CONESTOGA-ROVERS & ASSOCIATES

5900 Hollis Street, Suite A
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www.CRAworld.com

TRANSMITTAL

DATE: August 5, 2011

REFERENCE NO.: 240524

PROJECT NAME: 4255 MacArthur Boulevard, Oakland

TO: Jerry Wickham
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

RECEIVED
10:51 am, Aug 09, 2011
Alameda County
Environmental Health

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- ☐ Prints
- ☒ Final
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- ☐ Mail
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QUANTITY	DESCRIPTION
1	Subsurface Investigation Work Plan

- ☐ As Requested
- ☐ For Your Use
- ☒ For Review and Comment
- ☐

COMMENTS:
If you have any questions regarding the contents of this document, please call Peter Schaefer at (510) 420-3319.

Copy to: Denis Brown, Shell Oil Products US (electronic copy)
Roland C. Malone, Jr., PO Box 2744, Castro Valley, CA 94546
Kenneth Williams, MacArthur/High Trailer Park, c/o Bookkeeping, 332 Peyton Drive, Hayward, CA 94544
Terry L. Grayson, ConocoPhillips Risk Management & Remediation, 76 Broadway, Sacramento, CA 95818

Completed by: Peter Schaefer Signed: Peter Schaefer

Filing: **Correspondence File**

Denis L. Brown
Shell Oil Products US
HSE – Environmental Services
20945 S. Wilmington Ave.
Carson, CA 90810-1039
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Email denis.l.brown@shell.com

Jerry Wickham
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: Former Shell Service Station
4255 MacArthur Boulevard
Oakland, California
SAP Code 135701
Incident No. 98995758
ACEH Case No. RO0000486

Dear Mr. Wickham:

The attached document is provided for your review and comment. Upon information and belief, I declare, under penalty of perjury, that the information contained in the attached document is true and correct.

If you have any questions or concerns, please call me at (707) 865-0251.

Sincerely,

Denis L. Brown
Senior Program Manager

SUBSURFACE INVESTIGATION WORK PLAN

FORMER SHELL SERVICE STATION
4255 MACARTHUR BOULEVARD
OAKLAND, CALIFORNIA

SAP CODE	135701
INCIDENT NO.	98995758
AGENCY NO.	RO0000486

Prepared by:
Conestoga-Rovers & Associates

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Emeryville, California
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AUGUST 5, 2011
REF. NO. 240524 (12)
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1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) prepared this work plan on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell), as requested Alameda County Environmental Health's (ACEH's) May 23, 2011 letter.

As discussed in CRA's April 25, 2011 *Soil Vapor Probe Installation and Sampling Report*, CRA recommends resampling soil vapor probes SVP-1 through SVP-8 to confirm the results from this sampling event and to obtain samples from the probes which contained water during this sampling event. Analytical results for samples from soil vapor probes SVP-1 at 3 feet below grade (fbg) and 5 fbg and SVP-2 at 5 fbg are needed to better understand the potential for soil vapor intrusion to the southwest of the site. CRA proposes to conduct the next sampling event during the third quarter of 2011 to allow time for SVP-1 and SVP-6 at 3 fbg and 5 fbg, and SVP-2 at 5 fbg to dry out. Proposals for soil and groundwater investigations requested in ACEH's May 23, 2011 letter are detailed below.

The investigation proposed in this work plan will further delineate the extent of vadose zone soil and shallow groundwater impacts. Based on historical soil data (Table 1) from 20 fbg and below in twelve soil borings, the vertical extent of hydrocarbon impacts is adequately defined to below the San Francisco Bay Regional Water Quality Control Board's environmental screening levels (ESLs) for commercial land use[1], therefore, investigation of deeper zones is not warranted.

The site is a former Shell Service Station located on the western corner of MacArthur Boulevard and High Street in Oakland, California (Figure 1). Currently the site is a vacant lot. The former site layout consisted of a kiosk, three underground storage tanks, and two dispenser islands (Figure 2). The area surrounding the site is of mixed commercial and residential use.

A summary of previous work performed at the site and additional background information is contained in Appendix A. Historical soil analytical data are presented in Table 1, and historical soil sampling locations are presented on Figure 3.

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1 *Screening for Environmental Concerns at Site With Contaminated Soil and Groundwater*, California Regional Water Quality Control Board, Interim Final – November 2007 [Revised May 2008]

2.0 WORK TASKS

2.1 PERMIT

CRA will obtain a drilling permit from the Alameda County Public Works Agency (ACPWA).

2.2 HEALTH AND SAFETY PLAN (HASP)

CRA will prepare a HASP to protect site workers. The plan will be kept on site during field activities and will be reviewed and signed by each site worker.

2.3 UTILITY CLEARANCE

CRA will mark the proposed drilling locations, and the locations will be cleared through Underground Service Alert and a private line locator service prior to drilling.

2.4 SUBSURFACE INVESTIGATION

To further investigate the on-site extent of petroleum hydrocarbon impact to soil and groundwater, CRA will drill seven exploratory soil borings (SB-9 through SB-15) on site (Figure 2).

The borings will be advanced using a Geoprobe® rig, and each boring will be advanced until groundwater is encountered. Based on the first quarter 2011 data, depth to water in on-site wells is between 4.29 and 11.89 fbg.

A CRA geologist will supervise the drilling and describe encountered soils using the Unified Soil Classification System and Munsell Soil Color Charts. After clearing the borings to 5 fbg with an air- or water-knife, soil samples will be collected continuously for soil description. Soil samples will also be collected starting at 5 fbg for possible chemical analyses and screening in the field for organic vapors using a photo-ionization detector (PID). Soil sample selection will be based on field observations (including PID readings and soil types) and previous soil data (concentrations, depths, and locations; Table 1). At least two soil samples from each boring will be submitted for analysis. CRA will prepare a boring log for each boring, and PID measurements will be recorded on the boring logs.

Soil samples designated for chemical analyses will be retained in stainless steel sample tubes, brass sample tubes, or plastic sleeves. If plastic sleeves are used, they will be cut into 6-inch lengths. The tubes or sleeves will be covered on both ends with Teflon sheets and plastic end caps.

Following soil sampling, CRA will collect a grab groundwater sample at first-encountered groundwater (estimated at 5 to 13 fbg) from each boring using a Hydropunch® or a temporary well casing and a Teflon® bailer. Samples will be transferred into vials containing hydrochloric acid preservative with no headspace.

Soil and grab groundwater samples will be labeled, entered onto a chain-of-custody record, and placed into a cooler with ice for transport to a State of California certified laboratory for analyses. CRA will request a standard 2-week turn around time for laboratory results.

In addition, CRA proposes to drill a second soil borehole at two locations (SB-13 and SB-15) to collect undisturbed vadose-zone soil samples (Figure 2). The undisturbed vadose-zone soil samples and selected saturated zone soil samples from the Geoprobe® borings at each of these locations will be submitted for physical parameter analyses.

The borings to collect undisturbed vadose-zone soil samples will be advanced to 5 fbg using direct-push drilling equipment. Shelby tube samples will be collected continuously for physical parameter analysis. The ends of each tube will be covered with plastic end caps and sealed with electrical tape. Soil samples will be labeled, entered onto a chain-of-custody record, and transported to a reputable physical testing laboratory for analysis.

CRA will perform this work under the supervision of a professional geologist or engineer.

2.5 CHEMICAL ANALYSES

Selected soil and grab groundwater samples will be analyzed for total petroleum hydrocarbons as gasoline, benzene, toluene, ethylbenzene, xylenes, and fuel oxygenates using EPA Method 8260B.

2.6 PHYSICAL ANALYSES

Selected soil samples will be analyzed for grain size by ASTM Method D422, for the fraction of organic carbon by the Walkley-Black[2] method, for soil dry bulk density by ASTM Method D2937, for porosity by API Method RP40, and for moisture content by ASTM Method D2216 (moisture content analysis for vadose zone samples only).

2.7 REPORT PREPARATION

Following the receipt of analytical results from the laboratory, CRA will prepare a written report which will include field procedures, laboratory results, and boring logs.

3.0 SCHEDULE

CRA will begin work upon receiving ACEH's written approval of this work plan and the appropriate drilling permit from ACPWA.

---

2 Nelson, D. W., and L. E. Sommers. 1982. *Total Carbon, Organic Carbon, and Organic Matter.* In: A. L. Page et al. (editors), *Methods of Soil Analysis: Part 2 Chemical and Microbiological Properties.* American Society of Agronomy, Inc. Monograph Number 9, p. 539 - 579.

All of Which is Respectfully Submitted,
CONESTOGA-ROVERS & ASSOCIATES

Peter Schaefer, CEG, CHG

Erica Dyston for
Aubrey K. Cool, PG

FIGURES

12/16/08

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FIGURE 1

Former Shell Service Station
4255 MacArthur Boulevard
Oakland, California

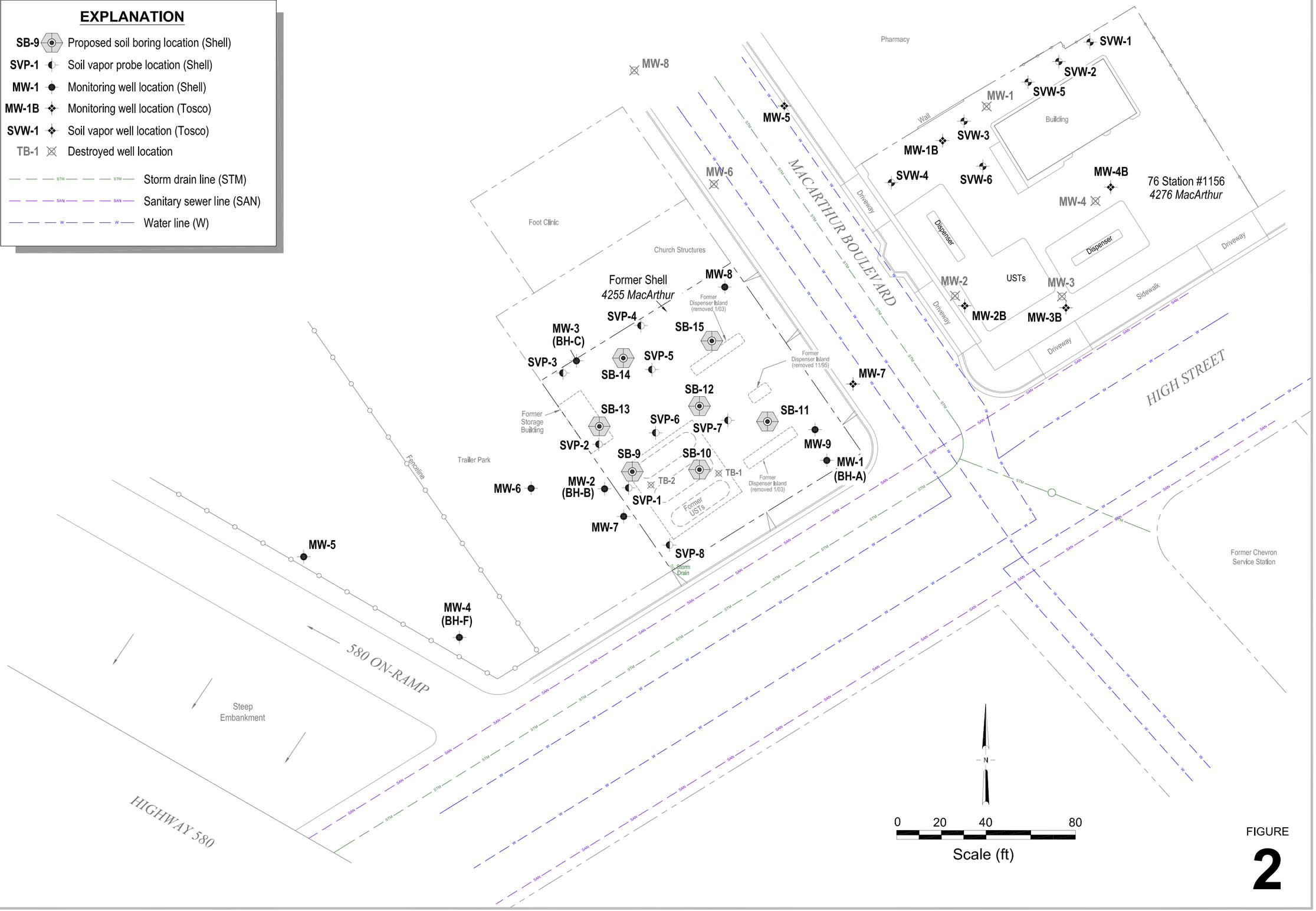
CONESTOGA-ROVERS & ASSOCIATES

Vicinity Map

08/04/2011

EXPLANATION

- SB-9 — Proposed soil boring location (Shell)
- SVP-1 — Soil vapor probe location (Shell)
- MW-1 — Monitoring well location (Shell)
- MW-1B — Monitoring well location (Tosco)
- SVW-1 — Soil vapor well location (Tosco)
- TB-1 — Destroyed well location
- STM — Storm drain line (STM)
- SAN — Sanitary sewer line (SAN)
- W — Water line (W)



FIGURE

2

Site Plan

Former Shell Service Station

4255 MacArthur Boulevard

Oakland, California

CONESTOGA-ROVERS & ASSOCIATES

I:\Shell\6-chars\2405--\240524-Oakland 4255 MacArthur\240524-FIGURES\240524 SITE PLAN.DWG

07/20/2011

EXPLANATION

- SVP-1 — Soil vapor probe location (Shell)
- MW-1 — Monitoring well location (Shell)
- MW-1B — Monitoring well location (Tosco)
- SVW-1 — Soil vapor well location (Tosco)
- TB-1 — Destroyed well location
- SB-5 — Soil boring location (Cambria, 10/2005)
- CPT-1 — CPT location (Cambria, 4/2005)
- SB-3 — Soil boring location (Cambria, 4/2005)
- D-1 — Dispenser soil sample location (Cambria, 01-02/2003)
- P-1 — Piping soil sample location (Cambria, 01-02/2003)
- TP-1 — Tank pit soil sample location (Cambria, 01-02/2003)
- SB-1 — Soil boring location (Cambria, 12/1998)
- S1 — Soil sample location (Weiss, 11/1995)
- BH-D — Soil boring location (Weiss, 11/1993 & 11/1994)
- S-A — Soil boring location (EMCON, 6/1985)
- HW-1 — Destroyed horizontal soil vapor extraction well location
- STM — Storm drain line (STM)
- SAN — Sanitary sewer line (SAN)
- W — Water line (W)

N

0 10 20 40

Scale (ft)

Foot Clinic
Church Structures
Trailer Park
Fenceline
580 ON-RAMP
MACARTHUR BOULEVARD
HIGH STREET
Driveway
Former Shell
4255 MacArthur
Former Storage Building
Former Dispenser Island (removed 1/03)
Former Dispenser Island (removed 11/95)
Former Horizontal SVE Piping
Approximate Excavation Boundary
Former USTs
Storm Drain

SB-1
MW-3 (BH-C)
SVP-3
CPT-2
CPT-3
SB-5
SVP-4
CPT-5
CPT-4
SVP-5
D-4-N-6
P-3
D-4
SB-4
CPT-1
SVP-2
CPT-9
MW-6
CPT-7
MW-2 (BH-B)
SVP-1
SB-2
CPT-10
MW-7
SB-3
S-I
CPT-8
CPT-11
CPT-6
SVP-6
SVP-7
SVP-8
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TB-1
TB-2
S-B
S-A
HW-1
HW-2
HW-3
HW-4
P-2-N6
S6
P-2
S5
S4
D-3
S3
S7
E-6, E-12
BH-E
D-5-E10
SB-7
S2
S1
S8
D-5
D-5-W10
D-5-S10
S9
S10
D-1
S15
S11
P-1
S12
S13
D-2
S14
MW-8
BH-D
MW-7
MW-9
MW-1 (BH-A)
SB-6
SB-8
MW-5
MW-4 (BH-F)

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Historical Soil Sampling Locations

CONESTOGA-ROVERS & ASSOCIATES

Former Shell Service Station

4255 MacArthur Boulevard
Oakland, California

FIGURE

3

TABLE

TABLE 1

HISTORICAL SOIL ANALYTICAL DATA
FORMER SHELL SERVICE STATION
4255 MACARTHUR BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	*Date*	*Depth (fbg)*	*TPHg (mg/kg)*	*B (mg/kg)*	*T (mg/kg)*	*E (mg/kg)*	*X (mg/kg)*	*MTBE (mg/kg)*	*TBA (mg/kg)*	*DIPE (mg/kg)*	*ETBE (mg/kg)*	*TAME (mg/kg)*	*Total Lead (mg/kg)*
S-1	6/10/1985	13.5-15	ND a	---	---	---	---	---	---	---	---	---	---
S-1	6/10/1985	18.5-20	ND a	---	---	---	---	---	---	---	---	---	---
S-A	6/10/1985	4-5.5	**15,800 a**	---	---	---	---	---	---	---	---	---	---
S-A	6/10/1985	8.5-10	2 a	---	---	---	---	---	---	---	---	---	---
S-A	6/10/1985	10-11.5	ND a	---	---	---	---	---	---	---	---	---	---
S-B	6/10/1985	13.5-15	2 a	---	---	---	---	---	---	---	---	---	---
BH-A (MW-1)	11/3/1993	6	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-A (MW-1)	11/3/1993	10.5	24	0.4	0.028	0.12	0.62	---	---	---	---	---	---
BH-A (MW-1)	11/3/1993	14	26	0.028	0.02	0.062	0.32	---	---	---	---	---	---
BH-A (MW-1)	11/3/1993	18	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-A (MW-1)	11/3/1993	22	<1	0.0063	0.0094	0.0097	0.057	---	---	---	---	---	---
BH-B (MW-2)	11/3/1993	6	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-B (MW-2)	11/3/1993	9	7.6	0.069	<0.0025	0.044	0.11	---	---	---	---	---	---
BH-B (MW-2)	11/3/1993	14	66	0.07	0.44	0.53	2.6	---	---	---	---	---	---
BH-B (MW-2)	11/3/1993	18.5	<1	0.032	0.012	0.0042	0.02	---	---	---	---	---	---
BH-B (MW-2)	11/3/1993	24	<1	0.021	0.023	0.0037	0.021	---	---	---	---	---	---
BH-C (MW-3)	11/4/1993	6.5	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-C (MW-3)	11/4/1993	11.3	**1,700**	1.1	2.5	**33**	**44**	---	---	---	---	---	---
BH-C (MW-3)	11/4/1993	16	**610**	**3.3**	5.7	**6.9**	**33**	---	---	---	---	---	---
BH-C (MW-3)	11/4/1993	22.5	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-D	11/3/1994	5	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-D	11/3/1994	10	<1	0.13	<0.0025	0.011	0.01	---	---	---	---	---	---
BH-D	11/3/1994	15	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-D	11/3/1994	20	<1	<0.0025	<0.0025	<0.0025	0.015	---	---	---	---	---	---
BH-E	11/3/1994	5	**5,900**	**23**	**160**	**120**	**430**	---	---	---	---	---	---
BH-E	11/3/1994	10	<1	0.031	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-E	11/3/1994	15	<1	0.0053	0.0033	<0.0025	0.007	---	---	---	---	---	---
BH-E	11/3/1994	20	<1	<0.0025	0.0077	<0.0025	0.015	---	---	---	---	---	---
BH-F (MW-4)	11/3/1994	5	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
BH-F (MW-4)	11/3/1994	10	13	0.029	0.14	0.17	0.54	---	---	---	---	---	---
BH-F (MW-4)	11/3/1994	15	<1	0.044	0.0033	0.017	0.032	---	---	---	---	---	---
BH-F (MW-4)	11/3/1994	20	<1	<0.0025	<0.0025	<0.0025	<0.0025	---	---	---	---	---	---
S1	11/17/1995	3	**3,200**	<5.0	**27**	**39**	**250**	---	---	---	---	---	---
S2	11/17/1995	2	**7,800**	<15	**51**	**71**	**540**	---	---	---	---	---	---
S3	11/17/1995	2	**7,300**	<12	**14**	**42**	**500**	---	---	---	---	---	---
S4	11/17/1995	2.5	1.5	0.052	<0.005	0.021	0.0069	---	---	---	---	---	---
S5	11/17/1995	3	1.1	<0.005	<0.005	<0.005	0.013	---	---	---	---	---	---
S6	11/17/1995	2.5	1.1	0.19	<0.005	0.046	0.020	---	---	---	---	---	---
S7	11/17/1995	3	10	0.12	0.030	0.24	0.98	---	---	---	---	---	---
S8	11/17/1995	3	**2,800**	<5.0	5.1	**25**	**140**	---	---	---	---	---	---
S9	11/17/1995	3.5	6.5	<0.005	<0.005	<0.005	0.021	---	---	---	---	---	---
S10	11/17/1995	3.5	44	<0.05	<0.05	0.051	0.22	---	---	---	---	---	---
S11	11/17/1995	3.5	2.6	0.026	<0.005	0.011	0.014	---	---	---	---	---	---
S12	11/17/1995	4	39	0.26	<0.05	0.42	1.7	---	---	---	---	---	---

TABLE 1

HISTORICAL SOIL ANALYTICAL DATA
FORMER SHELL SERVICE STATION
4255 MACARTHUR BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	*Date*	*Depth (fbg)*	*TPHg (mg/kg)*	*B (mg/kg)*	*T (mg/kg)*	*E (mg/kg)*	*X (mg/kg)*	*MTBE (mg/kg)*	*TBA (mg/kg)*	*DIPE (mg/kg)*	*ETBE (mg/kg)*	*TAME (mg/kg)*	*Total Lead (mg/kg)*
S13	11/17/1995	4	12	**0.85**	0.46	0.31	1.5	---	---	---	---	---	---
S14	11/17/1995	4	**300**	<0.5	<0.5	3.8	10	---	---	---	---	---	---
S15	11/17/1995	5	**210**	0.28	<0.25	1.9	6.4	---	---	---	---	---	---
SB-1 - 5.0	2/13/1998	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.025 b/<0.10	---	---	---	---	---
SB-1 - 7.0	2/13/1998	7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.025 b/<0.10	---	---	---	---	---
SB-2 - 5.0	2/13/1998	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.025 b/<0.10	---	---	---	---	---
SB-2 - 7.0	2/13/1998	7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	1.4 b/0.88	---	---	---	---	---
MW-5	11/12/2001	5.5	<1.0	<0.005	<0.005	<0.005	<0.005	<0.5	---	---	---	---	---
TP-1	1/27/2003	10.5	91	0.31	0.074	1.3	5.9	<0.5	---	---	---	---	3.35
TP-2	1/27/2003	10	2.0	<0.005	<0.005	<0.005	<0.005	<0.5	---	---	---	---	<0.500
TP-3	1/27/2003	11	<1.0	0.048	<0.005	0.010	0.0089	<0.5	---	---	---	---	1.13
TP-4	1/27/2003	10	1.6	<0.005	<0.005	<0.005	0.0086	<0.5	---	---	---	---	1.58
TP-5	1/27/2003	10	**380**	1.7	0.45	3.7	15	1.2	---	---	---	---	0.836
TP-6	1/27/2003	10	2.1	<0.005	<0.005	<0.005	<0.005	1.2	---	---	---	---	<0.500
D-1	1/30/2003	3	**260**	**0.64**	<0.005	3.9	5.0	1.2	---	---	---	---	5.55
D-2	1/30/2003	4	<1.0	0.0080	<0.005	0.0052	0.0081	<0.5	---	---	---	---	4.95
D-3	1/30/2003	3	130	<0.025	0.030	1.2	8.8	<0.5	---	---	---	---	5.45
D-4	1/30/2003	3	51	0.11	<0.025	0.59	0.12	<0.5	---	---	---	---	4.24
P-1	1/30/2003	3	130	0.058	<0.025	1.5	1.4	<0.5	---	---	---	---	11.3
P-2	1/30/2003	3	**420**	**1.5**	0.36	**8.6**	**21**	<0.5	---	---	---	---	4.96
P-3	1/30/2003	3	<1.0	0.0079	<0.005	0.0084	0.0050	<0.5	---	---	---	---	3.15
D-1-6.5	1/31/2003	6.5	87	0.11	<0.025	0.58	0.51	<0.5	---	---	---	---	---
D-2-5.5	1/31/2003	5.5	3.7	0.22	<0.005	0.064	0.073	**0.6**	---	---	---	---	---
D-3-8	1/31/2003	8	53	**0.27**	<0.025	0.13	0.38	<0.5	---	---	---	---	---
D-4-8	1/31/2003	8	**1,100**	**2.2**	<0.050	**10**	9.9	<0.5	---	---	---	---	---
D-5-6.0	1/31/2003	6	**2,200**	**2.0**	6.5	**28**	**110**	<0.5	---	---	---	---	---
P-1-5.5	1/31/2003	5.5	<1.0	<0.005	<0.005	<0.005	<0.005	<0.5	---	---	---	---	---
P-2-8	1/31/2003	8	**910**	**1.2**	<0.050	**16**	**32**	<0.5	---	---	---	---	---
P-3-8	1/31/2003	8	**420**	0.46	<0.050	**5.2**	**13**	<0.5	---	---	---	---	---
D-4-12	2/4/2003	12	2.9	0.19	<0.005	0.036	0.17	<0.5	---	---	---	---	---
D-4-N6	2/4/2003	6	5.5	0.024	0.10	0.025	0.11	<0.5	---	---	---	---	---
D-5-14	2/4/2003	14	<1.0	<0.005	<0.005	<0.005	<0.005	<0.5	---	---	---	---	---
D-5-S10	2/4/2003	10	<1.0	<0.005	<0.005	<0.005	<0.005	0.9	---	---	---	---	---
D-5-W10	2/4/2003	10	160	**0.40**	<0.025	0.035	<0.050	<0.5	---	---	---	---	---
D-5-E10	2/4/2003	10	35	0.035	<0.005	0.051	0.017	<0.5	---	---	---	---	---
P-2-12	2/4/2003	12	<1.0	<0.005	<0.005	<0.005	<0.005	<0.5	---	---	---	---	---
P-2-N6	2/4/2003	6	42	0.12	0.063	0.45	3.6	<0.5	---	---	---	---	---
E-6	2/4/2003	6	1.9	0.030	0.076	0.069	0.33	<0.5	---	---	---	---	---
E-12	2/4/2003	12	21	<0.005	<0.005	0.062	0.42	<0.5	---	---	---	---	---
SB-5	10/28/2005	5	19	<0.023	<0.023	0.11	0.030	0.064	0.083	<0.046	<0.023	<0.023	---

TABLE 1

HISTORICAL SOIL ANALYTICAL DATA
FORMER SHELL SERVICE STATION
4255 MACARTHUR BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	*Date*	*Depth (fbg)*	*TPHg (mg/kg)*	*B (mg/kg)*	*T (mg/kg)*	*E (mg/kg)*	*X (mg/kg)*	*MTBE (mg/kg)*	*TBA (mg/kg)*	*DIPE (mg/kg)*	*ETBE (mg/kg)*	*TAME (mg/kg)*	*Total Lead (mg/kg)*
SB-5	10/28/2005	10	58	<0.55	<0.55	<0.55	<0.55	<0.55	<2.8	<1.1	<0.55	<0.55	---
SB-5	10/28/2005	15	**220**	<0.50	<0.50	1.9	2.1	<0.50	<2.5	<1.0	<0.50	<0.50	---
SB-5	10/28/2005	20	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	0.035	<0.010	<0.010	<0.0050	<0.0050	---
SB-6	10/28/2005	5	<1.0	<0.0050	<0.0050	<0.0050	0.011	<0.0050	<0.010	<0.010	<0.0050	<0.0050	---
SB-6	10/28/2005	10.5	**160**	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	---
SB-6	10/28/2005	15	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	0.067	1.6	<0.010	<0.0050	<0.0050	---
SB-6	10/28/2005	20	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	0.19	0.19	<0.010	<0.0050	<0.0050	---
SB-6	10/28/2005	25	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	0.0073	<0.010	<0.010	<0.0050	<0.0050	---
SB-7	10/28/2005	5	**220**	**0.59**	<0.50	2.9	10	1.2	<2.5	<1.0	<0.50	<0.50	---
SB-7	10/28/2005	10	**2,600**	**13**	**17**	**45**	**270**	0.95	<2.5	<1.0	<0.50	<0.50	---
SB-7	10/28/2005	15	**260**	1.4	3.7	2.6	**13**	<0.50	<2.5	<1.0	<0.50	<0.50	---
SB-7	10/28/2005	20.5	<4.6	<0.023	<0.023	<0.023	0.069	0.097	0.12	<0.046	<0.023	<0.023	---
SB-7	10/28/2005	25	9.0	0.087	0.087	0.14	0.82	0.27	0.088	<0.010	<0.0050	<0.0050	---
SB-7	10/28/2005	30	1.2	0.023	0.038	0.031	0.15	0.077	0.030	<0.010	<0.0050	<0.0050	---
SB-7	10/28/2005	35	<1.0	0.031	0.028	0.020	0.089	0.10	0.024	<0.010	<0.0050	<0.0050	---
SB-7	10/28/2005	40	<1.0	0.017	0.015	0.0078	0.033	0.019	<0.010	<0.010	<0.0050	<0.0050	---
SB-8	10/28/2005	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.010	<0.010	<0.0050	<0.0050	---
SB-8	10/28/2005	10	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.010	<0.010	<0.0050	<0.0050	---
SB-8	10/28/2005	15	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.081	<0.010	<0.0050	<0.0050	---
SB-8	10/28/2005	20	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	0.014	0.020	<0.010	<0.0050	<0.0050	---
MW-6	6/16/2006	5	<4.00	<0.07	<0.07	<0.07	<0.22	<0.37	<3.7	<0.37	<0.37	<0.37	---
MW-6	6/16/2006	10	**239**	**0.50**	<0.08	3.5	17	0.57	<4.0	<0.40	<0.40	<0.40	---
MW-6	6/16/2006	15	**329**	0.25	<0.08	0.77	2.9	0.54	<3.9	<0.39	<0.39	<0.39	---
MW-6	6/16/2006	20	<4.00	<0.07	<0.07	<0.07	<0.22	<0.37	<3.7	<0.37	<0.37	<0.37	---
MW-7	6/20/2006	5	4.57	<0.07	<0.07	<0.07	<0.22	0.46	<3.7	<0.37	<0.37	<0.37	---
MW-7	6/20/2006	10	111	**0.41**	<0.07	1.2	4.5	3.1	<3.6	<0.36	<0.36	<0.36	---
MW-7	6/20/2006	15	62.1	1.4	0.56	**16**	**43**	1.5	<3.8	<0.38	<0.38	<0.38	---
MW-7	6/20/2006	20	<4.00	<0.07	<0.07	<0.07	<0.22	<0.37	<3.7	<0.37	<0.37	<0.37	---
MW-7	6/20/2006	25	<3.97	<0.08	<0.08	<0.08	<0.23	<0.38	<3.8	<0.38	<0.38	<0.38	---
MW-7	6/20/2006	29.5	<3.97	<0.08	<0.08	<0.08	<0.23	<0.39	<3.9	<0.39	<0.39	<0.39	---
MW-8	6/19/2006	5	<4.00	<0.08	<0.08	<0.08	<0.24	<0.40	<4.0	<0.40	<0.40	<0.40	---
MW-8	6/19/2006	10	<4.00	0.15	<0.08	<0.08	<0.23	<0.38	<3.8	<0.38	<0.38	<0.38	---
MW-8	6/19/2006	15	<4.00	<0.07	<0.07	<0.07	<0.22	<0.37	<3.7	<0.37	<0.37	<0.37	---
MW-8	6/19/2006	20	<4.00	<0.08	<0.08	<0.08	<0.23	<0.38	<3.8	<0.38	<0.38	<0.38	---
MW-8	6/19/2006	25	<4.00	<0.07	<0.07	<0.07	<0.22	<0.36	<3.6	<0.36	<0.36	<0.36	---
MW-8	6/19/2006	29.5	<4.00	<0.07	<0.07	<0.07	<0.22	<0.37	<3.7	<0.37	<0.37	<0.37	---
MW-9	6/19/2006	5	9.78	<0.07	<0.07	<0.07	0.97	<0.36	<3.6	<0.36	<0.36	<0.36	---
MW-9	6/19/2006	10	**552**	0.25	0.11	**4.7**	**20**	<0.40	<4.0	<0.40	<0.40	<0.40	---
MW-9	6/19/2006	15	<4.00	<0.08	<0.08	<0.08	<0.24	<0.40	<4.0	<0.40	<0.40	<0.40	---
MW-9	6/19/2006	20	<4.00	<0.08	<0.08	<0.08	<0.23	<0.38	<3.8	<0.38	<0.38	<0.38	---
MW-9	6/19/2006	25	<4.00	<0.08	<0.08	<0.08	<0.23	0.54	<3.8	<0.38	<0.38	<0.38	---
MW-9	6/19/2006	29.5	<4.00	<0.08	<0.08	<0.08	<0.23	<0.38	<3.8	<0.38	<0.38	<0.38	---
Shallow Soil (≤10 fbg) ESL [c]:			180	0.27	9.3	4.7	11	8.4	110	NA	NA	NA	NA
Deep Soil (>10 fbg) ESL [d]:			180	2.0	9.3	4.7	11	8.4	110	NA	NA	NA	NA

TABLE 1

HISTORICAL SOIL ANALYTICAL DATA
FORMER SHELL SERVICE STATION
4255 MACARTHUR BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	*Date*	*Depth (fbg)*	*TPHg (mg/kg)*	*B (mg/kg)*	*T (mg/kg)*	*E (mg/kg)*	*X (mg/kg)*	*MTBE (mg/kg)*	*TBA (mg/kg)*	*DIPE (mg/kg)*	*ETBE (mg/kg)*	*TAME (mg/kg)*	*Total Lead (mg/kg)*

Notes:
TPHg = Total petroleum hydrocarbons as gasoline analyzed by EPA Method 8260B; before 2001, analyzed by EPA Method 8015.
BTEX = Benzene, toluene, ethylbenzene, and total xylenes analyzed by EPA Method 8260B; before 2001, analyzed by EPA Method 8020.
MTBE = Methyl tertiary-butyl ether analyzed by EPA Method 8260B unless otherwise noted
TBA = Tertiary-butyl alcohol analyzed by EPA Method 8260B
DIPE = Di-isopropyl ether analyzed by EPA Method 8260B
ETBE = Ethyl tertiary-butyl ether analyzed by EPA Method 8260B
TAME = Tertiary-amyl methyl ether analyzed by EPA Method 8260B
fbg = Feet below grade
mg/kg = Milligrams per kilogram
ND = Not detected; detection limit unknown
<x = Not detected at reporting limit x
--- = Not analyzed
ESL = Environmental screening level
NA = No applicable ESL

a = Sample analysis method unknown.
b = Analyzed by EPA Method 8020.
c = San Francisco Bay Regional Water Quality Control Board commercial/industrial ESL for soil where groundwater is not a source of drinking water (Table B of *Screening for Environmental Concerns at Sites With Contaminated Soil and Groundwater*, California Regional Water Quality Control Board, Interim Final - November 2007 [Revised May 2008]).
d = San Francisco Bay Regional Water Quality Control Board commercial/industrial ESL for soil where groundwater is not a source of drinking water (Table D of *Screening for Environmental Concerns at Sites With Contaminated Soil and Groundwater*, California Regional Water Quality Control Board, Interim Final - November 2007 [Revised May 2008]).

Results in **bold** equal or exceed applicable ESL
Shading indicates that soil sample location was subsequently excavated; results are not representative of residual soil

APPENDIX A

SITE HISTORY

SITE HISTORY

1985 Subsurface Investigation: In June 1985, Emcon Associates (Emcon) drilled two soil borings (S-A and S-B) and installed one groundwater monitoring well (S-1) adjacent to the underground storage tanks (USTs). Up to 15,800 milligrams per kilogram (mg/kg) total petroleum hydrocarbons as gasoline (TPHg) were detected in the shallow soil samples from inside the UST area. In July 1992, GeoStrategies, Inc. performed a site reconnaissance and verified that the original monitoring well had been destroyed during the 1985 UST replacement. Investigation results are presented in Emcon's July 26, 1985 letter to Gettler-Ryan, Inc.

1985 UST Replacement: In December 1985, the USTs were replaced, and approximately 938 cubic yards of hydrocarbon-bearing soil were transported to a disposal facility. Up to 22,000 mg/kg total volatile hydrocarbons, 500 mg/kg benzene, 2,200 mg/kg toluene, and 4,500 mg/kg xylenes were detected in the soil samples from the excavation.

1993 Subsurface Investigation: In November 1993, Weiss Associates (WA) drilled three soil borings (BH-A, BH-B, and BH-C), which were converted into monitoring wells (MW-1, MW-2, and MW-3). Soil samples contained up to 1,700 mg/kg TPHg, 3.3 mg/kg benzene, 5.7 mg/kg toluene, 33 mg/kg ethylbenzene, and 44 mg/kg xylenes. WA's March 14, 1994 *Subsurface Investigation* report details the investigation results.

1994 Subsurface Investigation: In November 1994, WA drilled two on-site soil borings (BH-D and BH-E) and one off-site boring (BH-F) which was subsequently completed as a monitoring well (MW-4). Soil samples contained up to 5,900 mg/kg TPHg, 23 mg/kg benzene, 160 mg/kg toluene, 120 mg/kg ethylbenzene, and 430 mg/kg xylenes (BH-E at 5 feet below grade [fbg]). WA's January 26, 1995 *Subsurface Investigation* report presents details of the investigation.

1994-1997 Separate-Phase Hydrocarbon (SPH) Removal: SPHs were observed periodically in wells MW-2 and MW-3 between 1994 and 1997. During that time, an estimated total of 19.6 pounds of SPHs were removed from monitoring wells by bailing.

1995 Dispenser and Piping Removal and Sampling: In November 1995, WA collected 15 soil samples during dispenser and piping replacements. The soil samples contained up to 7,800 mg/kg TPHg, 0.85 mg/kg benzene, 51 mg/kg toluene, 71 mg/kg ethylbenzene, and 540 mg/kg xylenes. During the dispenser replacements, horizontal wells HW-1 through HW-4 were installed in the vadose zone at approximately 5 fbg and adjacent to the former piping and dispensers to facilitate future removal of petroleum hydrocarbons from the impacted soil. Approximately 68 cubic yards of soil were excavated for off-site disposal from the area of the

piping and dispensers. Dispenser and piping investigation results are discussed in WA's April 1, 1996 *Dispenser Replacement Sampling* report.

1997 Soil Vapor Extraction (SVE) Test: In August 1997, Cambria Environmental Technology, Inc. (Cambria) performed short-term SVE tests using an internal combustion engine on horizontal vapor extraction wells HW-1 through HW-4 and monitoring wells MW-2 and MW-3. Cambria measured vapor extraction flow rates, the vacuum applied to the wellheads, and the vacuum influence in nearby wells. Cambria calculated an effective radius of influence of 35 to 50 feet during testing of wells MW-2 and MW-3. Cambria concluded that the relatively high TPHg removal rates measured in horizontal wells HW-1 through HW-4 were most likely temporary and were not representative of site conditions due to extensive well screen in permeable fill material and that the low hydrocarbon removal rates in wells MW-2 and MW-3 were likely more representative of native soil conditions. Cambria's February 23, 1997 *Soil Vapor Extraction Test Report* presents SVE test results.

1998 Subsurface Investigation: In February 1998, Cambria drilled two off-site borings (SB-1 and SB-2) in the trailer park adjacent to the Shell site. No TPHg or benzene was detected in the soil samples. Soil samples contained up to 1.4 mg/kg methyl tertiary-butyl ether (MTBE) and 7,210 mg/kg total organic carbon. Grab groundwater samples contained up to 7,700 micrograms per liter (µg/l) TPHg, 210 µg/l benzene, and 46,000 µg/l MTBE (SB-2). Two soil samples (SB-1 and SB-2 at 5.5 fbg) were analyzed for physical parameters: total porosity was 35.2 percent (%) and 37.4% and specific permeability was 181 millidarcies (md) and 71 md, respectively; however, the laboratory noted that due to fine fractures that developed in the samples upon drying, the measured specific permeability values were an order of magnitude or more too high. The soil boring investigation results are presented in Cambria's March 19, 1998 *Subsurface Investigation* report.

1999-2003 Groundwater Extraction (GWE): From April 1999 until September 2003, Cambria conducted monthly GWE using a vacuum truck. Mobile GWE removed an estimated 15.1 pounds of liquid-phase hydrocarbons and 26.8 pounds of liquid-phase MTBE. GWE was discontinued at the site after September 2003 due to low pumping volumes. Quarterly groundwater monitoring reports during this period summarize GWE operations and mass removal.

2000-2003 Dual-Phase Vapor Extraction (DVE): From November 2000 to June 2001, from April 2002 to September 2003, and from July 2003 to September 2003, Cambria conducted mobile DVE using a vacuum truck. DVE was discontinued after September 2003 due to decreased mass removal. DVE removed an estimated 26.4 pounds of vapor-phase hydrocarbons. DVE dates and mass removal are provided in the quarterly groundwater monitoring reports during this period.

2001 Sensitive Receptor Survey (SRS), Conduit Study, and Site Conceptual Model (SCM): Cambria's SRS identified 25 monitoring wells, 4 cathodic protection wells, and 1 domestic well within one-half mile of the site. Cambria's conduit study concluded that nearby sewer, storm drain, and water lines located between 8 to 13 fbg could serve as preferential pathways for petroleum hydrocarbon and MTBE migration. However, Cambria did not identify any nearby conduits down gradient from the site. The SRS, conduit study, and SCM are included in Cambria's May 31, 2001 *First Quarter 2001 Monitoring Report, Sensitive Receptor Survey, and Site Conceptual Model.*

2001 Subsurface Investigation: In November 2001, Cambria installed one down-gradient monitoring well (MW-5) approximately 200 feet southwest of the site, on the Caltrans right-of-way adjacent to the I-580 on-ramp. No TPHg, benzene, toluene, ethylbenzene, and xylenes (BTEX), or MTBE was detected in the soil sample collected during the investigation. Cambria's January 10, 2002 *Off-Site Monitoring Well Installation Report* presents the investigation results.

2003 Tank Removal and Soil Excavation: In January and February 2003, L.A. Perks Plumbing and Heating removed all surface features, USTs, fuel dispensers, associated product piping, two tank backfill wells (TB-1 and TB-2), and four horizontal wells (HW-1 through HW-4). Cambria collected 31 soil samples and 1 grab groundwater sample and supervised over-excavation of hydrocarbon-impacted soils. Approximately 875 cubic yards of soil were removed from the site during the tank pull and over-excavation activities. Approximately 4,600 gallons of groundwater were pumped to dewater the UST excavation prior to removing the tanks. Soil samples from the former UST area contained up to 380 mg/kg TPHg, 1.7 mg/kg benzene, and 1.2 mg/kg MTBE (TP-5). The grab groundwater sample (TP-1-Water) from the former tank excavation area contained 11,000 µg/l TPHg, 410 µg/l benzene, and 5,200 µg/l MTBE. Soil samples from soil remaining in soil in the former dispenser areas contained up to 980 mg/kg TPHg, 1.2 mg/kg benzene, and 0.9 mg/kg MTBE. Following over-excavation, approximately 720 pounds of oxygen-releasing compound were mixed in the excavation base before backfilling with 1.5-inch drain rock to 4 fbg. The remainder of the excavation was backfilled and compacted with Class II road base material. Cambria's April 28, 2003 *Tank Closure and Soil Excavation Report* provides details of these activities.

2003-2011 SPH Removal: SPHs were observed periodically in wells MW-2, MW-3, and MW-4 between 2003 and 2011. An estimated total of 6.82 pounds of SPHs were removed from monitoring wells by manual bailing, and an estimated 0.82 pounds of SPHs have been removed from MW-2 with a skimmer bailer. In September 2009, Conestoga-Rovers & Associates (CRA) conducted mobile GWE on wells MW-2 and MW-3, which yielded approximately 44 gallons of water from each well with negligible SPHs.

April 2005 Subsurface Investigation: In April 2005, Cambria drilled 11 cone penetrometer test (CPT) borings (CPT-1 through CPT-11) and 2 Geoprobe® borings (SB-3 and SB-4). At each CPT location, an ultraviolet-induced florescence module was used to identify hydrocarbons in the subsurface. No soil samples were submitted for laboratory analysis. Based on the data collected during this investigation, it appeared that no SPHs were present at these locations, but that dissolved-phase hydrocarbons are present at most locations at two distinct depths: a shallow zone in the silt and clay above 17 fbg and a deeper zone in the silt, clay, and sand from approximately 19 to 20 fbg to the bottom of the borings at 25 fbg. Cambria's June 6, 2005 *Subsurface Investigation Report* presents details of this investigation.

October 2005 Subsurface Investigation: In October 2005, Cambria drilled four soil borings (SB-5 through SB-8). Soil samples contained up to 2,600 mg/kg TPHg, 13 mg/kg benzene, 17 mg/kg toluene, 45 mg/kg ethylbenzene, 270 mg/kg xylenes, 1.2 mg/kg MTBE, and 1.6 mg/kg tertiary-butyl alcohol. Cambria's December 14, 2005 *Subsurface Investigation Report presents* details of the investigation.

2006 Subsurface Investigation: In June 2006, Cambria installed four groundwater monitoring wells (MW-6 through MW-9). Soil samples from the well borings contained up to 552 mg/kg TPHg, 1.4 mg/kg benzene, and 3.1 mg/kg MTBE. Cambria's September 6, 2006 *Well Installation Report* presents details of the investigation.

2011 Subsurface Investigation: In February 2011, CRA installed eight nested soil vapor probes (SVP-1 through SVP-8) with screens at approximately 3 and 5 fbg. Soil vapor samples from the probes contained up to 270,000,000 micrograms per cubic meter ($\mu g/m^3$) TPHg, 650,000 $\mu g/m^3$ benzene, 420,000 $\mu g/m^3$ ethylbenzene, 1,500 $\mu g/m^3$ xylenes, and 4,600 $\mu g/m^3$ MTBE. No toluene was detected in the soil vapor samples. CRA's April 25, 2011 *Soil Vapor Probe Installation and Sampling Report* details this investigation.

Groundwater Monitoring Program: Groundwater sampling began in November 1993. Historically, SPHs have been observed intermittently in wells MW-2 and MW-3. SPHs were also observed in MW-4 during a single sampling event in August 2010, and since the December 2008 sampling event, no SPHs have been observed in MW-3. Groundwater is currently monitored and sampled semiannually during the first and third quarters.