Declaration from the Responsible Party

Workplan
Installation and Sampling of Groundwater Monitoring Wells
2440 East Eleventh Street
Oakland CA
RO No. 29

Dated 20 June 2006
Prepared by Streamborn, Berkeley CA

I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge.

Jeffrey Eandi
Vice President
Eandi Metal Works
976 Twenty-Third Avenue
Oakland CA 94606

Signed ____________________

Dated 7/5/06

STREAMBORN

510.528.4234
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Jeffrey M. Eandi
Eandi Metal Works
976 Twenty Third Avenue
Oakland CA 94606

20 June 2006

Project No. P279

Workplan
Installation and Sampling of Groundwater Monitoring Wells
2440 East Eleventh Street
Oakland CA
RO No. 29

Dear Mr. Eandi:

This workplan describes proposed investigation activities associated with releases from a former underground tank at 2440 East Eleventh Street, Oakland, California (Figures 1 and 2). Planned activities include installation of two additional monitoring wells and collection of soil and groundwater samples. This work was recommended in our Site Conceptual Model (Streamborn 2006a) and approved by the Alameda County Health Care Services Agency in its letter dated 23 May 2006 (ACHCSA 2006).

BACKGROUND

An environmental chronology for the property is presented in Table 1. A bibliography is presented in Table 2.

Eandi Metal Works formerly operated three underground tanks; two tanks were operated at 976 Twenty-Third Avenue and one tank was operated at 2440 East Eleventh Street.

In May 1992, the three underground tanks were removed. Two of the tanks were removed with nondetectable or insignificant levels of contamination and no further action was required by the Alameda County Health Care Services Agency. These two tanks were located at the main Eandi property on Twenty-Third Avenue, Oakland CA.

The third tank, a 1,000-gallon underground gasoline tank, was removed from an area immediately outside the northeast corner of the building at 2440 East Eleventh Street. TPH-gasoline, benzene, toluene, ethylbenzene, and xylenes were elevated in samples of soil collected during tank removal. Soil that was excavated during tank removal was spread nearby the excavation and allowed to aerate for approximately nine months. The aerated soil was then replaced in the excavation and trench plates were placed over the top of the excavation. The excavation remained in this state until 2004.

Mail: PO Box 8330, Berkeley CA 94707-8330 **Office: 900 Santa Fe Avenue, Albany CA 94706**

In June 2004, Streamborn sampled and analyzed soil from the sidewalls and base of the tank excavation; the results were nondetect for petroleum hydrocarbons and nonelevated for total lead. In September 2004, Streamborn closed (backfilled) the excavation and repaved the area (Streamborn 2004).

In July 1995, five exploratory soil borings were drilled in the vicinity of the former 1,000-gallon underground gasoline tank. Three of the borings were completed as monitoring wells (MW-1, MW-2, and MW-3). The remaining two borings (E-1 and E-2) were within the limits of the original tank excavation; these two boring were grouted upon completion. Soil samples were collected during drilling and selected soil samples were analyzed for TPH-gasoline, BTEX, and total lead.

Since 1995, groundwater monitoring has been periodically performed for the three monitoring wells. Groundwater samples have typically been analyzed for TPH-gasoline, BTEX, fuel oxygenates, and total lead.

In August 2004, seven soil borings (B1-B7) were drilled to depths between 20 and 32 feet. Soil samples were collected continuously during drilling and selected samples were analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260) and total lead. Temporary casings were placed in the borings. Groundwater samples were collected from the temporary casings and analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Methods 8260) and total lead. The temporary casings were then removed and the borings were grouted. Groundwater samples were concurrently collected from the three monitoring wells (MW-1, MW-2, and MW-3) and analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260) and total lead. The results of the investigation verified that groundwater contamination was confined to the immediate vicinity of the former 1,000-gallon underground gasoline tank.

Monitoring well locations are shown on Figure 3. Monitoring well purging and sampling results are summarized in Table 4. Monitoring well analytical results are summarized in Table 5.

HYDROGEOLOGY

Soils encountered during previous site investigations were generally fine-grained soils with intermittent, continuous and discontinuous coarse-grained lenses.

Groundwater has historically been measured at depths between 8 and 12 feet with a gradient direction towards the southwest. Groundwater level and gradient data are summarized in Table 3. The historic direction of groundwater gradient is depicted on Figure 3.

WELL SEARCH

On 13-14 June 2006, a search was conducted for wells within a 2,000-foot radius of the former 1,000-gallon underground gasoline tank at 2440 East Eleventh Street. The Alameda County Public Works Agency database and the State of California, Department of Water Resources database were searched. While many monitoring wells, cathodic protection wells, decommissioned wells, and other non-production wells were discovered; only one potential production well was documented. The potential production well is located approximately 1,270 feet upgradient (east) of the former 1,000-gallon underground gasoline tank. Details of the identified well are summarized in Table 9 and the well location is plotted on Figure 5.

The results of the well search confirm the results of our previous sensitive receptor survey (Streamborn 2006a) - the closest sensitive receptor is San Francisco Bay, specifically the Oakland-Alameda Estuary, located approximately 2,200 feet southwest (downgradient) of the former 1,000-gallon underground gasoline tank. Discharges of contaminated groundwater to surface water represent the greatest risk to this receptor.

PROPOSED SCOPE OF WORK

Monitoring Well Installation

Two monitoring wells (MW-4 and MW-5) are proposed at the locations shown on Figure 3. The locations were selected to delineate the downgradient extent of contamination.

Prior to drilling, the following will be performed:

- Drilling permits will be obtained from Alameda County.
- Underground Service Alert (USA) will be notified to mark buried utilities in the vicinity of the proposed drilling locations.
- The services of an independent utility locator firm will be retained to clear the proposed drilling locations.

Borings for the wells will be drilled using 8-inch outside diameter hollow-stem augers. The borings will be drilled to a depth of approximately 17 feet. During drilling, soil samples will be collected continuously below 5 feet. Soil samples will be classified in the field in approximate accordance with ASTM Standard 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Samples will be screened in the field using an organic vapor meter. Samples will also be examined for chemical staining and chemical odor.

If contamination is not observed during drilling, two soil samples from each boring will be retained for chemical analysis; one sample from a depth coincident with the groundwater table and one sample from the bottom of the boring. If field observations indicate the presence of contamination, then additional samples will be retained to define the top and bottom of the contaminated horizon, as well as the most-contaminated soil. The soil samples will be analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260), total lead, and lead scavengers (1,2-dichloroethane and ethylene dibromide) (EPA Method 8260). Soil sampling and testing requirements are described in Table 6.

The borings will be completed as 2-inch diameter PVC wells (Figure 4). Well completion specifications are summarized in Table 7.

Surging, bailing, and/or pumping will be employed to develop the wells. Well elevations (top of casing) will be surveyed relative to the Mean Sea Level (MSL datum).

Drilling, soil sampling, well installation, and well development will be performed in accordance with the attached standard operating procedures.

Groundwater Sampling

The wells will be sampled immediately following development.

Subsequent groundwater monitoring will include all five wells (MW-1 through MW-5) and will be conducted twice-per-year at seasonal high groundwater (circa March) and seasonal low groundwater (circa October).

Groundwater samples will be analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260), total lead, and lead scavengers (1,2-dichloroethane and ethylene dibromide) (EPA Method 8260). Groundwater sampling and testing requirements are summarized in Table 8.

If nondetect or insignificant concentrations of total lead and/or lead scavengers are measured in two consecutive monitoring events, total lead and/or lead scavengers may be dropped from the analytical suite.

Groundwater sampling will be performed in accordance with the attached standard operating procedure.

Investigation-Derived Waste

The activities described in this workplan will generate the following wastes: (1) soil cuttings and excess soil samples, (2) development and purge water, and (3) decontamination wastewater. The soil, development water, and purge water will be containerized in labeled steel 55-gallon drums and stored onsite.

Inert soil may be discharged onsite. Inert water may be discharged to the sanitary sewer. Non-inert wastes require specific interpretation with respect to current regulations and will be disposed of accordingly. Decontamination wastewater will be discharged to the sanitary sewer.

Reporting

The results of the drilling, monitoring well installation, soil sampling, and initial groundwater sampling will be summarized in a report. The results of subsequent groundwater sampling events will be summarized in data submittals.

QUALITY ASSURANCE/QUALITY CONTROL

Specific quality control procedures for sample collection and field-testing are discussed in the attached standard operating procedures.

Quality Control Samples

The laboratory will include laboratory blank, laboratory replicate, and laboratory spike quality control samples during soil and groundwater analysis. Field quality control samples will not be collected or analyzed.

Field Meter Quality Control Procedures

Meters for measurement of field parameters will be calibrated daily. Calibration standards should generally approximate or span the anticipated range of measurements. Recalibration may be appropriate if unusual measurements are noticed.

The field organic vapor monitor (used for site safety and to screen soil samples) will be calibrated using a standard gas prior to the beginning of each field day. Recalibration may be appropriate if unusual measurements are noticed.

HEALTH AND SAFETY

The attached Site Safety Plan presents the procedures to be followed to protect the safety of workers during planned fieldwork. Physical and chemical hazards, such as working around equipment and exposure to chemicals, are addressed. Work is planned in a previously investigated area, with existing data suggesting minimal chemical hazards. Although the proposed fieldwork does not necessarily require adherence to safety protocols for hazardous waste sites, the procedures in the Site Safety Plan are intended to comply with the pertinent sections of 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response.

Please contact us with any questions or comments.

Sincerely,

STREAMBORN

Douglas W. Lovell, PE
Geoenvironmental Engineer

REGISTERED PROFESSIONAL ENGINEER
DOUGLAS W. LOVELL
No. 31914
CIVIL
STATE OF CALIFORNIA

Expires 12/31/06

Attachments

cc: Jerry Wickham/Alameda County Health Care Services Agency, Alameda CA

Table 1 (Page 1 of 2)

Environmental Chronology

2440 East Eleventh Street
Oakland CA

Date	Performed By	Event
Unknown	Unknown	• 1,000-gallon underground leaded gasoline tank was installed.
15 August 1991	Eandi Metal Works	• The 1,000-gallon tank was emptied of product. Use of the tank was discontinued.
11 May 1992	Unknown	• The 1,000-gallon tank was removed and soil and groundwater contamination was discovered.
10 July 1995	AGI Technologies	• Five soil borings were drilled. Soil samples were collected and analyzed for TPH-gasoline, BTEX, MtBE (EPA Method 8020), and total metals. • Three of the borings were completed as monitoring wells (MW-1, MW-2, and MW-3). The other two borings (E-1 and E-2) were grouted. • Water levels were measured in wells MW-1, MW-2, and MW-3. • MW-1, MW-2, and MW-3 were developed and groundwater samples were collected. Samples were analyzed for TPH-gasoline, BTEX, MtBE (EPA Method 8020), and total lead. • An elevation survey was conducted for MW-1, MW-2, and MW-3.
17 July 1995	AGI Technologies	• Groundwater levels were measured in MW-1, MW-2, and MW-3. • Groundwater samples were collected from MW-1, MW-2, and MW-3. Samples were analyzed for TPH-gasoline, BTEX, MtBE (EPA Method 8020), and total lead.
20 October 1995	AGI Technologies	• Groundwater levels were measured in MW-1, MW-2, and MW-3. • Groundwater samples were collected from MW-1, MW-2, and MW-3. Samples were analyzed for TPH-gasoline, BTEX, and total lead.
25 January 1996	AGI Technologies	• Groundwater levels were measured in MW-1, MW-2, and MW-3. • Groundwater samples were collected from MW-1, MW-2, and MW-3. Samples were analyzed for TPH-gasoline, BTEX, MtBE (EPA Method 8020), and total lead.
25 April 1996	AGI Technologies	• Groundwater levels were measured in MW-1, MW-2, and MW-3. • Groundwater samples were collected from MW-1, MW-2, and MW-3. Samples were analyzed for TPH-gasoline, BTEX, MtBE (EPA Method 8020), and total lead.
11 - 12 June 2001	Kleinfelder	• Groundwater levels were measured in MW-1, MW-2, and MW-3. • Groundwater samples were collected from MW-1, MW-2, and MW-3. Samples were analyzed for TPH-gasoline, BTEX, and total lead.
5 February 2002	Kleinfelder	• Groundwater levels were measured in MW-1, MW-2, and MW-3. • Groundwater samples were collected from MW-1, MW-2, and MW-3. Samples were analyzed for TPH-gasoline, BTEX, MtBE (EPA Method 8020), and total lead.
9 June 2004	Streamborn	• Using a backhoe, the excavation for the former tank was partially re-excavated. • Soil samples were collected from the base (7.5-8 feet below ground surface) and each of the four sidewalls (5-5.5 feet below ground surface) by exposing native soil and driving a brass liner into the exposed soil. • Soil samples were analyzed for TPH-diesel/kerosene/stoddard solvent, TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260), and total lead.
12 August 2004	Streamborn	• Groundwater levels were measured in MW-1, MW-2, and MW-3. • Groundwater samples were collected from MW-1, MW-2, and MW-3. Samples were analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260), and total lead. • Seven geoprobe borings (B1-B7) were drilled to depths between 20 and 32 feet. Soil samples were collected continuously in the borings. • Two soil samples were retained from each of the borings for chemical analysis. One soil sample approximately coincided with the depth of groundwater observed during drilling and the other soil sample coincided with the bottom of the boring. Soil samples were analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260) and total lead. • Temporary casings were installed in the borings and water levels allowed to stabilize for at least one hour. Water levels were measured. • Purged groundwater samples were collected from the temporary casings. Samples were analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260) and total lead. • The temporary casings were removed from the borings and the borings were grouted.
17-23 September 2004	Streamborn	• Using a backhoe, the excavation for the former tank was completely re-excavated. The excavated soil was air-dried and replaced in the excavation using ±2-foot lifts. Each lift was compacted using a whacker. 6 inches of imported Class II aggregate base was placed as the final lift of soil. • The pavement and sidewalk were repaved with reinforced concrete. The concrete thickness was 8 inches. The reinforcement was #5 rebar on 12-inch centers.
2 March 2005	Streamborn	• Groundwater levels were measured in MW-1, MW-2, and MW-3. • Groundwater samples were collected from MW-1, MW-2, and MW-3. Samples were analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260).

Environmental Chronology

2440 East Eleventh Street
Oakland CA

General Notes

(a) TPH = total petroleum hydrocarbons.

(b) BTEX = benzene, toluene, xylenes, and total xylenes.

(c) MtBE = methyl tert-butyl ether.

Table 2

Bibliography

2440 East Eleventh Street
Oakland CA

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Table 3

Groundwater Level and Gradient Data

2440 East Eleventh Street
Oakland CA

Location	MW-1		MW-2		MW-3		Groundwater Gradient	
Ground Surface Elevation	NM		NM		NM			
Measuring Point GPS Coordinates	N 37° 46.808' W 122° 14.135'		N 37° 46.804' W 122° 14.152'		N 37° 46.799' W 122° 14.176'			
Measuring Point Elevation	TOC N Side = 99.90		TOC N Side = 99.57		TOC N Side = 98.45			
	Depth	Elev	Depth	Elev	Depth	Elev		
Intercepted Interval	10 to 20	NM	10 to 20	NM	10 to 20	NM	Direction	Magnitude
14 July 1995	9.72	90.18	10.74	88.83	10.95	87.50	-	-
17 July 1995	11.11	88.79	10.93	88.64	11.04	87.41	-	-
20 October 1995	11.96	87.94	11.92	87.65	12.11	86.34	-	-
25 January 1996	8.14	91.76	8.23	91.34	8.83	89.62	-	-
11-12 June 2001	10.35	89.55	11.50	88.07	11.08	87.37	-	-
5 February 2002	11.00	88.90	11.10	88.47	11.30	87.15	-	-
12 August 2004	10.95	88.95	11.17	88.40	11.77	86.68	N 115° W	0.02
2 March 2005	8.25	91.65	8.44	91.13	9.36	89.09	N 120° W	0.03
Total Depth (Last Measurement)	19.7		19.8		19.6			

General Notes

(a) Measurements cited in units of feet, referenced to site-specific datum (not Mean Sea Level).

(b) NM = not measured.

(c) TOC = top of PVC casing. N = north. Measuring points are the top of the PVC casing, north side.

(d) Depth to groundwater and total depth measured from the measuring point.

(e) Groundwater level measurements from 1995 through 1996 were performed by AGI Technologies (Bellevue WA).

(f) Groundwater level measurements from 2001 through 2002 were performed by Kleinfelder (Oakland CA).

(g) Groundwater level measurements since 2004 were performed by Streamborn (Berkeley CA).

(h) Elevation surveying was performed by AGI Technologies (Bellevue WA).

(i) Streamborn measured GPS coordinates on 2 March 2005 using a Garmin GPS II meter.

(j) The intercepted intervals correspond to the sand pack interval. The depths of the intercepted intervals were measured relative to the adjacent pavement or ground surface.

Table 4

Monitoring Well Purging and Sampling Information Since 2001

2440 East Eleventh Street
Oakland CA

Well No.	Sample Date	Sample Time	Purge Method	Purge Duration (minutes)	Approximate Volume Purged (gallons)	Volume Purged (static water casing volumes)	Purged Dry?	Dissolved Oxygen (mg/L)	pH	Specific Conductance (µS/cm)	Temp (˚C)	ORP (mV)	Turbidity/ Color
MW1	11 Jun 01	NM	Purge Pump	NM	20	NC	no	NM	6.8	310	21.4	NM	NM
	5 Feb 02	NM	Purge Pump	NM	4	NC	no	NM	6.6	290	18.8	NM	NM
	12 Aug 04	12:40	Submersible Pump	4	5	±3	no	1.1	7.0	230	18.8	-130	Clear/none
	2 Mar 05	2:42	Submersible Pump	7	6	±3	no	2.2	6.9	230	17.1	-160	Clear/none
MW2	12 Jun 01	NM	Purge Pump	NM	15	NC	no	NM	7.1	430	17.2	NM	NM
	5 Feb 02	NM	Purge Pump	NM	4	NC	no	NM	6.6	400	16.8	NM	NM
	12 Aug 04	12:09	Submersible Pump	4	5	±3	no	2.0	6.8	510	18.9	-170	Turbid/grey
	2 Mar 05	2:07	Submersible Pump	7	6	±3	no	2.2	6.7	490	17.7	-220	Clear/none
MW3	12 Jun 01	NM	Purge Pump	NM	12	NC	no	NM	7.4	440	17.2	NM	NM
	5 Feb 02	NM	Purge Pump	NM	4	NC	no	NM	6.6	410	17.8	NM	NM
	12 Aug 04	11:15	Submersible Pump	8	4	±3	no	1.7	6.6	440	19.0	-150	Clear/none
	2 Mar 05	1:30	Submersible Pump	6	5	±3	no	2.3	6.8	500	18.1	-200	Clear/none

General Notes

(a) NM = not measured.

(b) NC = not calculated.

(c) ORP = oxidation-reduction potential.

(d) Prior to 2004, measurements were made by Kleinfelder (Oakland CA).

(e) Since 2004, measurements have been made by Streamborn (Berkeley CA).

(f) Measurements cited in this table correspond to end of purging (time of sampling).

Table 5

Groundwater Analytical Data from Monitoring Wells

2440 East Eleventh Street
Oakland CA

Location	Sample Date	Sample Type	Total Lead (µg/L)	TPH-Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L)	Other Fuel Oxygenates (EPA Method 8260) (µg/L)
MW-1	17 Jul 1995	Grab	<40	**22,000**	**390**	**2,000**	**800**	**5,300**	<125	NM
	20 Oct 1995	Grab	<40	**14,000**	**270**	**540**	**360**	**1,800**	NM	NM
	25 Jan 1996	Grab	<40	**16,000**	**740**	**1,300**	**490**	**2,700**	<500	NM
	25 Apr 1996	Grab	<40	**4,600**	**180**	**450**	**190**	**1,000**	<250	NM
	11 Jun 2001	Grab	**14**	**7,100**	14	35	**240**	**720**	NM	NM
	5 Feb 2002	Grab	**3.7**	**9,300**	6.3	11	**230**	**560**	<0.7	NM
	12 Aug 2004	Grab	<5	**2,900**	9.1	6.0	**130**	**160**	0.72	<0.5 to <5
	2 Mar 2005	Grab	NM	**950**	1.9	0.60	19	4.0	0.80	<0.5 to <5
MW-2	17 Jul 1995	Grab	**56.4**	**21,000**	**370**	**1,700**	**930**	**5,100**	<125	NM
	20 Oct 1995	Grab	<40	**730**	18	27	26	7.9	NM	NM
	25 Jan 1996	Grab	<40	**14,000**	**74**	**660**	**1,000**	**2,600**	**670**	NM
	25 Apr 1996	Grab	<40	**13,000**	**370**	**440**	**1,000**	**2,900**	<500	NM
	12 Jun 2001	Grab	**7.7**	**3,200**	11	6.2	**170**	**270**	NM	NM
	5 Feb 2002	Grab	**3.5**	**2,900**	7.6	3.8	**220**	**160**	<0.7	NM
	12 Aug 2004	Grab	<5	**3,100**	2.6	1.8	<0.5	13	<0.5	<0.5 to <5
	2 Mar 2005	Grab	NM	**3,700**	<5	<2.5	**340**	22	<2.5	<2.5 to <25
MW-3	17 Jul 1995	Grab	**153**	**8,400**	**1,200**	**150**	**1,000**	**1,700**	<125	NM
	20 Oct 1995	Grab	<40	**5,800**	**600**	**590**	**43**	**340**	NM	NM
	25 Jan 1996	Grab	<40	**10,000**	**1,200**	**290**	**870**	**1,300**	<250	NM
	25 Apr 1996	Grab	<40	**8,900**	**830**	**140**	**1,000**	**1,000**	**400**	NM
	12 Jun 2001	Grab	**7.4**	**1,800**	37	4.5	**98**	19	NM	NM
	5 Feb 2002	Grab	**4.4**	**1,100**	32	2.1	**76**	9.5	<0.5	NM
	12 Aug 2004	Grab	<5	**1,100**	4.5	<0.5	6.0	1.8	1.4	<0.5 to <5
	2 Mar 2005	Grab	NM	**3,000**	27	3.0	**76**	22	<2.5	<2.5 to <25

Environmental Screening Level - Estuary Surface Water	**2.5**	**640**	**46**	**40**	**30**	**100**	**180**	
Environmental Screening Level - Indoor Air Concerns for Residential Land Use with Low/Moderate Permeability Soils	NA	Directly measure soilgas	1,900	530,000	170,000	160,000	45,000	

General Notes

(a) TPH = total petroleum hydrocarbons. MtBE = methyl tert-butyl ether. NA = not applicable. NM = not measured.

(b) 1995 and 1996 samples were collected by AGI Technologies (Bellevue WA).

(c) 2001 and 2002 samples were collected by Kleinfelder (Oakland CA).

(d) Since 2004, samples have been collected by Streamborn (Berkeley CA).

(e) 2002 and later MtBE samples have been analyzed by EPA Method 8260. 1995 and 1996 MtBE samples were analyzed by EPA Method 8020.

(f) Environmental Screening Levels from: *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater (Interim Final - February 2005). Prepared by San Francisco Bay Regional Water Quality Control Board, Oakland CA. February 2005.* *www.waterboards.ca.gov/sanfranciscobay/esl.htm*

Table 6

Soil Sampling and Testing Requirements

2440 East Eleventh Street
Oakland CA

Item	Requirement
Number of Borings	Two borings (MW-4 and MW-5).
Hollow-Stem Auger	±4-inch ID by ±8-inch OD hollow-stem augers.
Depth	Borings will be drilled approximately 9 feet below the highest measured groundwater elevation (depth to groundwater ±8 feet in March 2005). Accordingly, the expected boring depth is ±17 feet.
Sampling Interval and Sample Type	Collect soil samples continuously, starting at 5 feet and continuing to the total depth. Collect discrete (grab) samples.
Sampler	2.5-inch OD (2-inch ID) drive sampler fitted with three 2-inch diameter by 6-inch long metal liners.
Sampler Decontamination	Wash with Alconox or other low-phosphate soap, rinse with tap water, and rinse with distilled water.
Field Observations and Measurements	Screen samples with field organic vapor monitor. Note chemical staining and chemical odor. Visually classify samples according to ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
Samples Retained for Potential Physical Testing	None
Samples Retained for Chemical Testing	If contamination is not observed during drilling, two soil samples from each boring will be retained for chemical analysis; one sample from a depth coincident with the groundwater table and one sample from the bottom of the boring. If field observations indicate the presence of contamination, then additional samples will be retained to define the top and bottom of the contaminated horizon, as well as the most-contaminated soil. Analyze soil samples for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260), total lead, and lead scavengers (1,2-dichloroethane and ethylene dibromide) (EPA Method 8260).
Sample Handling for Chemical Testing	Cap liner with plastic cap, label, place in ziplock bag, store on ice in cooler, enter onto chain-of-custody, and maintain sample custody until sent to laboratory.
Field Quality Control Samples for Chemical Testing	None.

General Notes

(a) TPH = total petroleum hydrocarbons.

(b) BTEX = benzene, toluene, ethylbenzene, and total xylenes.

Table 7

Well Completion Specifications

2440 East Eleventh Street
Oakland CA

Item	Specification
Number of wells	Two wells (MW-4 and MW-5).
Depth of wells	The base of the well will be approximately 9 feet below the highest historically measured depth to water (±8 feet in March 2005). Accordingly, the expected well depth is ±17 feet.
Screen length	10-feet.
Screened interval	Extending from 7 to 17 feet.
Casing type	Schedule 40 PVC, flush-threaded couplings (no glue).
Casing diameter	Nominal 2-inch inside diameter.
Bottom plug	Schedule 40 PVC, flush-threaded (no glue).
Sediment trap	None.
Screen slot size	0.010-inch, factory slotted.
Casing and screen decontamination	None.
Filter pack	#2/12 silica sand (or similar gradation).
Filter pack interval	From the base of the bottom cap to ±1 foot above the top of the screened interval.
Bentonite seal	Natural bentonite chips or pellets, ±1-foot layer above the filter pack.
Grout	Cement-bentonite grout (94 pounds cement, 7 gallons water, 5 pounds bentonite).
Centralizers	None.
Surface completion	Traffic-rated utility box, locking top cap, combination lock.
Investigation-derived waste	Containerize in labeled steel drums.

Table 8

Groundwater Sampling and Testing Requirements

2440 East Eleventh Street
Oakland CA

Item	Specification
Monitoring Wells to be Sampled	• Five wells (MW-1, MW-2, MW-3, MW-4, and MW-5).
Sampling Frequency	• Two new monitoring wells (MW-4 and MW-5) will be developed and immediately sampled. Subsequently, all five monitoring wells will be sampled twice-per year at seasonal high groundwater (circa March) and season low groundwater (circa October).
Purge Equipment	• Bailer or purge pump.
Purge Equipment Decontamination	• Wash with Alconox or other low-phosphate soap, rinse with tap water, rinse with distilled water.
Purge Criteria	• Wells that recharge in a timely manner should be purged of at least 3 (standing water) casing volumes and sampled after field parameters stabilize. If field parameters have not stabilized by the time 10 (standing water) casing volumes have been purged, sampling will be conducted anyway. • Wells that recharge slowly may be purged dry once and sampled after recharge is sufficient to submerge the sampler.
Field Measurements and Observations	• Water level in well prior to purging, turbidity (qualitative clarity and color), pH, oxidation-reduction potential, temperature, specific conductivity, dissolved oxygen, and purge volume.
Sampler	• Teflon bailer with bottom-emptying device.
Sampler Decontamination	• Wash with Alconox or other low-phosphate soap, rinse with tap water, rinse with distilled water.
Natural Sample Collection	• Sample from the midpoint of standing water column.
Sample Filtration	• None.
Sample Analysis	• Analyze groundwater samples for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260), total lead, and lead scavengers (1,2-dichloroethane and ethylene dibromide) (EPA Method 8260). • If nondetect or insignificant concentrations of total lead and/or lead scavengers are measured in two consecutive monitoring events, total lead and/or lead scavengers may be dropped from the analytical suite.
Sample Container	• Six 40 mL glass vials with hydrochloric acid as preservative for TPH-gasoline/BTEX/fuel oxygenates and lead scavengers (1,2-dichloroethane and ethylene dibromide). • One 250 mL plastic container with nitric acid as preservative for total lead.
Sample Handling and Storage During Transport to Laboratory	• Verify no headspace in 40 mL vials. Label sample containers, place in ziplock bag, store on ice in cooler, enter onto chain-of-custody, and maintain sample custody until sent to laboratory.
Field QC Samples	• None.

General Notes

(a) TPH = total petroleum hydrocarbons.

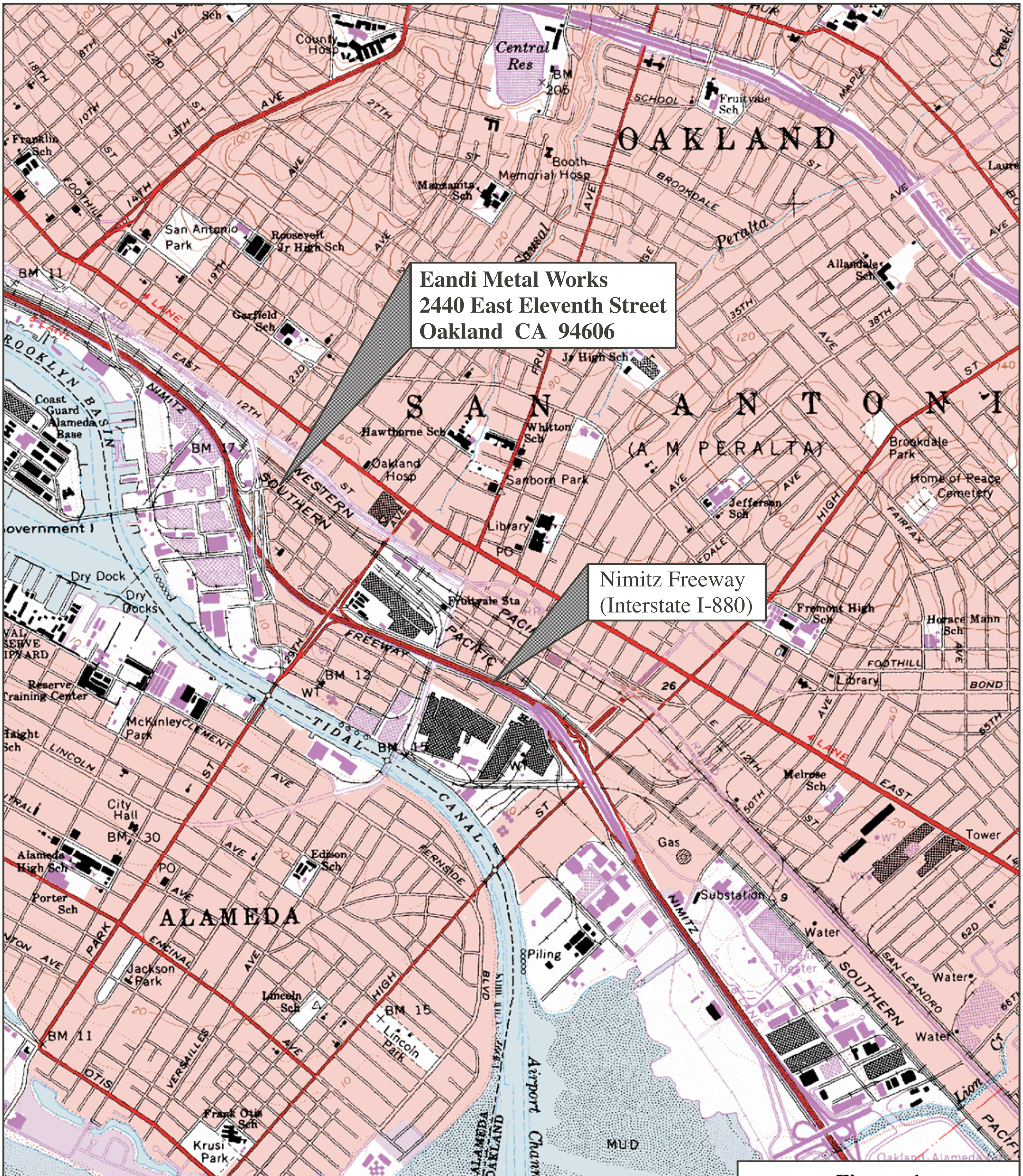
(b) BTEX = benzene, toluene, ethylbenzene, and total xylenes.

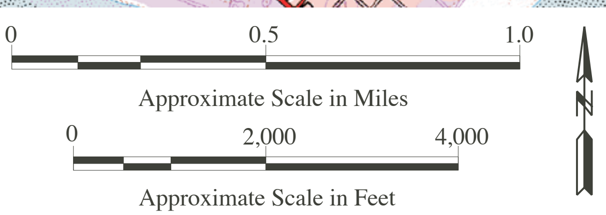
Table 9

Documented Production Wells within 2,000-feet of the Former 1,000-Gallon Underground Gasoline Tank

2440 East Eleventh Street
Oakland CA

Well Address	Diameter (inches)	Depth (feet)	Approximate Distance / Direction from the Subject Property	Source Database	Comments
27th Avenue and East 14th Street	8-16	681	1,270 feet to the east-northeast	Department of Water Resources	• Former Montgomery Ward & Co. • Unknown street address. • Unknown installation date. • Unknown if well still exists. • This well may or may not be in service.





Basemap: U.S. Geological Survey, 7.5 Minute Quadrangle, Oakland East CA. 1959 (Photorevised 1980)

Figure 1

Location Map

2440 East Eleventh Street
Oakland CA

STREAMBORN

0 500 1,000

Approximate Scale in Feet

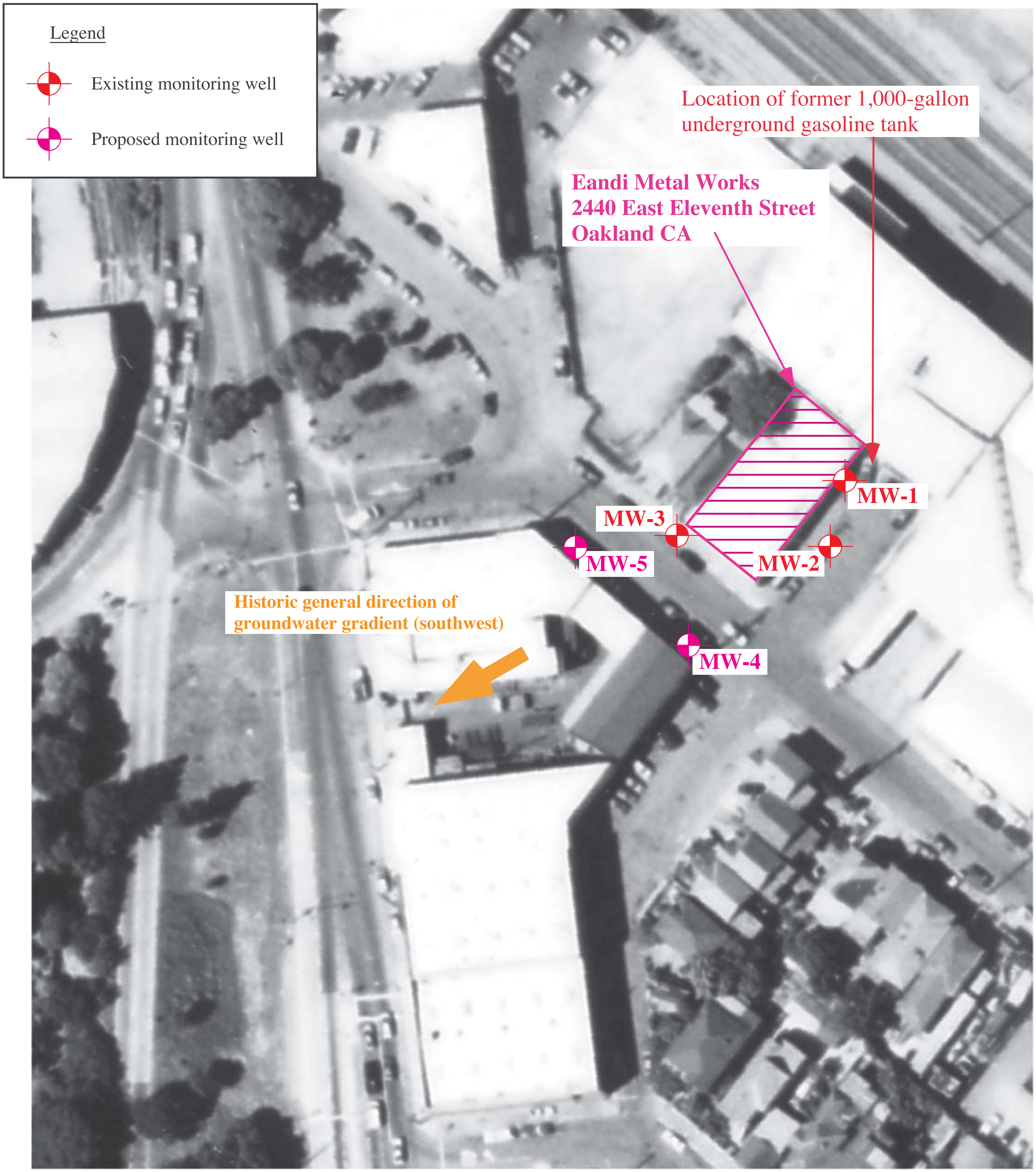
Basemap: Aerial photograph, flown 24 August 1998, photograph ALA-AV-6100-11-38. Pacific Aerial Surveys, Oakland CA.

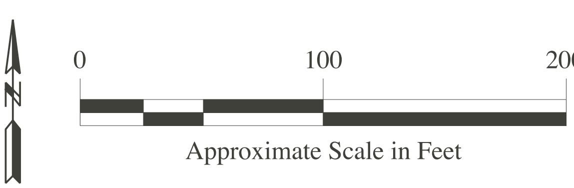
Figure 2

Vicinity Map

2440 East Eleventh Street
Oakland CA

STREAMBORN





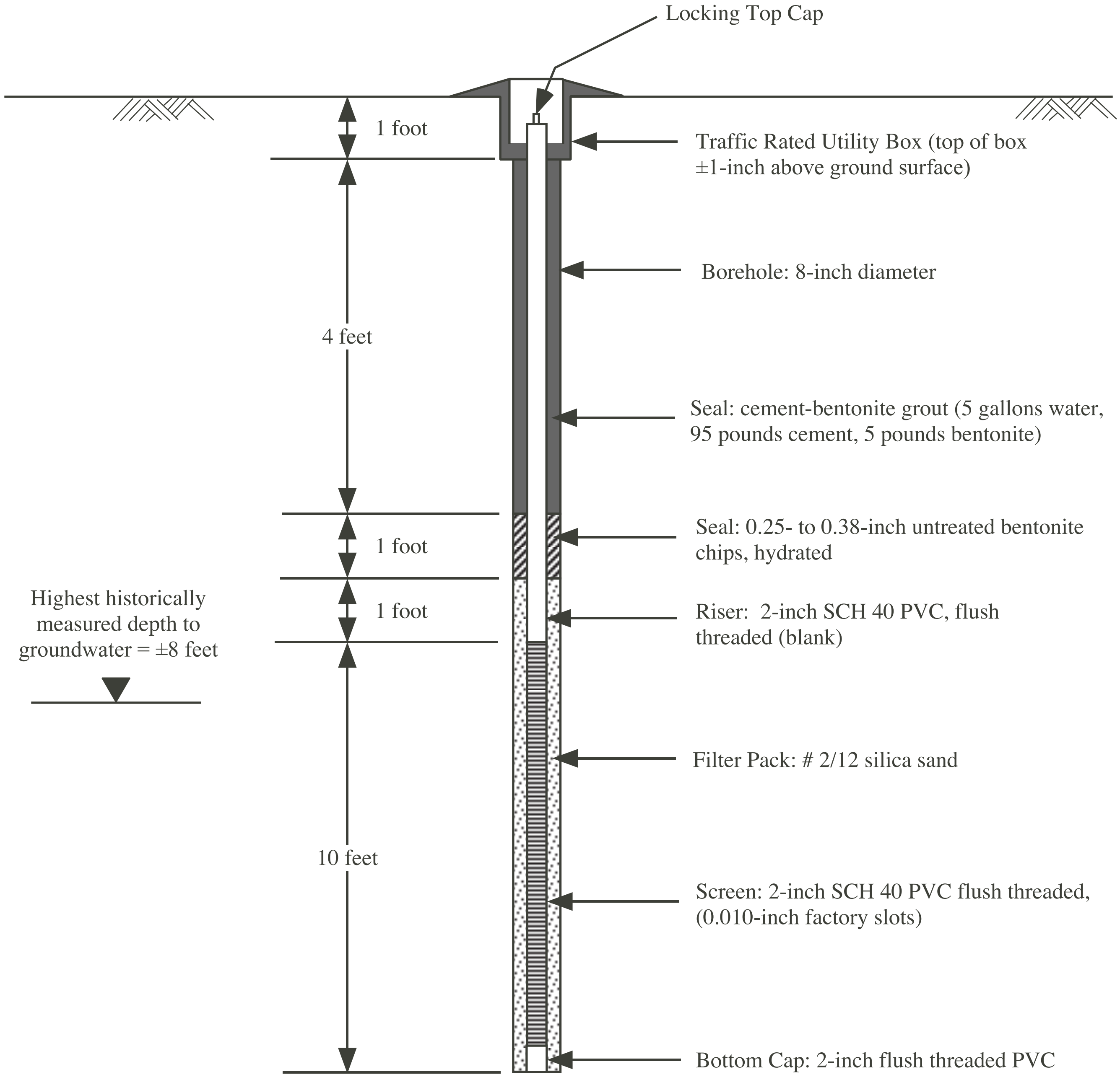
Basemap: Aerial photograph, flown 24 August 1998, photograph number ALA-AV-6100-11-38, original scale 1:12,000. Pacific Aerial Surveys, Oakland CA

Figure 3

Site Plan

2440 East Eleventh Street
Oakland CA

STREAMBORN



Not to Scale

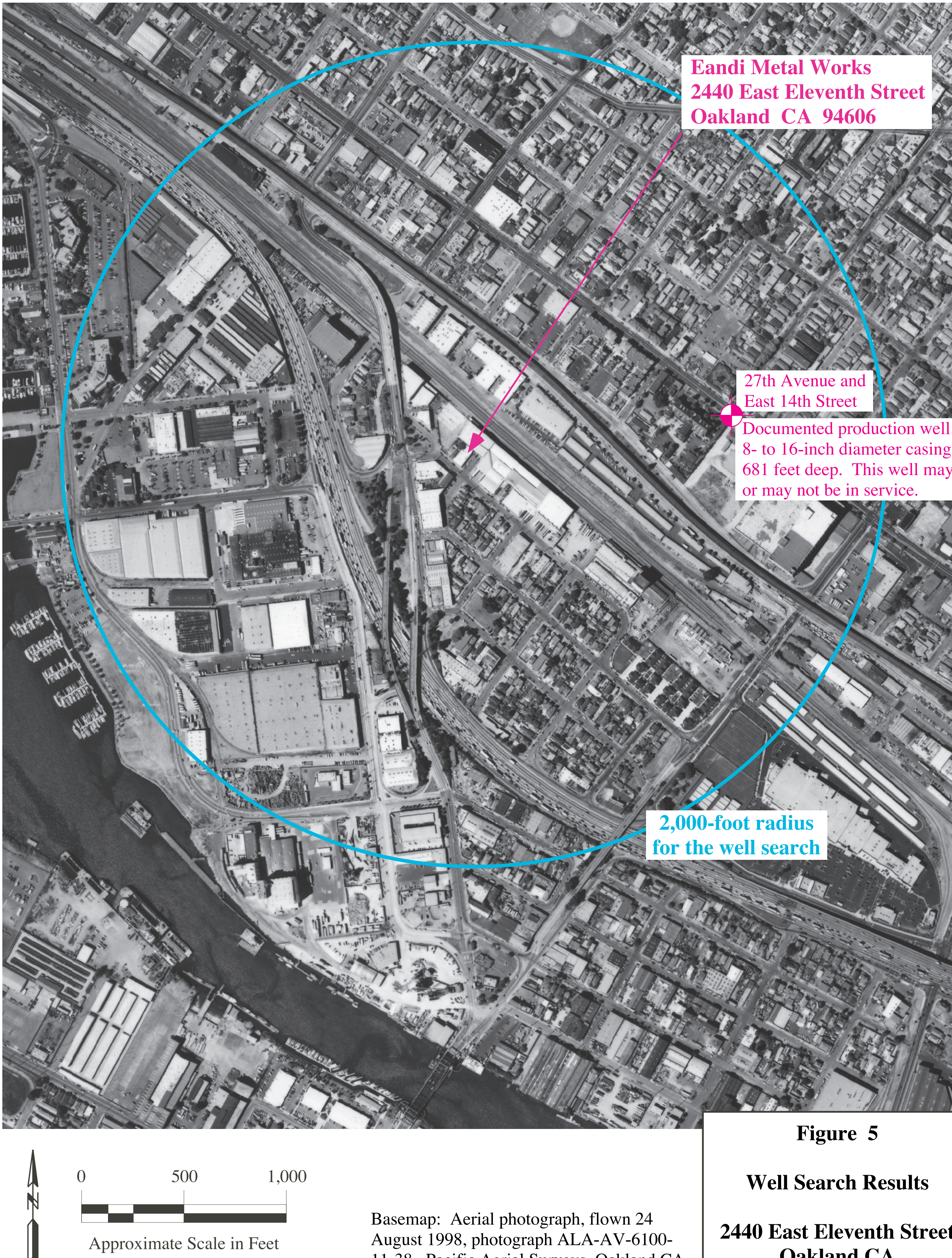
Figure 4

Completion Schematic for New Wells

2440 East Eleventh Street
Oakland CA

Note: This design should be modified to conform to site-specific conditions observed during drilling.

STREAMBORN



Basemap: Aerial photograph, flown 24 August 1998, photograph ALA-AV-6100-11-38. Pacific Aerial Surveys, Oakland CA.

Figure 5

Well Search Results

2440 East Eleventh Street
Oakland CA

STREAMBORN

ATTACHMENT 1

Standard Operating Procedures

STANDARD OPERATING PROCEDURE (SOP) 1A
HOLLOW-STEM AUGER DRILLING AND SPLIT-SPOON SOIL SAMPLING

1.0 INTRODUCTION AND SUMMARY

This SOP describes methods for drilling with the use of hollow-stem augers and soil sampling with the use of spilt-spoon samplers. Drilling activities covered by this SOP may be conducted to obtain soil samples or to create a borehole within which a well may be constructed. Soil samples may be obtained to log subsurface materials, to collect samples for chemical characterization, or to collect samples for physical parameter characterization.

The soil sampling techniques described in this SOP are generally suitable for chemical characterization and physical classification tests; because a driven split-spoon sampler is employed, the resulting soil samples should generally be considered "disturbed" with respect to physical structure and may not be suitable for measuring sensitive physical parameters, such as strength and compressibility. The augering techniques described in this SOP generally produce a borehole with a diameter corresponding to the outside diameter of the auger flights, a relatively small annulus of remolded soil surrounding the outside diameter of the auger flights, and limited capability for cross-contamination between subsurface strata as the leading flights of the augers pass from contaminated strata to uncontaminated underlying strata. However, should conditions require strict measures to help prevent cross-contamination or maintain the integrity of an aquitard, consideration should be given to augmenting the procedures of this SOP, for example, by using pre-drilled and grouted isolation casing.

The procedures for hollow-stem auger drilling and split-spoon soil sampling generally consist of initial decontamination, advancement of the augers, driving and recovery of the split-spoon sampler, logging and packaging of the soil samples, decontamination of the split-spoon, and continued augering and sampling until the total depth of the borehole is reached. Withdrawal of the augers upon reaching the total depth requires completion of the borehole by grouting, by constructing a well, or other measures; borehole completion is not covered in this SOP.

2.0 EQUIPMENT AND MATERIALS

- Drill rig, drill rods, hollow-stem augers, and drive-weight assembly (for driving the split-spoon sampler) should conform to ASTM D 1586 - Standard Method for Penetration Test and Split-Barrel Sampling of Soils, except: (1) hollow-stem augers may exceed 6.5 inches inside diameter as may be necessary for installing 4-inch diameter well casing, (2) hollow-stem augers should have a center bit assembly (end plug), (3) alternative drive-weight assemblies or downhole hammers are acceptable as long as the type, weight, and equivalent free fall are noted on the boring log.
- Split-spoon sampler should conform to ASTM D 1586 - Standard Method for Penetration Test and Split-Barrel Sampling of Soils, except: (1) split-spoon should be fitted with liners for collection of chemical characterization sample, and (2) allowable split-spoon diameters include nominal 1-1/2-inch inside

diameter by nominal 2-inch outside diameter (Standard Penetration Test split-spoon), nominal 2-inch inside diameter by nominal 2-1/2-inch outside diameter (California Modified split-spoon), or nominal 2-1/2-inch inside diameter by nominal 3-inch outside diameter (Dames & Moore split-spoon). The split-spoon type and length of the split-barrel portion of the sampler should be noted on the boring log, as should the use of a sample catcher if employed.

- Liners should be 3- to 6-inch length, fitted with plastic end-caps, brass or stainless steel, with a nominal diameter corresponding to that of the inside diameter of the split-spoon sampler. The boring log should note whether brass or stainless steel liners were used.
- Teflon sheets, approximate 6-mil thickness, precut to a diameter or width of the liner diameter plus approximately 1 inch
- 1/2-pint widemouth glass jars, laboratory cleaned
- Kimwipes, certified clean silica sand, or deionized water (for blank sample preparation)
- Duct tape
- Sample labels, boring log forms, chain-of-custody forms, hazardous waste labels, and daily report forms
- Ziploc plastic bags of size to accommodate a liner
- Stainless steel spatula and knife
- Cooler with ice or dry ice (do not use blue ice)
- Field organic vapor monitor. The make, model, and calibration information of the field organic vapor monitor (including compound and concentration of calibration gas) should be noted on the boring log.
- Aluminum foil, and rubber bands
- Pressure washer or steam cleaner
- Large trough (such as a water tank for cattle), plastic-lined pit, or equivalent for decontamination of hollow-stem augers, drill rod, and end plug
- Buckets and bristle brushes for decontamination of liners, split-spoon sampler, and other small gear
- Low residue, low phosphate, organic free soap such as Alconox
- Distilled water
- Steel, 55-gallon, open-top drums conforming to the requirements of DOT 17H

As specified in the Site Safety Plan, additional safety and personnel decontamination equipment and materials may be needed.

3.0 TYPICAL PROCEDURES

The following typical procedures are intended to cover the majority of drilling and sampling conditions. However, normal field practice requires re-evaluation of these procedures and implementation of alternate procedures upon encountering unusual or unexpected subsurface conditions. Deviations from the following typical procedures may be expected and should be noted on the boring log.

1. Decontaminate drill rig, drill rods, hollow-stem augers, split-spoon sampler and other drilling equipment immediately prior to mobilization to the site.
2. Investigate the location of the proposed boreholes for buried utilities and obstructions. At least 48 hours before drilling, contact known or suspected utility services individually or through collective services such as "USA" and "Underground Alert". As appropriate, retain private buried utility location services or geophysical investigation services to search for buried utilities and obstructions. Also as appropriate, pothole suspect utility locations prior to drilling or relocate boreholes. During initial advancement of each borehole, drill cautiously and have the driller pay particular attention to the "feel" of the hollow-stem auger. The suspected presence of an obstruction, buried pipeline or cable, utility trench backfill, or similar may be cause for suspension of drilling, subject to further investigation.
3. Advance the hollow-stem auger, fitted with end plug, to the desired sampling depth. Note depth interval, augering conditions, and driller's comments on boring log. Samples should be taken at intervals of 5 feet or less in homogeneous strata and at detectable changes of strata.
4. Remove drill rod and end plug from the hollow stem and note presence of water mark on drill rod, if any. If below the groundwater table in clean sand, allow water level in hollow-stem to equilibrate prior to removing end plug and remove plug slowly so as to minimize suction at the base of the plug. Also, monitor top of hollow-stem using field organic vapor monitor, as appropriate.
5. Decontaminate split-spoon, liners, spatulas and knives, and other equipment that may directly contact the chemical characterization sample. Fit split-spoon with liners and attach to drill rod.
6. Lower split-spoon sampler through hollow-stem of auger until sampler is resting on soil. Note discrepancy between elevation of tip of sampler and leading edge of augers, if any. If more than 6-inches of slough exists inside the hollow-stem augers, consider the conditions unsuitable and re-advance the hollow-stem augers and end plug to a new sampling depth.
7. Drive and recover the split-spoon according to the requirements of ASTM D 1586 - Standard Method for Penetration Test and Split-Barrel Sampling of Soils. Record depth interval, hammer blows for each 6-inches, and sample recovery on boring log. Monitor the recovered split-spoon with the field organic vapor monitor, as appropriate.
8. Remove either bottom-most or second-from-bottom liner (or both) from split-spoon for purposes of chemical characterization and physical parameter testing.

Observe soil at each end of liner(s) for purposes of completing sample description. Place teflon sheet at each end of liner, cover with plastic caps, and tape plastic caps with duct tape (do not use electrical tape) to further minimize potential loss of moisture or volatile compounds. Label liner(s) and place in ziploc bag on ice or dry ice inside cooler.

9. Visually classify soil sample in approximate accordance with ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Descriptions should include moisture content, color, textural information, group symbol, group name, and odor. Optional descriptions, especially if classification is performed with protective gloves, include particle angularity and shape, clast composition, plasticity, dilatancy, dry strength, toughness, and reaction with HCl. Add notes on geologic structure of sample, as appropriate. Record depth interval, visual classification, and other notes to the boring log.
10. Repeat steps 3 through 9 until total depth of borehole is reached.
11. Complete borehole according to the requirements specified elsewhere.
12. Decontaminate hollow-stem augers, drill rod, and end plug between boreholes and after finishing last borehole prior to drill rig leaving site.
13. Change decontamination solutions and clean decontamination trough, buckets, and brushes between boreholes.
14. Containerize soil cuttings, excess soil sample, and decontamination wastewaters in steel drums. Affix hazardous waste labels to the drums.
15. Complete pertinent portion of the chain-of-custody form.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality control sampling consists of sequential replicates, collected at an approximate frequency of 1 sequential replicate for every 10 natural samples. Sequential replicates are collected by packaging two adjacent liners of soil from a selected split-spoon drive. Each sample is labeled according to normal requirements. The replicate samples obtained in such a manner are suitable for assessing the reproducibility of both chemical and physical parameters. Interpretations of data reproducibility should recognize the potential for significant changes in soil type, even over 6-inch intervals. Accordingly, sequential replicates do not supply the same information as normally encountered duplicate or split samples. Duplicate or split samples are better represented by the laboratory performing replicate analyses on adjacent subsamples of soil from the same liner.

Optional quality control samples may be collected to check for cross-contamination using field blanks. Field blanks may be prepared by (1) swipe sampling decontaminated liners and split-spoon with kimwipes, (2) pouring clean silica sand into a decontaminated split-spoon sampler that has been fitted with liners, or (3) pouring deionized water over the decontaminated liners and split-spoon and collecting the water that contacts the sampling implements for aqueous analysis. Field blanks may be prepared at the discretion of the field staff given reasonable doubt regarding the efficacy of the decontamination procedures.

The comparability of the field visual classification may be checked by conducting laboratory classification tests. Requests for laboratory testing verification of the field classification should be left to the discretion of the field staff.

Field decisions that may also affect the quality of collected data include the frequency of sampling and the thoroughness of documentation. Subject to reasonable limitations of budget and schedule, the completeness, comparability, and representativeness of data obtained using this SOP will be enhanced by decreasing the sampling interval (including collecting continuous samples with depth) and increasing the level of detail for sample classification and description of drilling conditions. More frequent sampling and more detailed documentation may be appropriate in zones of chemical concentration or in areas of critical geology (for example, zones of changing strata or cross-correlation of confining strata).

5.0 DOCUMENTATION

Observations, measurements, and other documentation of the drilling and soil sampling effort should be recorded on the following:

- Boring Log
- Sample Label
- Chain-of-Custody

Documentation should include any deviations from this SOP, notations of unusual or unexpected conditions, and documentation of the containerization and disposition/disposal of investigation-derived waste. Specific instructions for selected forms are provided below.

5.1 Sample Label

- Project name and project number
- Boring or well number
- Sample depth interval (feet below ground surface), record the depth interval using notation similar to "19.2-19.7", generally do not record just one depth "19.2" because of uncertainty regarding the location such depth corresponds to (midpoint, top, etc.)
- Sample date and sample time
- Sampler
- Optional designation of orientation of sample within the subsurface, for example, an arrow with "up" or "top" designated

5.2 Boring Log

- Project name and project number

- Boring number
- Description of boring location, including taped or paced measurements to noticeable topographic features (a location sketch should be considered)
- Date and time drilling started and completed
- Drilling company and name of drilling supervisor, optional names and responsibilities of driller's helpers
- Manufacturer and model number of drill rig
- Inside diameter of the hollow stem and outside diameter of the auger flights of the hollow-stem augers, optional description of type of bit on end plug and leading edge of auger, optional description of the size of drill rod
- Depth at which groundwater was first encountered with the notation "during drilling"
- Method of borehole completion
- Other notations and recordings described previously in 2. EQUIPMENT AND MATERIALS and 3. TYPICAL PROCEDURES

6.0 DECONTAMINATION

Prior to entering the site, the drill rig and appurtenant items (drill rod, hollow-stem augers, end plug, split-spoon sampler, shovels, troughs and buckets, drillers stand, etc.) should be decontaminated by steam cleaning or pressure washing. Between each borehole, appurtenant items that contacted downhole soil (essentially all appurtenant items including drill rod, hollow-stem augers, end plug, split spoon sampler, shovels, troughs and buckets, etc.) should be decontaminated by steam cleaning or pressure washing. Prior to leaving the site, the drill rig and appurtenant items should be decontaminated by steam cleaning and pressure washing. Onsite decontamination should be conducted within the confines of a trough or lined pit to temporarily contain the wastewater. Between each borehole and prior to demobilization, the trough or lined pit should be decontaminated by steam cleaning or pressure washing. If a rack or other support is used to suspend appurtenant items over the trough or lined pit during decontamination, only the rack or other support needs to be decontaminated between boreholes.

Prior to each sample, the split-spoon sampler, liners, sample catcher, spatulas and knives, and other equipment or materials that may directly contact the sample should be decontaminated. Decontamination for these items should consist of a soap wash (Alconox or other organic free - low residue soap), followed by a tap water rinse, followed by a distilled water rinse. Wastewater from the soap wash should be temporarily contained. Wastewater from the tap water and distilled water rinses may be discharged to the ground surface or a sanitary sewer.

Between each borehole, buckets and brushes should be decontaminated by steam cleaning or pressure washing. Before each borehole, fresh decontamination solutions should be prepared.

7.0 INVESTIGATION-DERIVED WASTE

Wastes resulting from the activities of this SOP may include soil cuttings, excess soil sample, decontamination wastewaters, and miscellaneous waste (paper, plastic, gloves, jars, aluminum foil, etc.) Unless otherwise prohibited by the Site Safety Plan, miscellaneous waste should be double-bagged in plastic garbage bags and disposed of as municipal waste.

Soil cuttings and excess soil sample from each borehole should be placed in individual steel drums with hazardous waste labels affixed. Solids from multiple boreholes may be combined within a single drum if field observations (presence or absence of chemical staining and field organic vapor monitoring) indicate the solids are similarly uncontaminated or similarly contaminated. Given sufficient drums and reasonable doubt, separate drums should be used for each borehole.

Decontamination wastewaters for each borehole should be placed in individual steel drums with hazardous waste labels affixed. Wastewaters from multiple boreholes may be combined, subject to the same limitations as solids.

8.0 SAFETY

Normal and special safety precautions are described in the Site Safety plan. The Site Safety plan should be reviewed periodically during drilling to keep mindful of important safety measures. Physical hazards typically prevail because the drill rig contains exposed rotating and hammering equipment and because drill rod and augers are heavy material with sharp edges.

Chemical hazards are typically discovered upon withdrawal of the end plug or withdrawal of the soil-filled split-spoon sampler from the hollow-stem auger, as well as removal of the soil-filled liners from the split-barrel. Opportune monitoring for volatile chemicals may be conducted at these times. Splash protection and direct contact protection are also essential measures to minimize the potential for chemical exposure.

9.0 REFERENCES

American Society for Testing and Materials. Annual Book of ASTM Standards, Section 4 - Construction, Volume 4.08 - Soil and Rock I). ASTM, Philadelphia, PA.

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. National Water Well Association, Dublin, OH. 1989.

STANDARD OPERATING PROCEDURE (SOP) 2A
COMPLETION OF BORINGS AS WELLS

1.0 INTRODUCTION AND SUMMARY

This SOP describes methods for installation of a monitoring well within an existing borehole. The well construction techniques discussed in this SOP are generally suitable for construction of wells screened in one groundwater zone which will be used for water quality sampling and/or observations of groundwater elevation (piezometers). Typically, 2- or 4-inch diameter wells, with total depths less than 80-feet will be installed using this SOP. Large diameter or deep wells may require modification of the methods described herein. Discussion of specific well casing and screen material is beyond the scope of this SOP, and well casing and screen material should be selected on a site specific basis. The permitting activities of this SOP apply in California and different permits are needed in other locations.

The procedures for construction of wells generally consist of well permitting, well design, decontamination of well casing and screen, simultaneous assembly and lowering of casing and screen into the borehole, placement of the filter-pack around the screen, installation of a bentonite seal above the filter pack, sealing of the remaining annular space with grout, and surface completion.

2.0 EQUIPMENT AND MATERIALS

- Pressure washer or steam cleaner
- Grout mixing equipment
- Tap water
- Hand tools (pipe wrenches, chain wrenches, pipe vise, shovels, rubber mallet, etc.)
- Tape measure long enough to reach the bottom of the boring
- Well casing, screen, and end caps
- Centralizers (generally not required)
- Buckets and bristle brushes for decontamination
- Low residue, organic free soap such as Liquinox or Alconox
- Filter pack material (typically clean sand of specified gradation)
- Bentonite pellets (or powder) for seal above filter pack, unaltered sodium bentonite
- Cement for grout
- Locking hasp
- Protective surface casing

- Well construction log and daily report forms
- Calculator

Site specific conditions may require other specialized equipment.

3.0 TYPICAL PROCEDURES

The following procedures apply to most well installations. However, normal field practice requires re-evaluation and modification of these procedures upon encountering unexpected situations during well construction. Deviations from the following procedures may occur and should be documented.

1. Determine local jurisdiction charged with regulation of wells and apply for required local permits. Local jurisdictions may include county, water district, or city. Determine special design considerations (such as minimum length of grout seal) and inspection requirements (such as witnessing the placement of the grout seal). Also file notice of intent to construct well with the California Department of Water Resources using its standardized form.
2. Well design begins with the conception of the purpose for the well, and should include consideration of the analytes of interest, anticipated subsurface conditions at the intended well location, and the soil conditions encountered during drilling and recorded on the boring log.

   Design considerations discussed in this SOP are limited to portions of the well subject to modification by information gathered during drilling. Such information includes depth to groundwater, thickness of water bearing strata, and grain size distribution of the water bearing strata. Conceptual well designs should be modified as required in the field to prevent connection of naturally separate groundwater zones, to allow an adequate surface seal to be installed, and to maximize the chance for detection of the contaminants of concern.
3. Prior to installation in the borehole, well casing and screen should be decontaminated and inspected.

   Decontamination may consist of steam cleaning/pressure washing, hand washing, or equivalent. A tap water rinse should be employed after washing. If oil or grease is observed on the casing or screen, a soap wash and tap water rinse should be employed. This procedure should be applied to both the outside and the inside of well casing and screen immediately before assembly and well installation.
4. Assembly of the well screen and blank casing is accomplished simultaneously with insertion into the boring. Initially, a bottom plug is attached to the bottom of the screen and the screen is lowered into the boring. The next length of casing (screen or blank depending on the specific well design) is attached and the process is repeated until the well extends from the ground surface to the bottom of the boring. Various types of mechanical clamps are used to prevent dropping of the well screen into the well during assembly. It is useful to leave

surplus blank casing extending above grade at this point to facilitate subsequent construction activities.

Measure the length of well screen and blank casing inserted into the boring and record the quantities on the well construction log. The total length of well screen and casing should be confirmed by taping.

5. Install the filter pack by pouring filter pack material into the annulus between the casing and borehole. Unless otherwise delineated in the Workplan, Quality Assurance Project Plan, or Sampling Plan, install filter pack from (1) an elevation approximately 6-inches beneath the elevation of the bottom cap of the well casing to (2) approximately 2-feet above the top of the screened interval.

   If augers or drill casing remain in the ground during well construction, the annulus between the well material and the casing may be used as a tremie If the well is constructed in an open borehole that (1) exceeds 30-feet depth or (2) is below the groundwater table, then the filter pack should be placed using a tremie pipe. The filter pack should be poured slowly into the borehole and the depth to the top of the filter pack should be "tagged" periodically with a tape. Adequate time should be allowed for the filter pack material to settle through standing water prior to tagging or the tape may be lost by burial. Tagging may be time consuming, but provides reasonable checks of filter pack bridging during installation.

   If augers or other temporary casing are being used as a tremie, they should be withdrawn as the filter pack is placed. During placement, the elevation of the tip of the augers/temporary casing should be kept slightly above the top of the filter pack. Minimizing the separation between the top of the filter pack and tip of the augers/temporary casing during filter pack placement will help prevent inclusions of formation material or slough within the filter pack. However, if the tip of the augers/temporary casing is not kept above the top of the filter pack and the filter pack is allowed to settle within the augers/temporary casing, a filter pack bridge may occur and the well casing may become "locked" inside the augers/temporary casing.

   The theoretical quantity of filter pack material required to fill the annulus should be calculated. The quantity of filter pack material actually installed in the well should be measured and compared to the calculated quantity. Both quantities should be recorded on the well construction log.

6. The bentonite seal is installed by pouring bentonite pellets or slurried bentonite powder onto the top of the filter pack. Unless otherwise delineated in the Workplan, Quality Assurance Project Plan, or Sampling Plan, the bentonite seal should extend approximately two feet above the top of the filter pack. The quantity and type of bentonite used should be recorded on the well construction log. The top of the bentonite seal should be measured by taping. If bentonite pellets are used and the seal exists above the groundwater table, water should be poured on top of the pellets after their installation and the pellets should be allowed to hydrate for approximately 10 minutes before proceeding with installation of the overlying grout seal.

7. The grout seal should be tremied into the well to prevent inclusions of formation material or slough in the annular seal. Unless otherwise delineated in the Workplan, Quality Assurance Project Plan, or Sampling Plan, grout seal may consist of (1) neat cement grout, using 1 sack (94 pounds dry weight) of Type I/II Portland cement to 5 gallons of water, or (2) cement-bentonite grout using the same basic formula but substituting approximately 5% powdered bentonite for part of the cement. Local requirements may require inspection of grout seal placement by the regulating authority.

   If augers or temporary casing remain in the borehole during grouting, the level of the grout should be kept above the tip of the augers or casing to help prevent inclusions of formation material in the grout seal.

   The volume of the grout actually used should be recorded on the well construction log and compared to the theoretical annular volume of the sealed interval. Any discrepancies should be noted on the well construction log.

8. Complete the surface of the well by installing a protective surface casing and locking mechanism around the top of the well casing.
9. The completed well should be protected from disturbance while bentonite seal hydrates and grout cures. Further well activities, such as development or sampling, should be withheld for a period of 3 to 7 days to allow these materials to obtain an initial set.
10. Complete and file form DWR 188 plus reports or forms required by local agencies.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance checks for well completion include comparison of theoretical versus actual volumes of filter pack, bentonite seal, and grout seal. Discrepancies that indicate actual "take" was less than theoretical may indicate inclusions of formation material or slough within the annulus. Specific attention to such discrepancies is necessary if the bentonite seal and grout seal are needed to separate contaminated from uncontaminated zones that may be penetrated by the well.

Other quality assurance details include accurate measurement and documentation of the lengths and types of materials used to complete the well.

5.0 DOCUMENTATION

Observations, measurements, and other documentation of the well completion effort should be recorded on the following:

- Well Completion Log
- DWR 188

Documentation should include any deviations from this SOP, as well as documentation of the containerization and disposition/disposal of investigation-derived waste.

6.0 DECONTAMINATION

Materials used for filter pack, bentonite seal, and grout seal should be new at the beginning of each project. Typically, damaged or partially-used containers of material that are brought onsite by drillers or other material suppliers should not be used for well completion. If there is sufficient question regarding contamination of materials, obtain representative samples for later laboratory testing.

Well casing and screen should be decontaminated immediately prior to insertion within the borehole.

If augers or temporary casing are removed during well construction, these materials should be decontaminated by steam cleaning, pressure washing, or equivalent.

7.0 INVESTIGATION-DERIVED WASTE

Wastewater from casing and screen decontamination may be discharged to the ground surface near the well subject to the landowner's permission. Otherwise, these wastewaters may be discharged to the sanitary sewer.

Borehole fluids displaced during well completion, excess grout, and decontamination wastes from the cleaning of augers or temporary casing should be placed in steel drums. The drums should be labeled indicating the generator's name, accumulation date, contents, and well number.

8.0 SAFETY

Primary chemical hazards during well completion are associated with dermal exposure to borehole fluids that may be displaced during completion. Primary protection against dermal exposure includes splash protection and gloves.

Other specific site safety guidance is provided in the Site Safety Plan.

9.0 REFERENCES

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*. National Water Well Association, Dublin, OH. 1989.

DWR, 1990. *California Well Standards, Bulletin 74-90 (Supplement to Bulletin 74-81), Final Draft*. California Department of Water Resources, Sacramento CA. January 1990.

STANDARD OPERATING PROCEDURE (SOP) 3A

WELL DEVELOPMENT

1.0 INTRODUCTION AND SUMMARY

This SOP describes procedures to develop wells that have been properly installed. Typically, fine soil particles are entrained within the filter pack and adjacent formation during well installation. The well development procedures described herein are intended to help remove the fine soil particles, resulting in enhanced hydraulic response of the well and increased representativeness of water quality samples collected from the well.

Typically, this SOP will be used to develop 2- or 4-inch diameter monitoring wells and occasionally larger diameter monitoring or pumping wells; all screened within a single groundwater zone. The procedures described herein should be modified for domestic wells. The procedures described herein may also need modification if product is observed in the well.

Well development activities generally include decontaminating the downhole equipment, repetitive combinations of surging/swabbing and overpumping/bailing, measurement and observation of well yield, turbidity, and field parameters, and containerizing the development wastewater. Development is typically conducted until (1) no further improvement in well response and turbidity is observed, or (2) a reasonable time has been devoted to development.

2.0 EQUIPMENT AND MATERIALS

- Pressure washer or steam cleaner
- Buckets and bristle brushes for decontamination
- Low residue, organic free soap such as Liquinox or Alconox
- Tap water
- Steel, 55-gallon, open-top drums conforming to the requirements of DOT 17H
- Field organic vapor monitor. The make, model, and calibration information of the field organic vapor monitor (including compound and concentration of calibration gas) should be documented.
- Glass beaker, ±250 milliliter for measurement of field parameters. A similar flow-through cell may also be used.
- Water level meter
- pH, temperature, and specific conductivity instruments, including pH and specific conductivity standards approximating or spanning the natural groundwater parameters.
- Vented surge block or swab of appropriate diameter for the screened interval of the well casing.

- Bailing and/or overpumping equipment consisting of one or a combination of the following:

  Bailer: Steel or PVC. Dedicated or new bailer rope. Generally as large a diameter as will fit down well.

  Submersible Pump: Typically centrifugal, either single or multiple-stage.

  Air-Lift Pump: Dual-casing assembly with eductor casing (outer casing) to extend at least 2-feet beyond inner casing. Foot valve should be provided at the bottom of the eductor casing to prevent release of aerated water into the well when the air lift pump is turned off. Air from compressor should be dual-filtered to remove oil.

As specified in the Site Safety Plan, additional safety and personnel decontamination equipment and materials may be needed.

3.0 TYPICAL PROCEDURES

The following procedures are intended to cover the majority of well development conditions. However, normal field practice requires re-evaluation of these procedures upon encountering unusual or unexpected conditions such as observation of free product, measuring elevated pH in the development water, or observing dramatic increases in turbidity as development progresses. Deviations from the following procedures may be expected and should be documented.

1. Development should generally be initiated after the well sealing materials (grout) have obtained an initial cure. Typically, development may begin 3 to 7 days after well completion.
2. Remove top cap and perform field organic vapor monitoring of well casing.
3. Measure static water level and total depth of well. Compare total depth to well completion diagram. Calculate volume of standing water in casing.
4. Decontaminate downhole equipment (see DECONTAMINATION in this SOP).
5. Begin bailing or overpumping using as high an evacuation rate as possible. Record the following at the beginning of development and during each cycle:
   - Volume removed and time
   - pH, temperature, and specific conductance
   - Turbidity (clarity and color)
   - Approximate drawdown and well yield
   - Whether well was bailed/pumped dry
   - Other observations (such as presence of product) as appropriate

   Bail/overpump until at least one casing volume of standing water has been removed. Continue bailing/overpumping if the removed water remains very turbid, indicating removal of fines from the screened interval. Terminate bailing/overpumping upon improvement of clarity.

6. Surge/swab the well to loosen fines from the screened interval. Position vented surge block several feet above the screened interval and surge/swab with upward motion. Lower the surge/swab several feet and repeat, keep surging/swabbing progressively lower intervals until the bottom of the screened interval is reached. For each interval, surge/swab for several minutes or as indicated by field experimentation.
7. Repeat items 5 and 6 until evacuated water at the end of the bailing/over-pumping cycle is low or non-turbid, field parameters are representative of natural groundwater conditions, and well yield has stabilized at a value representative of the intercepted groundwater zone. Terminate development after a reasonable period of time even if these conditions are not observed. Unless otherwise specified in the Workplan, Quality Assurance Project Plan, or Sampling Plan, 4 hours may typically be taken as a reasonable time effort.
8. Terminate development by bailing or overpumping for an extended period of time to remove fines that have been loosened by the last cycle of surging/swabbing. Record final observations.
9. Containerize development water and decontamination wastewater in steel drum(s). Label drum(s) with hazardous waste label, description of contents, and well number from which waste originated.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Meters for measurement of field parameters should be calibrated at least once per day. Calibration standards should generally approximate or span natural groundwater characteristics. Recalibration may be appropriate if unusual measurements are noticed. Calibration activities should be documented on the instrument calibration log.

Quantitative turbidity measurements may be taken with a turbidity meter (both field and laboratory versions are available). If qualitative descriptions of turbidity are used, these terms (clear, translucent, opaque) may be further defined on the development log. Representative samples may also be collected and returned to the laboratory for measurement with a turbidity meter.

Because well development is typically the first activity of a newly completed well and because the activity is fairly vigorous, the following precautions may be appropriate:

- If product is observed but not anticipated within the groundwater zone intercepted by a well, and the well penetrated a contaminated overlying groundwater zone, well development may be interrupted subject to further consideration or study. Faulty well sealing may result in migration of product from overlying to underlying groundwater zones, which is exacerbated during development.

- If elevated pH is observed but not anticipated, and the well is being developed soon after completion, well development may be interrupted subject to further consideration or study. Elevated pH may originate from grout that has not yet cured, or from grout contamination of the filter pack.
- If turbidity increases dramatically after surging/swabbing and does not return to previously observed levels, the cause may be a broken well casing, broken screen, or dislodged end cap, which allows soil to enter the casing unfiltered by the filter pack. Probing the well may disclose a break or faulty joint. Consider interrupting well development if this condition is suspected.

5.0 DOCUMENTATION

The well completion schematic should be taken into the field to serve as reference information. Observations, measurements, and other documentation of the development effort should be recorded on the following:

- Well Development Log

Documentation should include any deviations from this SOP, as well as the documentation of the containerization and disposition/disposal of investigation-derived waste.

6.0 DECONTAMINATION

Prior to entering the site, well development equipment should be decontaminated by steam cleaning, pressure washing, or equivalent.

Prior to development of each well, down-well equipment should be decontaminated by steam cleaning or pressure washing, washing with soap, and rinsing with tap water, or equivalent.

Prior to leaving the site, equipment should be steam cleaned, pressure washed, or equivalent.

7.0 INVESTIGATION-DERIVED WASTE

Development water and decontamination wastewater should be containerized in steel drums. Drums should be labeled with hazardous waste labels, including generator's name and accumulation date. The drums should also be labeled with a description of contents and well number of waste origination. Waste from different wells may be combined in single drums, but chemically-affected and clean wastes should not be mixed.

8.0 SAFETY

Primary chemical hazards during well development are associated with dermal exposure. Primary protection against dermal exposure includes splash protection and gloves. Air-lift pumping may also exacerbate the release of volatile organic compounds from groundwater to air, thus increasing the risk of exposure; frequent monitoring with the field organic vapor monitor may be employed to mitigate this risk.

Other specific site safety guidance is provided in the Site Safety Plan.

9.0 REFERENCES

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. National Water Well Association, Dublin, OH. 1989.

STANDARD OPERATING PROCEDURE (SOP) 4A
WELL PURGING AND SAMPLING

1.0 INTRODUCTION AND SUMMARY

This SOP describes procedures to purge and sample wells that have been properly installed and developed. Typically, this SOP will be used for sampling monitoring wells with 2- or 4-inch diameter casings. The sampling described herein is appropriate for a variety of groundwater analyses, including: total and dissolved metals, volatile and semi-volatile organic compounds, and general minerals.

The procedures described in this SOP should be modified for domestic wells or wells with dedicated sampling equipment. The procedures should also be modified if product is observed in the well.

Typical well sampling and purging activities include decontaminating the purging and sampling equipment, purging the stagnant water from the well casing and filter pack by pumping or bailing, measuring field parameters and evacuated volume of groundwater during purging, terminating the purging process when field parameters stabilize, collecting groundwater samples by pumping or bailing, and labeling and preserving the collected samples.

2.0 EQUIPMENT AND MATERIALS

- Buckets and bristle brushes for decontamination
- Low residue, organic free soap such as Liquinox or Alconox
- If sampling is to be performed for metals, dilute (10%) reagent-grade nitric acid (for decontamination)
- Tap water (for decontamination)
- Distilled water (for decontamination and quality control blank samples)
- Cooler with ice (do not use blue ice or dry ice)
- Ziplock bags of size to accommodate sample containers
- Steel, 55-gallon, open-top drums, DOT 17H
- Field organic vapor monitor. The make, model, and calibration information of the field organic vapor monitor (including compound and concentration of calibration gas) should be documented.
- Laboratory-cleaned containers of proper type and size for the analytical parameters.
- Reagent-grade chemicals for sample preservation, as required for the analytical parameters.
- If dissolved metals analyses are required, 45-micron cellulose acetate filters and filtering device. Alternate filter type and size (cellulose nitrate, Teflon, or glass-

fiber pre-filters) may be required as specified in the Quality Assurance Project Plan or Sampling Plan. The make, type, and size of filter, including disposable filters, should be documented.

- Glass beaker, ±250 milliliter for measurement of field parameters. A similar flow-through cell may also be used.
- Water level meter
- pH, temperature, and specific conductivity instruments, including pH and specific conductivity standards approximating or spanning the natural groundwater parameters. As specified in the Quality Assurance Project Plan or Sampling Plan, oxidation-reduction potential (ORP) or dissolved oxygen meters may also be required.
- Purging equipment consisting of one of the following:

  <u>Bailer</u>: Steel, PVC, Teflon, or stainless steel. Dedicated or new bailer rope.

  <u>Bladder Pump</u>: Plastic or Teflon bladder.

  <u>Submersible Electric Pump</u>: Normally used where relatively large quantities of purge water are expected from wells with quick recharge.

  <u>Surface Centrifugal Pump</u>: Limited to water lift of approximately 20 feet. Dedicated or new flexible plastic suction hose.
- Sampling device consisting of one of the following:

  <u>Bailer</u>: Teflon or stainless steel. Dedicated or new bailer rope. If samples are collected for volatile organic compound analysis, bailer should also be fitted with bottom-emptying device.

  <u>Bladder Pump</u>: Teflon bladder. Dedicated or new Teflon or Tygon tubing for sample discharge line.

As specified in the Site Safety Plan, additional safety and personnel decontamination equipment and materials may be needed.

3.0 TYPICAL PROCEDURES

The following procedures are intended to cover the majority of purging and sampling conditions. However, normal field practice requires re-evaluation of these procedures and implementation of alternate procedures upon encountering unusual or unexpected conditions. Deviations from the following procedures may be expected and should be documented.

1. Remove top cap and perform field organic vapor monitoring of well casing
2. Measure static water level and total depth and compare to historic measurements. Re-measure if discrepancies are noted with historic data. Document observations of product, if appropriate. Calculate volume of standing water in casing.

3. Decontaminate purging and sampling equipment (see section DECONTAMINATION in this SOP)
4. Begin purging and if possible, adjust purge rate to expose as little of the screened interval as possible (subject to reasonable time constraints). Record the following observations at the beginning of purge, periodically during purge, and during sampling:

   • Purge volume and time

   • pH, temperature, and specific conductivity

   • Turbidity (clarity and color)

   • Approximate drawdown and well yield during purge

   • Whether well was purged dry

   • Other observations (such as presence of product) as appropriate
5. Terminate purging when one of the following conditions is observed:

   Quick Recharge Wells Quick recharge wells are those that recover to at least one-half the original standing water depth within 10 minutes of terminating purge. Quick recharge wells should be purged of at least 3 standing water casing volumes. Once 3 standing water casing volumes have been removed, wells should be sampled after field parameters have stabilized (this commonly occurs by the time 3 standing water casing volumes have been removed). If field parameters have not stabilized by the time 10 standing water casing volumes have been removed, the wells should be sampled anyway. Wells should be allowed to recover to at least one-half the original standing water depth prior to sampling.

   Slow Recharge Wells Slow recharge wells are those that are purged dry and recover to less than one-half the original standing water depth within 10 minutes of terminating purge. Slow recharge wells should be purged dry once and sampled after the well has recovered sufficiently to submerge the tip of the bailer.
6. If recharge has submerged the entire screened interval, sample from mid-depth of screened interval. Otherwise, sample from mid-depth of water column at time of sampling.
7. If dissolved metals analyses are to be performed, filter sample. Also if dissolved metals analyses are to be performed and the sample is moderately turbid or very turbid, consider collecting companion filtered and unfiltered samples.
8. For parameters other than dissolved metals, do not filter sample. Fill sample containers directly and preserve according to the requirements of the analytical procedure. Containers should generally filled to capacity. 40 milliliter glass vials should be filled from the bottom using a sample discharge tube (bottom-emptying device for bailer or discharge tube of bladder pump). 40 milliliter vials should not have headspace.
9. Label sample containers, place in ziplock bag, and place on ice in cooler.

10. Log samples onto chain-of-custody form and maintain sample custody until shipped to laboratory.
11. Containerize purge water, excess sample, and decontamination wastewater in steel drum(s).

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality control samples may consist of the following:

- Duplicate samples at a frequency of 1 per 10 natural samples
- Cross-contamination blank (also known as a sampler rinsate blank) at a frequency of 1 per 10 natural samples. Cross-contamination blanks are prepared by passing deionized water over and through decontaminated sampling equipment (including sample filter if used).
- If analyses require collection of samples in 40 milliliter vials, travel blanks may also be included at a frequency of 1 per day of sampling.
- Optional quality control samples include standard reference materials and natural matrix spikes.

Meters for measurement of field parameters should be calibrated at least once per day. Calibration standards should generally approximate or span natural groundwater characteristics. Recalibration may be appropriate if unusual measurements are noticed. Calibration activities should be documented on the instrument calibration log.

5.0 DOCUMENTATION

The following information should be collected prior to sampling and taken into the field for reference:

- Well completion schematic
- Summary of historic water level, total depth, and field parameter measurements

Observations, measurements, and other documentation of the purging and sampling effort should be recorded on the following:

- Well Purge and Sample Log
- Chain-of-Custody

Documentation should include any deviations from this SOP, as well as documentation of the containerization and disposition/disposal of investigation-derived waste.

6.0 DECONTAMINATION

Prior to entering the site, purging and sampling equipment should be decontaminated by steam cleaning, pressure washing, or equivalent.

Prior to sampling each well, down-well equipment and equipment that will contact the sample (except sample containers) should be decontaminated according to the following procedure:

- Steam clean or pressure wash (optional unless oily contamination covers equipment)
- Wash with soap
- Rinse with tap water
- Rinse with distilled water

If metals are included in the analytical parameters, the decontamination procedures should include:

- Steam clean or pressure wash (optional unless oily contamination covers equipment)
- Wash with soap
- Rinse with tap water
- Rinse with dilute nitric acid (skip for pumps containing metal parts)
- Rinse with tap water
- Rinse with distilled water

Suction or discharge hoses from purge and sampling pumps should generally be used once and discarded (or dedicated to the well). Purge or sampling pumps should be decontaminated by pumping the decontamination solutions through the pumps.

Prior to leaving the site, purging and sampling equipment should be steam cleaned, pressure washed, or equivalent.

7.0 INVESTIGATION-DERIVED WASTE

Purge water and excess water sample should be containerized in steel drums. Drums should be labeled with the following information: generator's name, accumulation date, waste description, and source well(s). Wastes from different wells may be combined, but wastes that are anticipated to contain chemical should not be mixed with waste that are not thought to be contaminated.

8.0 SAFETY

Primary chemical hazards during well purging and sampling are associated with dermal exposure. Acids used for decontamination and sample preservation may also present chemical hazards. Primary protection against dermal exposure includes splash protection and gloves. Special chemical hazards may be associated with the presence of product, if discovered during sampling. Water quality samples are not generally considered representative in the presence of product. Accordingly, it may be appropriate to abandon sampling efforts if product is discovered.

Other specific site safety guidance is provided in the Site Safety Plan.

9.0 REFERENCES

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. National Water Well Association, Dublin, OH. 1989.

ATTACHMENT 2

Site Safety Plan

Site Safety Plan

Installation and Sampling of Groundwater Monitoring Wells

2440 East Eleventh Street
Oakland CA

Anticipated Field Work The anticipated field work includes drilling of borings, installation of monitoring wells, and soil and groundwater sampling.

Chemical Hazard Evaluation Petroleum (gasoline) constituents have been released in the work area. Chemical hazards are summarized in Table 1.

Physical Hazard Evaluation Physical hazards that may be encountered include: heavy machinery, heavy lifting, slip-trip-fall, loud noise, and heat exposure.

Health and Safety Responsibilities This site safety plan will be implemented by the site safety officer under the supervision of the project manager and in coordination with an appropriate client representative. Safety personnel and their responsibilities are presented in Table 2.

Work Zone A work zone will be established around the area of work. The work zone is an area of sufficient size to allow safe completion of the work while maintaining control of access to the work area. The work zone will be restricted by requesting people not directly involved in the work to stay out, and/or by restricting access by other suitable means (such as with a work fence, traffic cones, or barricades).

No smoking, chewing of tobacco or gum, eating, or drinking will be allowed in the work zone.

Personal Protective Equipment Field work will begin in modified Level-D personal protection (Table 3). If air monitoring within the breathing zone reveals organic vapor concentrations that exceed the action levels specified below, then personal protective equipment will be upgraded to modified Level-C (Table 3).

Monitoring Visual monitoring should be routinely conducted by the workers. Workers should evaluate themselves and co-workers for signs of fatigue as the work progresses. Work breaks should be taken as reasonably required to maintain safety and efficiency.

The breathing zone in the work area will be monitored using a field organic vapor monitor (photoionization detector calibrated to 100 ppm v/v isobutylene). If continuous readings greater than 10 ppm above background are detected in the breathing zone, personal protection should be upgraded to modified Level-C from modified Level-D. 10 ppm was selected using the exposure criteria in Table 1.

If continual readings greater than 100 ppm above background are recorded in the breathing zone, work should stop. Work should be resumed after consultation with the project manager and possibly the client, and may include additional safety precautions.

Emergency Procedures These procedures are designed to allow rapid treatment of workers for injuries or exposure to hazardous substances occurring on the work site. A secondary purpose of these procedures is to allow documentation of emergencies.

Emergency information is summarized in Table 4. The location of the nearest hospital is shown on Figure 1.

If required, first aid should be provided for injured workers.

The site safety officer should be notified immediately of an emergency. It is the site safety officer's responsibility to document the emergency and report it to the project manager and client in a timely manner.

Decontamination Decontamination refers to removal of potential chemical contamination from worker's clothing and from health and safety monitoring equipment. In many instances, removal and thorough cleaning of work clothing is adequate for worker decontamination. However, if skin contact with chemical-containing material occurs during field work, the affected area should be washed thoroughly with soap and water.

Monitoring equipment should be kept clean by wiping as required with a paper towel or other suitable material.

Site Safety Wastes Wastes generated by site safety activities may include disposable protective equipment such as gloves, tyvek-coveralls, and boot covers, as well as used paper towels. These items may be disposed of with normal municipal refuse.

Liquid wastes from washing may be disposed of in the sanitary sewer.

Table 1

Chemical Hazard Evaluation

2440 East Eleventh Street
Oakland CA

Chemical	Odor Threshold (ppm v/v)	Lower Explosive Limit (ppm v/v)	Threshold Limit Value - Time Weighted Average (ppm v/v)	Immediately Dangerous to Life and Health (ppm v/v)
Xylenes	20	10,000	100	1,000
Ethylbenzene	0.09 - 0.6	12,000	100	2,000
Benzene	34 - 119	13,000	1	500 - 1,000
Toluene	0.16 - 37	12,000	50	2,000
TPH-Gasoline	NA	14,000	300	NA
Lead	NA	NA	OSHA = 0.5 mg/m^3	100 mg/m^3
Methyl tert-butyl ether (MtBE)	0.053	16,000	40	NA

General Note

(a) Lower explosive limits from MSDS sheets. Remaining criteria from: *3M, 1998 Respirator Selection Guide*. 3M, Occupational Health and Environmental Safety Division, St Paul MN. 2002.

Table 2

Safety Personnel and Responsibilities

2440 East Eleventh Street
Oakland CA

Personnel	Responsibilities
Project Manager (Douglas W. Lovell)	Development and overall implementation of Site Safety Plan, provide properly trained onsite personnel to complete the work, coordination of safety issues with client.
Site Safety Officer (Jeremy C. Gekov)	Onsite implementation of Site Safety Plan, coordination and documentation of field safety procedures, communication of safety issues to project manager, delineate work zone, atmospheric monitoring, review site safety procedures with subcontractors, contact Underground Service Alert, clear underground utilities, maintain adequate supply of safety equipment onsite.
Subcontractor's Site Safety Officer (to be determined)	Understand and obtain subcontracting crews' compliance with Site Safety Plan, maintain onsite supply of safety equipment for subcontractor's personnel, relay safety concerns to Site Safety Officer.

Table 3

Personnel Protective and Monitoring Equipment

2440 East Eleventh Street
Hayward CA

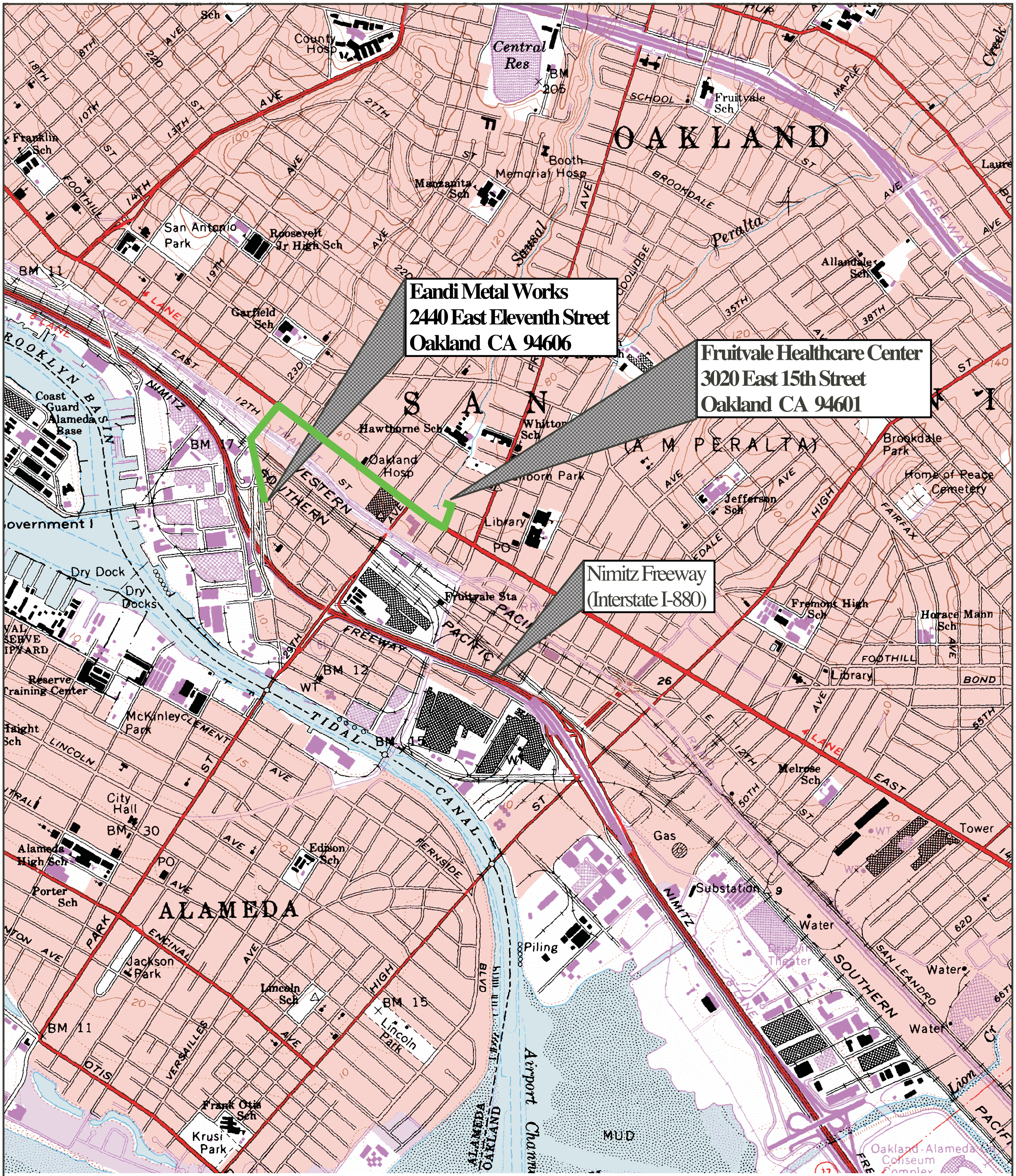
Item	Requirement
Modified Level-D Personal Protective Equipment	Hardhat, dedicated work clothing (cotton coveralls or tyveks), water repellent steel-toed boots, work gloves, latex gloves (as appropriate), nitrile gloves (as appropriate), first aid kit, fire extinguisher, warning tape, optional eye and hearing protection.
Modified Level-C Personal Protective Equipment	Add Half-face respirator with OV-HEPA cartridges and mandatory tyveks to modified Level-D protective equipment. Change respirator cartridges upon detection of breakthrough (by smell), increase in breathing resistance, or daily (whichever is more frequent).
Atmospheric Monitoring	Field organic vapor monitor capable of detecting organic vapor concentrations of 1 ppm (v/v). Field organic vapor monitor to be calibrated to known reference gas daily. Action levels (measurement in the breathing zone of work area): >10 ppm for 10 minutes: upgrade to modified Level C >100 ppm for 10 minutes: stop work, consult with project manager
Visual Monitoring	Evaluate yourself and co-workers for signs of fatigue and visual signs of distress (that may be caused by physical labor and possible chemical exposure).

Table 4

Emergency Information

2440 East Eleventh Street
Hayward CA

Emergency Service or Contact	Telephone	Address and Directions
Hospital	510-784-4251	• Fruitvale Healthcare Center 3020 East Fifteenth Street Oakland CA • From the facility, turn right (north) onto Twenty-Third Avenue. • Bear right (northeast) and stay on Twenty-Third Avenue. • Turn right (southeast) onto East Fourteenth Street/International Boulevard. • Turn left onto Derby Avenue. Proceed on Derby Avenue to East Fifteenth Street. • Fruitvale Healthcare Center is located in a cul-de-sac on East Fifteenth Street. • See hospital location map.
Ambulance	911	
Fire Department	911	
Police Department	911	
Onsite Telephone	510-532-8311	
Site Safety Officer	Jeremy C. Gekov 510-528-4234 (work) 707-318-6161 (mobile)	
Project Manager	Douglas W. Lovell 510-528-4234 (work) 510-520-3146 (mobile) 510-527-4180 (home)	
Facility Representative	Jeffrey M. Eandi 510-532-8311	
Subcontractors	To be determined	



0 0.5 1.0

Approximate Scale in Miles

0 2,000 4,000

Approximate Scale in Feet

N

Basemap: U.S. Geological Survey, 7.5 Minute Quadrangle, Oakland East CA. 1959 (Photorevised 1980)

Hospital Location Map

2440 East Eleventh Street
Oakland CA

STREAMBORN