 243 Bicarbonate: 243	Bromide: 0.66 Chloride: 95.0 Fluoride: 0.81 Sulfate: 0.23	Total Dissolved Solids: 290	ND	Total Organic Carbon: 16 TOC Test 2: 15
M035-A	108-S01-008	11/04/97	Alkalinity: 367 Bicarbonate: 367	Bromide: 0.18 Chloride: 20.5 Fluoride: 0.56 Phosphate: 0.36 Sulfate: 21.4	Total Dissolved Solids: 340	ND	NA

Notes:

mg/L	=	Milligrams per liter
NA	=	Not analyzed
ND	=	Not detected
J	=	Value estimated at reported concentration
R	=	Rejected

TABLE 4.1-3
SITE 1
QUARTER 2
GENERAL CHEMICALS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 2)

Well Number	Sample Number	Sample Date	Alkalinity (mg/L)	Anions (mg/L)	Total Dissolved Solids (mg/L)
M001-E	108-S01-016	02/04/98	Alkalinity: 523 Bicarbonate: 396 Carbonate: 128	Bromide: 3.3 Chloride: 728 Fluoride: 0.36 Phosphate: 0.61 Sulfate: 0.33	Total Dissolved Solids: 1800
M002-E	108-S01-017	02/04/98	Alkalinity: 391 Bicarbonate: 391	Bromide: 8.5 Chloride: 3090 Fluoride: 0.28 Sulfate: 465	Total Dissolved Solids: 5400
M003-E	108-S01-018	02/04/98	Alkalinity: 228 Bicarbonate: 228	Bromide: 0.38 Chloride: 69.5 Fluoride: 0.26 Phosphate: 0.42 Sulfate: 25.2	Total Dissolved Solids: 420
M027-E	108-S01-019	02/03/98	Alkalinity: 612 Bicarbonate: 612	Bromide: 7.9 Chloride: 1760 Fluoride: 0.34 Nitrate: 0.14 Nitrite: 0.14 Phosphate: 0.3 Sulfate: 142	Total Dissolved Solids: 4300
M028-A	108-S01-020	02/03/98	Alkalinity: 417 Bicarbonate: 417	Bromide: 0.27 Chloride: 34.6 Fluoride: 0.15 Nitrate: 0.98 Sulfate: 97.8	Total Dissolved Solids: 630
M028-C	108-S01-021	02/03/98	Alkalinity: 485 Bicarbonate: 485	Bromide: 39.5 Chloride: 8600 Fluoride: 0.16 Sulfate: 981	Total Dissolved Solids: 14000
M028-E	108-S01-022	02/03/98	Alkalinity: 372 Bicarbonate: 372	Bromide: 0.62 Chloride: 114 Fluoride: 0.39 Sulfate: 0.98	Total Dissolved Solids: 640

TABLE 4.1-3
SITE 1
QUARTER 2
GENERAL CHEMICALS DETECTED IN GROUNDWATER
ALAMEDA POINT

Well Number	Sample Number	Sample Date	Alkalinity (mg/L)		Anions (mg/L)		Total Dissolved Solids (mg/L)	
M029-E	108-S01-023	02/04/98	Alkalinity:	442	Bromide:	0.62	Total Dissolved Solids:	700
			Bicarbonate:	442	Chloride:	136		
					Fluoride:	0.15		
					Phosphate:	0.1		
					Sulfate:	3.9		
M030-E	108-S01-024	02/04/98	Alkalinity:	144	Bromide:	0.12	Total Dissolved Solids:	190
			Bicarbonate:	144	Chloride:	6.3		
					Fluoride:	0.2		
					Nitrate:	1.1		
					Sulfate:	30.4		
M031-E	108-S01-026	02/10/98	Alkalinity:	322	Bromide:	0.77	Total Dissolved Solids:	790
			Bicarbonate:	322	Chloride:	200		
					Fluoride:	0.29		
					Phosphate:	0.34		
					Sulfate:	56.8		
M034-A	108-S01-027	02/04/98	Alkalinity:	256	Bromide:	0.42	Total Dissolved Solids:	470
			Bicarbonate:	256	Chloride:	67.5		
					Fluoride:	0.7		
					Sulfate:	0.34		
M035-A	108-S01-028	02/03/98	Alkalinity:	315	Bromide:	0.16	Total Dissolved Solids:	440
			Bicarbonate:	315	Chloride:	15.3		
					Fluoride:	0.46		
					Nitrate:	0.8		
					Phosphate:	0.27		
					Sulfate:	38.9		

Notes:
mg/L = Milligram per liter
J = Value estimated at reported concentration

TABLE 4.1-3
SITE 1
QUARTER 3
GENERAL CHEMICALS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 2)

Well Number	Sample Number	Sample Date	Alkalinity (mg/L)	Anions (mg/L)	Total Dissolved Solids (mg/L)	Total Sulfide (mg/L)	Total Organic Carbon (mg/L)
M001-E	108-S01-029	05/04/98	Alkalinity: 511 Bicarbonate: 450 Carbonate: 61.1	Bromide: 4.6 Chloride: 656 Phosphate: 1.3	Total Dissolved Solids: 1400	ND	NA
M003-E	108-S01-031	05/04/98	Alkalinity: 243 Bicarbonate: 243	Sulfate: 33.1	Total Dissolved Solids: 360	ND	NA
M027-E	108-S01-032	05/14/98	Alkalinity: 569 Bicarbonate: 569	Bromide: 4.9 Chloride: 1120 Phosphate: 0.14 Sulfate: 119	Total Dissolved Solids: 3470 J	ND	NA
M028-A	108-S01-033	05/04/98	Alkalinity: 400 Bicarbonate: 400	Sulfate: 87.1	Total Dissolved Solids: 680	ND	NA
M028-C	108-S01-034	05/05/98	Alkalinity: 895 Bicarbonate: 895	Bromide: 29.8 Chloride: 9170 Sulfate: 1030 J	Total Dissolved Solids: 18000	ND	NA
M028-E	108-S01-035	05/04/98	Alkalinity: 414 Bicarbonate: 414	Bromide: 1.4 Chloride: 235 Fluoride: 3.1 Sulfate: 38.6	Total Dissolved Solids: 1000	ND	NA
M029-E	108-S01-036	05/06/98	Alkalinity: 337 Bicarbonate: 337	Bromide: 1.5 Chloride: 207.0 Sulfate: 1.3 J	Total Dissolved Solids: 1400	ND	NA
M034-A	108-S01-040	05/07/98	Alkalinity: 272 Bicarbonate: 272	Bromide: 0.62 Chloride: 65.8 Fluoride: 0.7 Sulfate: 0.54 J	Total Dissolved Solids: 600	ND	NA

TABLE 4.1-3
SITE 1
QUARTER 3
GENERAL CHEMICALS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 2 of 2)

Well Number	Sample Number	Sample Date	Alkalinity (mg/L)	Anions (mg/L)	Total Dissolved Solids (mg/L)	Total Sulfide (mg/L)	Total Organic Carbon (mg/L)
M035-A	108-S01-041	05/07/98	Alkalinity: 249 Bicarbonate: 249	Bromide: 0.11 Chloride: 12.6 Fluoride: 0.42 Phosphate: 0.15 Sulfate: 61 J	Total Dissolved Solids: 320	ND	NA

Notes:
J = Value estimated at reported concentration
mg/L = Milligrams per liter
NA = Not analyzed
ND = Not detected
R = Rejected

TABLE 4.1-3
SITE 1
QUARTER 4
GENERAL CHEMICALS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 1 of 2)

Well Number	Sample Number	Sample Date	Alkalinity (mg/L)	Anions (mg/L)	Total Dissolved Solids (mg/L)	Total Sulfide (mg/L)	Total Organic Carbon (mg/L)
M001-E	108-S01-042	08/03/98	Alkalinity: 520 Bicarbonate: 385 Carbonate: 135	Bromide: 3.3 Chloride: 679 Phosphate: 0.56	Total Dissolved Solids: 1900	ND	NA
M003-E	108-S01-043	08/03/98	Alkalinity: 265 Bicarbonate: 265	Bromide: 0.45 Chloride: 77.0 Phosphate: 0.38 Sulfate: 27.8	Total Dissolved Solids: 650	ND	NA
M027-E	108-S01-044	08/03/98	Alkalinity: 696 Bicarbonate: 696	Bromide: 9.9 Chloride: 2910 Sulfate: 181	Total Dissolved Solids: 6300	ND	NA
M028-A	108-S01-045	08/03/98	Alkalinity: 283 Bicarbonate: 283	Bromide: 0.66 Chloride: 112.0 Sulfate: 23.0	Total Dissolved Solids: 830	ND	NA
M028-C	108-S01-046	08/04/98	Alkalinity: 444 Bicarbonate: 444	Bromide: 34.1 Chloride: 6060 Nitrate: 0.69 Sulfate: 1070	Total Dissolved Solids: 22000	ND	NA
M028-E	108-S01-047	08/03/98	Alkalinity: 442 Bicarbonate: 442	Bromide: 1.7 Chloride: 395 Fluoride: 1.0 Sulfate: 65.8	Total Dissolved Solids: 1600	ND	NA
M029-E	108-S01-048	08/03/98	Alkalinity: 397 Bicarbonate: 397	Bromide: 1.6 Chloride: 366.0 Sulfate: 7.4	Total Dissolved Solids: 1300	ND	NA
M034-A	108-S01-050	08/03/98	Alkalinity: 402 Bicarbonate: 402	Bromide: 1.1 Chloride: 85.7 Sulfate: 0.45	Total Dissolved Solids: 860	ND	NA

Continue

TABLE 4.1-3
SITE 1
QUARTER 4
GENERAL CHEMICALS DETECTED IN GROUNDWATER
ALAMEDA POINT
(Page 2 of 2)

Well Number	Sample Number	Sample Date	Alkalinity (mg/L)	Anions (mg/L)	Total Dissolved Solids (mg/L)	Total Sulfide (mg/L)	Total Organic Carbon (mg/L)
M035-A	108-S01-051	08/03/98	Alkalinity: 391 Bicarbonate: 391	Bromide: 0.18 Chloride: 13.0 Sulfate: 59.6	Total Dissolved Solids: 740	ND	NA

Notes:
mg/L = Milligrams per liter
NA = Not analyzed
ND = Not detected