OWENS-BROCKWAY
GLASS CONTAINERS
a unit of Owens-Illinois

Western Region Office

ENVIRONMENTAL PROTECTION

98 NOV 20 PM 1:23

November 17, 1998

Mr. Barney M. Chan
Alameda County Health Care Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject: Groundwater Monitoring - Oakland Plant

Dear Mr. Chan:

Enclosed is the current groundwater monitoring report and final work plan for the installation of off-site borings as requested in your letter of October 15, 1998. Assuming you approve the submitted work plan, our intent is to schedule the underground locator work, obtain the bore hole permits and complete the borings during January 1999. This schedule should result in the investigative report being completed and submitted to you by the end of February.

If you have questions regarding the report or plan, please give me a call at (925) 734-6276. I look forward to your approval of the work plan so we can proceed with its implementation.

Sincerely,

Robert C. Neal

Robert C. Neal, P.E.
Environmental Administrator

Questions:

- only monitored after County letter
- are analytes OK, dropped PNA & HVOCs
- need to treat for high dissolved plume

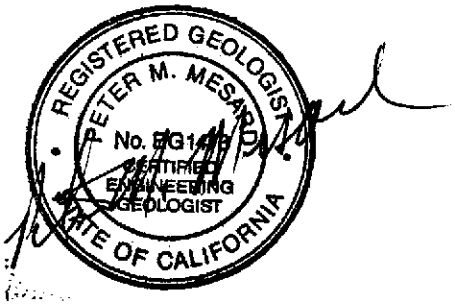
6150 Stoneridge Mall Road, Suite 375 Pleasanton, CA 94588-3242 (925) 463-7950 Fax: (925) 463-8399

GROUNDWATER INVESTIGATION WORK PLAN

OWENS-BROCKWAY GLASS CONTAINERS
3600 ALAMEDA AVENUE
OAKLAND, CALIFORNIA

18 November 1998

K/J 950007.10



Prepared for:

OWENS-BROCKWAY GLASS CONTAINERS
6150 Stoneridge Mall Road, Suite 375
Pleasanton, California 94588

Prepared by:

KENNEDY/JENKS CONSULTANTS
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1 INTRODUCTION

Kennedy/Jenks Consultants (Kennedy/Jenks) prepared this Groundwater Investigation Work Plan (Work Plan) on behalf of Owens-Brockway Glass Containers (Owens-Brockway). The Owens-Brockway plant is located at 3600 Alameda Avenue, Oakland, California (the Site). The Site location is shown on Figure 1. This Work Plan was prepared in response to 3 December 1997 and 15 October 1998 letters from Alameda County Department of Environmental Health (ACDEH). The scope of the proposed groundwater investigation was discussed with Mr. Barnie Chan of ACDEH at a 20 January 1998 meeting.

2 BACKGROUND

The Oakland plant was constructed in 1936 and occupies a city block which is bounded by Alameda and Fruitvale Avenues, the Inner Harbor Channel, 37th Street and 8th Street. The plant includes a glass manufacturing operation, warehouses, and paved outdoor storage areas. The Site plan is shown on Figure 2.

2.1 Previous Investigation and Remedial Activities

Historically, fuel oil (or furnace fuel) used to operate the plant was stored in large underground storage tanks (USTs) on the west side of the plant until the late 1980s. Soil containing petroleum hydrocarbons (PHCs) was encountered in July 1986 during construction of a fork lift ramp to the plant's basement.

As a result of this discovery, sixteen exploratory soil borings were advanced by Exceltech, Inc. during July 1986 in the vicinity of the ramp, the USTs and the former maintenance building. Eighteen groundwater monitoring wells were subsequently installed at the Site from July 1986 through December 1986, the deepest of which was advanced to approximately 32 feet below ground surface (bgs). The well construction details are summarized in Table 1. The soil and groundwater samples collected in the vicinity of the USTs contained low boiling range (purgeable) PHCs and high boiling range (extractable) PHCs. In addition, benzene, toluene, ethylbenzene and total xylenes (BTEX) were detected in soil and groundwater samples. Several groundwater samples in the vicinity of the tanks and the maintenance shop contained detectable levels of halogenated volatile organic compounds (HVOCs). The results of these activities were documented in Exeltech's February 1987 report entitled *Soil and Groundwater Contamination Investigation*.

In September 1986, a 16,000-gallon fuel oil UST was removed, its source pipeline was capped, and 148 cubic yards of petroleum-impacted soil was excavated and disposed at Chemical Waste Management's Kettleman Hills Class I facility. A 36-inch diameter recovery well was installed in the tank excavation and equipped with a product recovery device in 1987. The original recovery well (R-1) was upgraded and a second recovery well (R-2) was installed near Monitoring Well MW-2 in 1989. The two recovery wells were operated for several months without collecting any PHCs. They are now inoperable.

Owens-Brockway also operated four USTs (one 350-gallon, two 8,000-gallon and one 12,000-gallon) located adjacent to the power building. These four USTs were removed and replaced with two USTs (gasoline and diesel) during 1986. According to Exceltech, visual evidence of releases from these tanks was noted during the removal activities. Three of the monitoring wells (MW-16, 17 and 18) were installed in the vicinity of these tanks. These gas and diesel USTs, installed in 1986, were removed on 9 October 1998 under the oversight of the Oakland Fire Department.

The *September Quarterly Ground-Water Sampling Report*, prepared by Ensco Environmental Services in November 1988, reported that the monitoring well network at the Site was sampled six times between April 1987 and September 1988 (Table 2 summarizes the historical groundwater analytical data) The field measurements indicated that several wells contained separate-phase petroleum product.

Since the monitoring wells were initially installed, Wells MW-3 and MW-18 have been destroyed during construction activities at the plant.

Groundwater is tidally influenced and shallow groundwater is encountered between 9 and 13 feet bgs. Flow is generally south and southwest toward the Harbor Channel.

2.2 Recent Sampling Activities

In a letter to Owens-Brockway dated 28 April 1997, ACDEH requested that Owens-Brockway resume groundwater monitoring at the Site. ACDEH requested that Wells MW-1, 2, 5, 6, 7, 8, 9, 10, 13, 15, and 17 be sampled and analyzed for total petroleum hydrocarbons as gasoline (TPHg), diesel (TPHd) and motor oil (TPHmo); BTEX; and all wells except MW-13, 15, and 17 should be analyzed HVOCs and polychlorinated biphenyls (PCBs).

Prior to conducting groundwater sampling, the groundwater depth and petroleum product thickness in Wells MW-2, 5, 6, 7, 8, 9 and 17 were measured twice during the week of 11 August 1997, and then once per week for three consecutive weeks beginning 26 August 1997. Following the thickness measurement in each well, the recoverable petroleum product from each well was removed with a bailer and contained in a 55-gallon drum for disposal to the oil-water separator associated with the plant. Wells MW-5, 6, 7, 9, and 17 were also cleaned by attaching absorbent pads to PVC pipe and swabbing the inside of the casings.

Following the measurement of depth to groundwater and purging operations, groundwater samples were collected on 16 September 1997 from Wells MW-1, 5, 7, 8, 9, 10, 13, 15, and 17. Wells MW-2 and MW-6 contained separate-phase petroleum product; therefore, groundwater samples were not collected from them, although a product sample was obtained from Well MW-2 and analyzed by gas chromatography techniques in order to compare the product sample to hydrocarbon fuel standards ("fingerprinting").

Samples collected from Wells MW-1, 5, 7, 8, 9, 10, 13, 15, and 17 were analyzed for purgeable and extractable petroleum hydrocarbons by EPA Method 8015 Modified and for BTEX by EPA Method 8020. The groundwater samples collected from Wells MW-1, 5, 7, 8, 9, and 10 were also analyzed for HVOCs by EPA Method 8260 and for PCBs by EPA Method 8080.

The groundwater elevations are tabulated in Table 3 and presented on Figure 3. On 16 September 1997, the hydraulic gradient ranged from 0.01 to 0.024 feet/foot in a south to southwesterly direction toward the Harbor Channel. This is consistent with historical information.

No HVOCs or PCBs were detected in the samples analyzed. Results of the groundwater analyses for PHCs and BTEX are summarized in Table 2. The chromatogram for the product sample collected from Well MW-2 contained hydrocarbons in the C10 to C22 range; however, the pattern did not match the laboratory's diesel standard. Extractable PHCs (TPHd and TPHmo) were detected in groundwater in all the monitoring wells sampled on 16 September 1997. Purgeable PHCs (TPHg) were detected in the groundwater samples collected from Wells MW-7, 9, and 17. The analytical results typically did not match the gasoline, diesel, and motor oil standards. The results of this

sampling event and the product thickness monitoring were presented in the 19 November 1997 letter report prepared by Kennedy/Jenks.

A groundwater monitoring event was conducted on 2 November 1998. Groundwater samples were collected from Wells MW-1, MW-8, MW-10, MW-13, MW-15 and MW-17 following depth to groundwater measurements and purging operations. Five wells (MW-2, MW-5, MW-6, MW-7 and MW-9) were not sampled due to the presence of separate-phase petroleum. The analytical results are presented in Table 2. A detailed description of this monitoring event and the results are provided in a separate document.

3 INVESTIGATION OBJECTIVE AND SCOPE OF WORK

3.1 Groundwater Investigation

The objective of the investigation is to further assess the extent of PHCs in shallow groundwater downgradient of the western portion of the Site. Based upon the results of the September 1997 groundwater sampling event, five shallow borings are proposed to be advanced to collect reconnaissance groundwater samples to be analyzed for PHCs. The presence of deeply buried utilities, such as the Sausal Creek storm drain, may influence groundwater flow direction and migration of PHCs. Based upon a review of public utility drawings and Owens-Brockway plant utility drawings, only the Sausal Creek storm sewer extends to the groundwater table. Therefore, several of the proposed borings are located in close proximity to the storm drain to evaluate this potential preferential flow path.

The locations of the storm sewer and other area utilities, as well as the proposed five borings, are shown on Figure 4.

3.2 Groundwater Monitoring

The concentrations of PHCs in groundwater at the Site have not significantly changed since monitoring began in 1986. Furthermore, the results of the November 1998 groundwater sampling are substantially the same as the data collected in September 1997. On the basis of these consistent long-term monitoring results, Owens-Brockway proposes to conduct groundwater monitoring annually. No!

4 FIELD PROCEDURES

4.1 Reconnaissance Groundwater Sampling

As discussed in Section 3, five soil borings (KB-1 through KB-5) will be advanced to collect reconnaissance groundwater samples to further delineate the presence of PHCs downgradient of the Site. The proposed boring locations are shown on Figure 4. Based upon historical water level measurements in monitoring wells located at the Site, shallow groundwater will be encountered at a depth of approximately 9 to 13 feet bgs.

Prior to drilling, Kennedy/Jenks will contact Underground Services Alert (USA) to mark the buried utilities in the vicinity of the five borings. In addition, a private locator will be retained by Kennedy/Jenks to attempt to locate buried utilities and other subsurface obstructions. Kennedy/Jenks will apply for the necessary drilling permits with Alameda County Public Works (ACPW) prior to starting the field activities. Drilling activities will be coordinated with ACPW to allow for scheduling of any inspections. In addition, an excavation permit from the City of Oakland will be obtained by the drilling contractor.

The soil borings will be advanced with a hydraulic push/drive sampling system in order to minimize the soil residuals generated. The borings will be continuously cored and the soils will be lithologically logged by a Kennedy/Jenks geologist or engineer using the Unified Soil Classification System (ASTM D 2488-93) under the direction of a California Registered Geologist. **No soil samples will be collected for laboratory analysis.** Field documentation will include the completion of boring logs that record lithologies encountered during advancement of each borehole. — need to screen borings

A reconnaissance groundwater sample will be collected from each of these borings and analyzed for purgeable and extractable PHCs by EPA Method 8015 Modified and for BTEX by EPA Method 8020. A silica gel cleanup step will be added prior to sample analysis for extractable PHCs to evaluate the presence of soluble biogenic materials that are measured indiscriminately by TPH analyses such as EPA Method 8015 Modified. The silica gel cleanup will be conducted using EPA Method 3630 Modified. The samples will be extracted with methylene chloride and the extract placed in a column containing silica gel to separate the petroleum hydrocarbons from the other polar compounds such as alcohols and acids that may be present due to biological degradation of PHCs. Quality control samples (blanks and spikes) will also be subjected to silica gel cleanup and analyzed for extractable PHCs to ensure that the silica gel column does not retain PHCs. For comparison purposes, groundwater samples will also be analyzed for extractable PHCs by Method 8015 Modified without the silica gel cleanup step. No groundwater sample will be collected from a boring if separate-phase PHCs are observed.

Once each boring has reached groundwater, a reconnaissance groundwater sample will be collected by lowering a PVC screen and riser into the boring. A bailer will be slowly lowered into the PVC screen and allowed to fill with groundwater. Appropriate containers will be filled with groundwater from the bailer. The PVC screen and riser will be withdrawn following collection of the groundwater sample and the boring will be backfilled with cement.

The samples will be stored at about 4 degrees centigrade in a cooled container until delivery under chain-of-custody procedures to a California-certified laboratory for analysis. The samples will be analyzed within ten days from the date of collection.

A detailed description of the equipment and procedures to be used during drilling and groundwater sampling is included in Appendix A.

4.2 Investigation-Derived Residuals

Borehole cuttings and other investigation-derived residuals will be contained in either DOT-approved 55-gallon drums or 5-gallon pails with bolt-on lids, which will be sealed, dated, and labeled as to their contents. These residuals will be stored at the Site prior to disposal, pending receipt of laboratory analytical results for the groundwater samples.

4.3 Monitoring Well Sampling

As described in Section 3, the eleven monitoring wells (MW-1, MW-2, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-13, MW-15, and MW-17) will be sampled annually in accordance with the procedures included in Appendix B. The groundwater samples will be analyzed for purgeable and extractable PHCs by EPA Method 8015 Modified and for BTEX by EPA Method 8020. A groundwater sample will not be collected from those wells containing separate-phase PHCs. The product thickness will be measured in those wells with separate-phase PHCs present.

The next scheduled groundwater monitoring event will be November 1999.

5 QUALITY ASSURANCE/QUALITY CONTROL

In order to validate the groundwater sample results, duplicate groundwater samples will be collected and analyzed by EPA Method 8015 Modified for purgeable and extractable PHCs and for BTEX by EPA Method 8020. Duplicate samples measure consistency in sampling and analysis. One duplicate sample will be collected during each day of groundwater sampling. The duplicate sample will be collected immediately after collecting the original sample from one of the borings. A travel blank will accompany the sample container and will be analyzed for BTEX.

6 INVESTIGATION SUMMARY REPORT

Following completion of the groundwater investigation and receipt of the laboratory reports, an investigation summary report will be prepared and submitted to ACDEH under signature of a California Registered Geologist or Engineer. The report will include a description of field procedures, results of the analytical testing, conclusions and if appropriate recommendations for additional work.

The results of the annual groundwater monitoring well sampling will be submitted to ACDEH in a separate document.

7 REFERENCES

Ensco 1988. September Quarterly Groundwater Sampling and Analysis for O.I. Glass Container Division, S.T.S., 3600 Alameda Avenue, Oakland, California. Ensco Environmental Services, Inc., November 1988.

Exceltech 1987. Soil and Groundwater Contamination Investigation, Owens-Illinois Glass Container Division, 3600 Alameda Avenue, Oakland, California. Exceltech, Inc., February 1987.

Kennedy/Jenks 1997. Groundwater Monitoring, Owens-Brockway Oakland Plant, Kennedy/Jenks Consultants. 19 November 1997.

TABLES

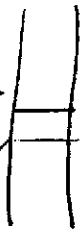
MW-6

11/21/98

Scan 12.5

DTW 13.2

* sheen



MW-5 OK

sheen 8.5

DTW 11.5

TABLE 1

Summary of Well Construction Details

Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Installed	Measurement Elevation[a]	Top of Screen[b]	Screen Length	Well Depth[c]	Casing Diameter (inches)	Comments
MW-1	9/12/86	16.02	8	21	29	2	
MW-2	9/12/86	17.11	10	20	30	2	
MW-3	9/12/86	15.46	10	20	30	2	Destroyed
MW-4	9/29/86	16.02	8.5	20	28.5	2	TOCE = 18.05 (11/88 report)
MW-5	9/29/96	16.19	8.5	20	28.5	2	
MW-6	9/29/96	17.48	12.5	16	28.5	2	
MW-7	9/30/86	16.11	12.5	11	23.5	2	TOCE = 15.76 (11/88 report)
MW-8	10/22/86	16.57	15	13.5	28.5	2	
MW-9	7/23/86	7.33[d]	5	10	20	2	
MW-10	10/22/86	15.96	10	15	25	2	
MW-11	11/24/86	13.99	10	20	30	2	
MW-12	11/24/86	13.83	11	15	26	2	
MW-13	12/11/86	13.98	9.5	15	24.5	2	
MW-14	11/25/86	14.78	10	15	25	2	
MW-15	12/17/86	15.16	9.5	20	29.5	2	
MW-16	12/12/86	13.48	10	14.5	24.5	2	
MW-17	12/15/86	14.17	9.5	15	24.5	2	
MW-18	12/15/86	14.89	9	15	24	2	Destroyed
R-1	1987	NM[e]	NA	NA	24	36	
R-2	1989	NM	NA	NA	NA	12	

Notes:

(a) Top of casing elevation (TOCE) except where noted; measured in feet above US Coast and Geodetic Datum (mean sea level). Elevations measured by Exceltech in 1986.
(b) Depth to top of screened interval (feet below top of casing).
(c) Depth to bottom of screened interval (feet below top of casing).
(d) Well casing elevation was not measured for this well; well is located beneath forklift ramp and this measurement is the ground surface elevation in feet MSL.
(e) NM = not measured
(f) NA = not available

TABLE 2

Summary of Groundwater Analytical Results

Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	TPPH [a] (µg/l) [h]	TEPH [b] (µg/l)	O&G [c] (µg/l)	B [d] (µg/l)	T [e] (µg/l)	E [f] (µg/l)	X [g] (µg/l)
MW-1	9/23/86	<0.01 [i]	NA [i]	25,000	<10	<10	NA	<10
	4/9/87	BDL [k]	NA	NA	BDL	BDL	NA	BDL
	9/16/87 [l]	–	–	–	–	–	–	–
	12/1/87 [l]	–	–	–	–	–	–	–
	3/7/88 [l]	–	–	–	–	–	–	–
	6/8/88 [l]	–	–	–	–	–	–	–
	9/14/88 [l]	–	–	–	–	–	–	–
	9/16/97	<50	190	<300	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	160	NA	<0.5	<0.5	<0.5	<0.5
MW-2	4/9/87 [m]	–	–	–	–	–	–	–
	9/16/87 [m]	–	–	–	–	–	–	–
	12/1/87 [m]	–	–	–	–	–	–	–
	3/7/88 [l]	–	–	–	–	–	–	–
	6/8/88 [l]	–	–	–	–	–	–	–
	9/14/88 [l]	–	–	–	–	–	–	–
	9/16/97 [m]	–	–	–	–	–	–	–
	11/2/98 [m]	–	–	–	–	–	–	–
MW-3 [n]	9/23/86	<10	NA	18,000	<10	<10	NA	<10
	4/9/87	370	NA	NA	BDL	BDL	NA	BDL
	9/16/87 [m]	–	–	–	–	–	–	–
	12/1/87 [m]	–	–	–	–	–	–	–
	3/7/88	NA	190,000	NA	NA	NA	NA	NA
	6/9/88	NA	16,000	NA	NA	NA	NA	NA
	9/14/88 [m]	–	–	–	–	–	–	–
MW-4	10/3/86	20	NA	7,200	<5	<5	NA	<5
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	1.3	66	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	100	NA	BDL	BDL	NA	8.9
	3/7/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	100	NA	BDL	BDL	NA	BDL
MW-5	10/3/86	1,400	NA	24,000	<5	<5	NA	6.6
	4/9/87	54	NA	NA	BDL	BDL	NA	BDL
	9/16/87	NA	96,000	NA	NA	NA	NA	NA
	12/1/87	NA	2,000	NA	NA	NA	NA	NA
	3/9/88	NA	BDL	NA	NA	NA	NA	NA
	6/9/88	NA	12,000	NA	NA	NA	NA	NA
	9/14/88	NA	6,300	NA	NA	NA	NA	NA
	9/16/97	<50	7,500	4,100	<0.5	<0.5	<0.5	<0.5
	11/2/98 [m]	–	–	–	–	–	–	–

TABLE 2

Summary of Groundwater Analytical Results
Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	TPPH [a] (µg/l) [fh]	TEPH [b] (µg/l)	O&G [c] (µg/l)	B [d] (µg/l)	T [e] (µg/l)	E [f] (µg/l)	X [g] (µg/l)
MW-6	4/9/87[m]	–	–	–	–	–	–	–
	9/16/87	NA	400,000	NA	NA	NA	NA	NA
	12/1/87	NA	30,000	NA	NA	NA	NA	NA
	3/9/88	NA	9,800	NA	NA	NA	NA	NA
	6/9/88	NA	63,000	NA	NA	NA	NA	NA
	9/14/88	NA	140,000	NA	NA	NA	NA	NA
	9/16/97[m]	–	–	–	–	–	–	–
	11/2/98 [m]	–	–	–	–	–	–	–
MW-7	10/3/86	260	NA	8,000	<5	<5	NA	<5
	4/9/87[m]	–	–	–	–	–	–	–
	9/16/87	NA	790,000	NA	NA	NA	NA	NA
	12/1/87	NA	5,300	NA	NA	NA	NA	NA
	3/9/88	NA	BDL	NA	NA	NA	NA	NA
	6/9/88	NA	12,000	NA	NA	NA	NA	NA
	9/14/88	NA	67,000	NA	NA	NA	NA	NA
	9/16/97	850	26,000	11,000	<0.5	<0.5	<0.5	<0.5
	11/2/98 [m]	–	–	–	–	–	–	–
MW-8	10/23/86	1,300	NA	14,000	<0.2	<0.2	NA	<1
	4/9/87	73	NA	NA	BDL	BDL	NA	BDL
	9/16/87[m]	–	–	–	–	–	–	–
	12/1/87	NA	630	NA	NA	NA	NA	NA
	3/9/88	NA	2,600	NA	NA	NA	NA	NA
	6/9/88	NA	1,700	NA	NA	NA	NA	NA
	9/14/88	NA	150	NA	NA	NA	NA	NA
	8/12/97[m]	–	–	–	–	–	–	–
	9/16/97	<50	290	<300	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	1,300	NA	<0.5	<0.5	<0.5	<0.5
MW-9	4/9/87[m]	–	–	–	–	–	–	–
	9/16/87	NA	1,300	NA	NA	NA	NA	NA
	12/1/87	NA	18,000	NA	NA	NA	NA	NA
	3/9/88	NA	47,000	NA	NA	NA	NA	NA
	6/8/88[m]	–	–	–	–	–	–	–
	9/14/88[m]	–	–	–	–	–	–	–
	9/16/97	6,000	19,000	9,000	<13	<13	<13	18
	11/2/98 [m]	–	–	–	–	–	–	–
MW-10	10/23/86	380	NA	7,200	<0.2	<0.2	NA	<0.2
	4/9/87	300	NA	NA	BDL	BDL	NA	BDL
	9/16/87	NA	3,800	NA	NA	NA	NA	NA
	12/1/87	NA	590	NA	NA	NA	NA	NA
	3/8/88	NA	BDL	NA	NA	NA	NA	NA
	6/8/88	NA	3,800	NA	NA	NA	NA	NA
	9/14/88	NA	570	NA	NA	NA	NA	NA

TABLE 2

Summary of Groundwater Analytical Results

Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	TPPH [a] (µg/l) [h]	TEPH [b] (µg/l)	O&G [c] (µg/l)	B [d] (µg/l)	T [e] (µg/l)	E [f] (µg/l)	X [g] (µg/l)
MW-10	9/16/97	<50	1,300	<300	<0.5	<0.5	<0.5	<0.5
(cont'd)	11/2/98	<50	1,400	NA	<0.5	<0.5	<0.5	<0.5
MW-11	12/5/86	<8	NA	1,200	<0.4	<0.4	NA	1.4
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	NA	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	NA	NA	0.8	BDL	NA	10
	3/7/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	100	NA	BDL	BDL	NA	BDL
MW-12	12/5/86	100	NA	2,500	0.49	1	NA	1.3
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	NA	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	NA	NA	BDL	BDL	NA	13
	3/7/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	120	NA	BDL	BDL	NA	BDL
MW-13	12/24/86	<10	NA	57,000	<0.2	<0.9	NA	<0.9
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	NA	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	NA	NA	1.6	BDL	NA	12
	3/8/88	7.7	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	130	NA	BDL	BDL	NA	BDL
	9/16/97	<50	120	<300	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	120	NA	<0.5	<0.5	<0.5	<0.5
MW-14	12/5/86 [o]	<8	NA	3,200	<0.4	<0.2	NA	<0.2
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	1.7	56	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	66	NA	1.2	4	NA	10
	3/7/88	20	BDL	NA	BDL	BDL	NA	BDL
	6/8/88 [l]	–	–	–	–	–	–	–
	9/14/88 [l]	–	–	–	–	–	–	–
MW-15	12/24/86	120	NA	1,600	<0.2	<0.9	NA	9.2
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	8.4	BDL	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	NA	NA	3.3	0.84	NA	14
	3/8/88	90	BDL	NA	0.8	BDL	NA	BDL
	6/9/88	53	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	NA	100	NA	NA	NA	NA	NA
	9/16/97	<50	890	380	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	340	NA	<0.5	<0.5	<0.5	<0.5

TABLE 2

Summary of Groundwater Analytical Results

Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	TPPH [a] (µg/l) [h]	TEPH [b] (µg/l)	O&G [c] (µg/l)	B [d] (µg/l)	T [e] (µg/l)	E [f] (µg/l)	X [g] (µg/l)
MW-16	12/24/86	<10	NA	1,200	<0.2	<0.9	NA	<0.9
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	64	NA	BDL	BDL	NA	BDL
	12/1/87	120	150	NA	1	0.37	NA	9.1
	3/7/88	10	BDL	NA	0.5	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	190	NA	BDL	BDL	NA	BDL
	9/16/97 [m]	–	–	–	–	–	–	–
MW-17	12/24/86	240	NA	2,400	5	1.2	NA	14
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	44	680	NA	BDL	BDL	NA	0.55
	12/1/87	540	1,300	NA	7.8	2.4	NA	28
	3/8/88	4,300	3,800	NA	83	BDL	NA	46
	6/8/88 [l]	–	–	–	–	–	–	–
	9/14/88	54,000	64,000	NA	BDL	BDL	NA	BDL
	9/16/97	1,900	110,000	9,600	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	16,000	NA	<0.5	<0.5	<0.5	0.6
MW-18 [n]	12/24/86	<20	NA	1,600	<0.3	<0.3	NA	0.99
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	480	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	18	NA	BDL	BDL	NA	6.6
	3/7/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	190	NA	BDL	BDL	NA	BDL

Notes:

(a) TPPH = total purgeable petroleum hydrocarbons using EPA Method 8015 modified.
(b) TEPH = total extractable petroleum hydrocarbons using EPA Method 8015 modified.
(c) O&G = total oil and grease.
(d) B = benzene using EPA Method 8020
(e) T = toluene using EPA Method 8020
(f) E = ethylbenzene using EPA Method 8020
(g) X = total xylenes using EPA Method 8020
(h) (µg/l) = micrograms per liter
(i) < = analyte not present in the sample at or above the indicated detection limit
(j) NA = not analyzed
(k) BDL = below detection limit; actual limit not available for compilation of this table.
(l) Not sampled; well inaccessible.
(m) Not sampled; separate-phase petroleum product present.
(n) Well destroyed.
(o) Other volatile organic compounds were detected in the 12/5/86 sample collected from Well MW-14 using EPA Method 8010 (the sum of 1,1,2,2-tetrachloroethane, 1,1,1,2-tetrachloroethane and perchloroethene was 190 µg/l).

TABLE 3

Summary of Groundwater Depths and Elevations

Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-1	9/23/86	NM	–
	4/9/87	8.98	7.04
	9/16/87	NM	–
	12/1/87	NM	–
	3/7/88	NM	–
	6/8/88	NM	–
	9/14/88	NM	–
	9/16/97	9.35	6.67
	11/2/98	9.16	6.86
MW-2	4/9/87	NM	–
	9/16/87	NM	–
	12/1/87	20.19	-3.08
	3/7/88	NM	–
	6/8/88	NM	–
	9/14/88	NM	–
	8/12/97	15.15	1.96
	8/14/97	12.58	4.53
	8/26/97	11.58	5.53
	9/2/97	11.29	5.82
	9/9/97	11.50	5.61
	9/16/97	11.83	5.28
	11/2/98	12.10	5.01
MW-3[c]	9/23/86	NM	–
	4/9/87	10.53	4.93
	9/16/87	11.44	4.02
	12/1/87	12.73	2.73
	3/7/88	15.22	0.24
	6/9/88	14.78	0.68
	9/14/88	NM	–
MW-4	10/3/86	NM	–
	4/9/87	8.73	7.29
	9/16/87	10.53	5.49
	12/1/87	9.08	6.94
	3/7/88	9.05	6.97
	6/8/88	9.25	6.77
	9/14/88	10.47	5.55
	11/2/98	NM	–
MW-5	10/3/86	NM	–
	4/9/87	12.02	4.17
	9/16/87	11.77	4.42
	12/1/87	11.37	4.82

TABLE 3

Summary of Groundwater Depths and Elevations
Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-5 (cont'd)	3/9/88	13.06	3.13
	6/9/88	12.74	3.45
	9/14/88	13.38	2.81
	8/12/97	11.81	4.38
	8/14/97	11.91	4.28
	8/26/97	11.42	4.77
	9/2/97	10.50	5.69
	9/9/97	11.25	4.94
	9/16/97	12.30	3.89
	11/2/98	11.48	4.71
MW-6	4/9/87	13.28	4.20
	9/16/87	13.40	4.08
	12/1/87	13.04	4.44
	3/9/88	15.00	2.48
	6/9/88	14.56	2.92
	9/14/88	14.90	2.58
	8/12/97	13.96	3.52
	8/14/97	13.91	3.57
	8/26/97	13.58	3.90
	9/2/97	8.91	8.57
	9/9/97	10.91	6.57
	9/16/97	11.96	5.52
	11/2/98	13.20	4.28
MW-7	10/3/86	NM	–
	4/9/87	12.13	3.98
	9/16/87	12.29	3.82
	12/1/87	11.24	4.87
	3/9/88	11.85	4.26
	6/9/88	12.46	3.65
	9/14/88	12.97	3.14
	8/12/97	11.91	4.20
	8/14/97	11.83	4.28
	8/26/97	11.00	5.11
	9/2/97	10.83	5.28
	9/9/97	11.58	4.53
	9/16/97	12.15	3.96
	11/2/98	12.24	3.87
MW-8	10/23/86	NM	–
	4/9/87	10.35	6.22
	9/16/87	10.71	5.86
	12/1/87	9.89	6.68

TABLE 3

Summary of Groundwater Depths and Elevations
Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-8 (cont'd)	3/9/88	9.61	6.96
	6/9/88	9.96	6.61
	9/14/88	10.71	5.86
	8/12/97	10.04	6.53
	9/16/97	9.90	6.67
	11/2/98	9.80	6.77
MW-9[d]	4/9/87	NM	–
	9/16/87	NM	–
	12/1/87	6.83	–
	3/9/88	6.44	–
	6/8/88	NM	–
	9/14/88	7.70	–
	8/12/97	6.83	–
	8/14/97	6.46	–
	8/26/97	6.29	–
	9/2/97	6.33	–
	9/9/97	6.58	–
	9/16/97	6.62	–
	11/2/98	6.90	–
MW-10	10/23/86	NM	–
	4/9/87	10.29	5.67
	9/16/87	11.19	4.77
	12/1/87	10.08	5.88
	3/8/88	10.36	5.60
	6/8/88	10.89	5.07
	9/14/88	11.34	4.62
	9/16/97	10.27	5.69
	11/2/98	10.30	5.66
MW-11	12/5/86	–	–
	4/9/87	9.02	4.97
	9/16/87	9.96	4.03
	12/1/87	9.44	4.55
	3/7/88	9.31	4.68
	6/8/88	9.42	4.57
	9/14/88	9.10	4.89
	11/2/98	NM	–
MW-12	12/5/86	NM	–
	4/9/87	6.83	7.00
	9/16/87	7.80	6.03
	12/1/87	7.59	6.24
	3/7/88	7.02	6.81

TABLE 3

Summary of Groundwater Depths and Elevations
Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-12 (cont'd)	6/8/88	7.38	6.45
	9/14/88	8.14	5.69
	11/2/98	NM	–
MW-13	12/24/86	NM	–
	4/9/87	10.79	3.19
	9/16/87	10.98	3.00
	12/1/87	10.21	3.77
	3/8/88	10.51	3.47
	6/8/88	10.85	3.13
	9/14/88	10.93	3.05
	9/16/97	10.55	3.43
	11/2/98	10.98	3.00
MW-14	12/5/86	NM	–
	4/9/87	7.17	7.61
	9/16/87	8.78	6.00
	12/1/87	8.26	6.52
	3/7/88	7.26	7.52
	6/8/88	NM	–
	9/14/88	NM	–
	11/2/98	NM	–
MW-15	12/24/86	NM	–
	4/9/87	11.88	3.28
	9/16/87	11.77	3.39
	12/1/87	11.25	3.91
	3/8/88	11.24	3.92
	6/9/88	12.15	3.01
	9/14/88	12.34	2.82
	9/16/97	11.92	3.24
	11/2/98	11.60	3.56
MW-16	12/24/86	NM	–
	4/9/87	9.47	4.01
	9/16/87	10.07	3.41
	12/1/87	9.23	4.25
	3/7/88	9.46	4.02
	6/8/88	9.56	3.92
	9/14/88	9.99	3.49
	9/16/97	7.32	6.16
	11/2/98	NM	–

TABLE 3

Summary of Groundwater Depths and Elevations

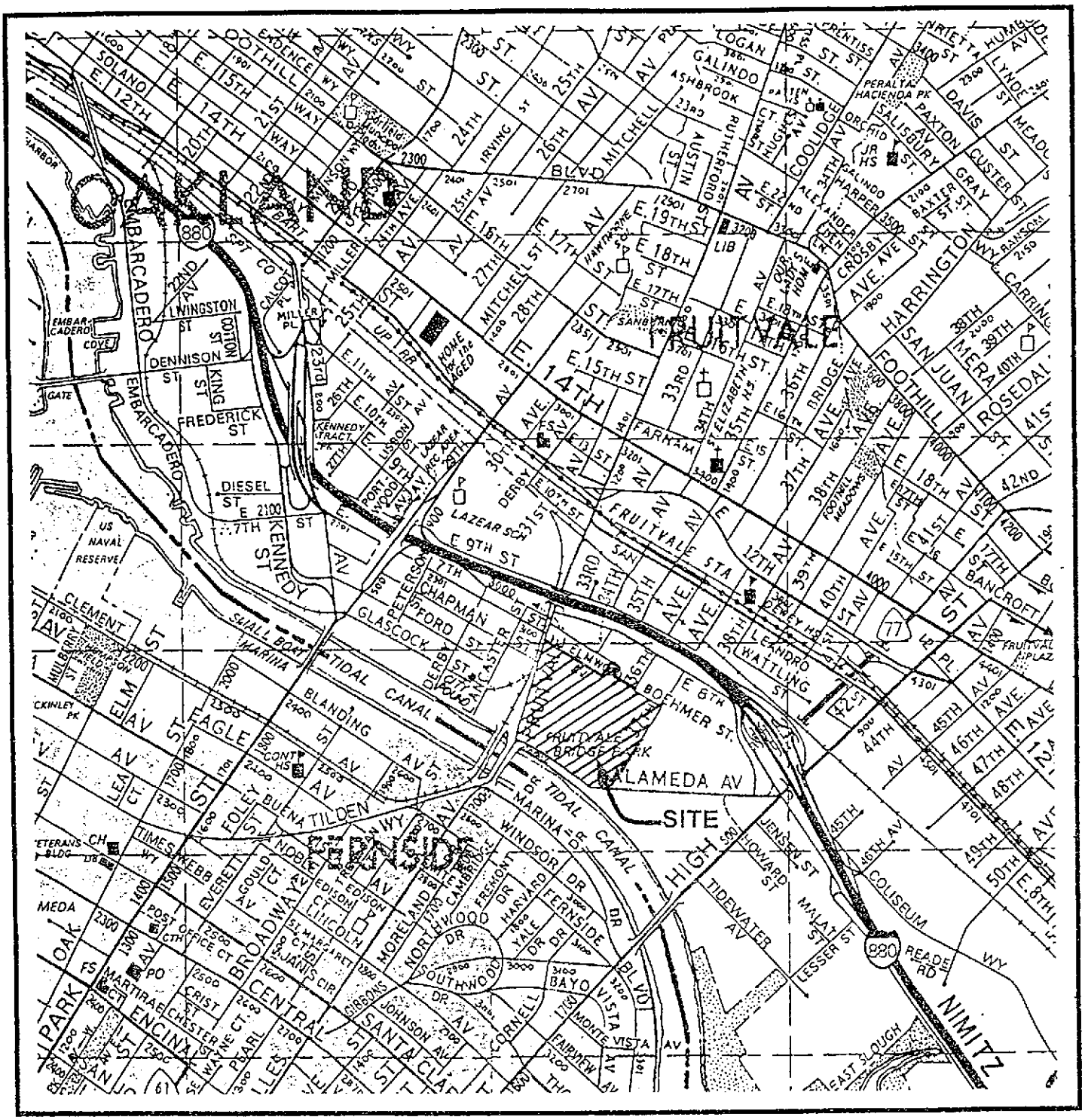
Owens-Brockway, Oakland, California
K/J 950007.10

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-17	12/24/86	NM	–
	4/9/87	9.95	4.22
	9/16/87	10.59	3.58
	12/1/87	9.87	4.30
	3/8/88	10.10	4.07
	6/8/88	NM	–
	9/14/88	10.58	3.59
	8/12/97	9.54	4.63
	8/14/97	9.58	4.59
	8/26/97	9.25	4.92
	9/2/97	9.50	4.67
	9/9/97	9.58	4.59
	9/16/97	9.74	4.43
	11/2/98	9.96	4.21
MW-18[c]	12/24/86	NM	–
	4/9/87	9.91	4.98
	9/16/87	10.37	4.52
	12/1/87	10.19	4.7
	3/7/88	9.60	5.29
	6/8/88	10.01	4.88
	9/14/88	10.82	4.07

Notes:

(a) Depth to water measured from the top of the well casing. Not corrected for product thickness.
(b) Groundwater elevations are reported in feet above mean sea level.
(c) Well destroyed.
(d) Casing elevation not measured.
(e) NM = Not measured.

FIGURES



SCALE OF MULTIPLE MAP PAGES
INCH TO 4260 FEET

0 ¼ ½ ¾ 1 2 MILES
0 .1 .2 .5 1 KILOMETERS

SCALE OF SINGLE MAP PAGES

0 ¼ ½ ¾ 1 MILES
0 .1 .2 .5 1 KILOMETERS

SOURCE

The Thomas Guide: San Francisco, Alameda, and Contra Costa Counties Street Guide and Directory, Thomas Bros. Maps, 1991.

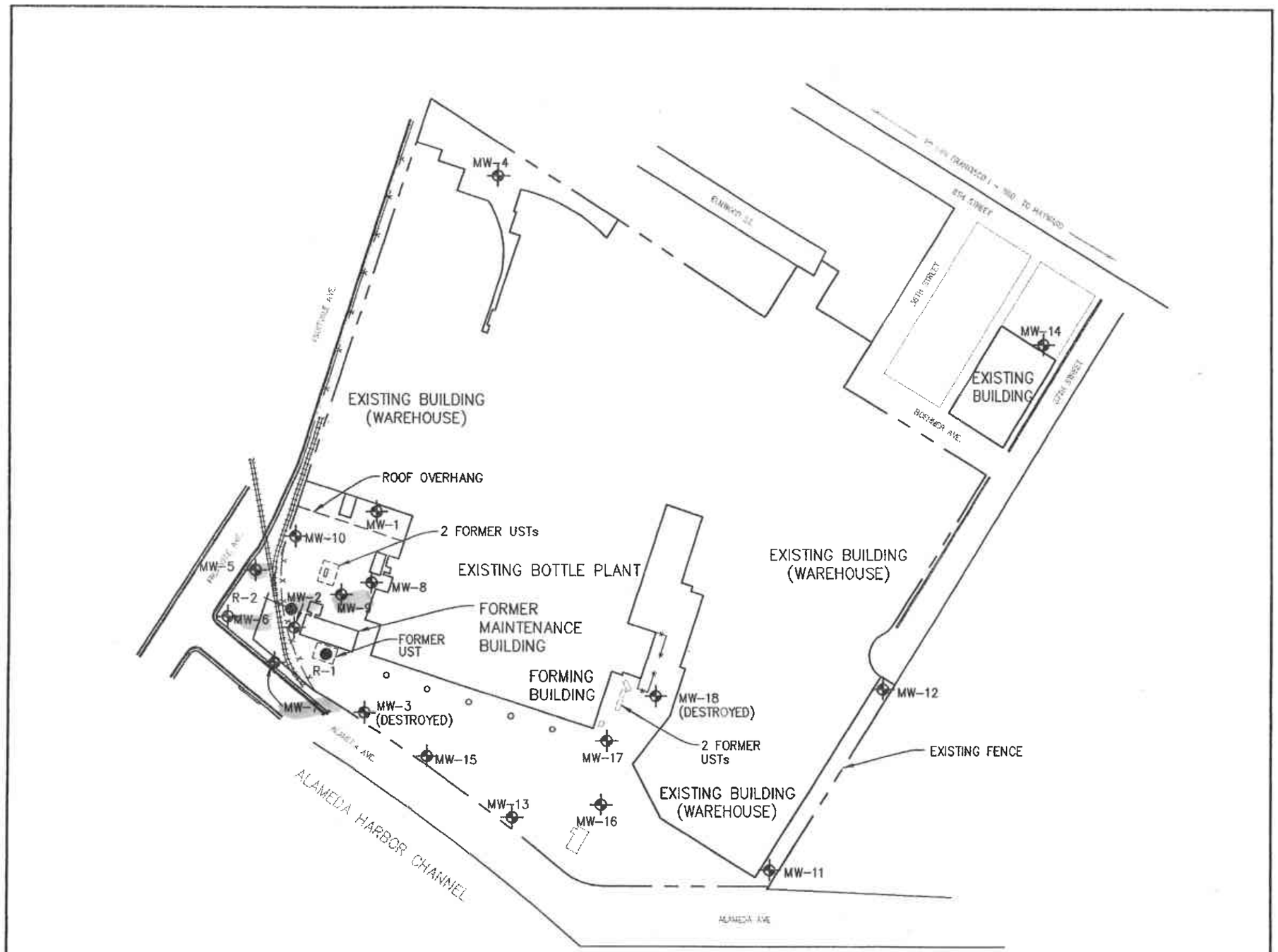
Kennedy/Jenks Consultants

Owens Brockway
Oakland, California

Site Location

K/J 950007.10
November 1998

Figure 1



N

0 100 200 400

Approximate Graphic Scale
in Feet

LEGEND

⊕ MW-2	GROUNDWATER MONITORING WELL
● R-1	PRODUCT RECOVERY WELL

SOURCE

Site Plan for Soil and Groundwater Investigation, Exceltech, February 1987.

Kennedy/Jenks Consultants

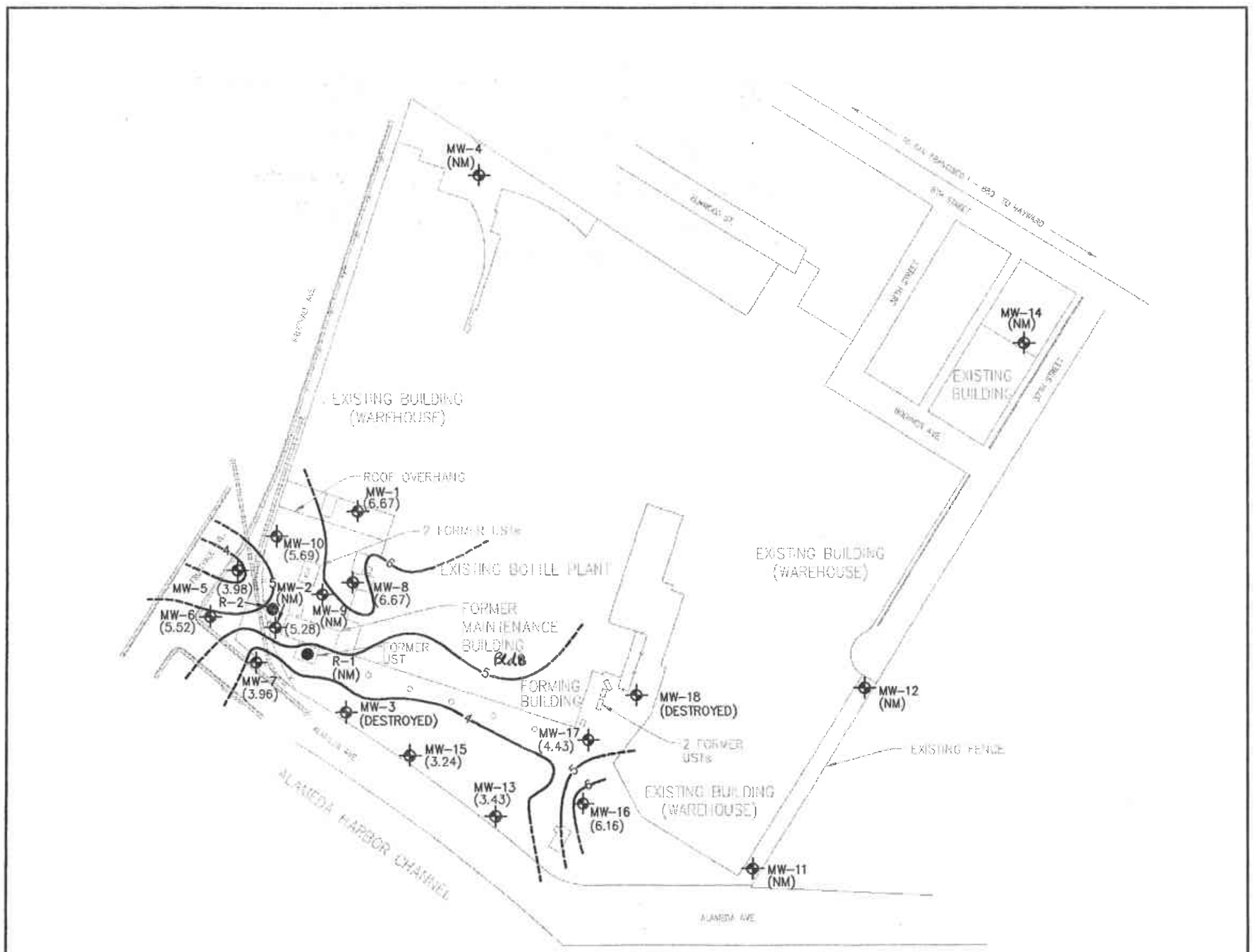
Owens Brockway
Oakland, California

Site Plan

K/J 950007.10
November 1998

Figure 2

FILE: N:\95\sb\950007.10\Nov98f2.dwg DWG 11/18/98 at 09:57



N

0 100 200 400

Approximate Graphic Scale
in Feet

LEGEND

MW–2	GROUNDWATER MONITORING WELL
R–1	PRODUCT RECOVERY WELL
4	GROUNDWATER ELEVATION ISOCONTOUR LINE
(3.24)	GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL, BASED ON 16 SEPTEMBER 1997 DEPTH TO WATER MEASUREMENTS (NOT CORRECTED FOR PRESENCE OF FREE PRODUCT)
(NM)	NOT MEASURED

SOURCE

Site Plan for Soil and Groundwater Investigation, Exceltech, February 1987.

NOTE

Groundwater Elevation Contours Lines are inferred.

Kennedy/Jenks Consultants

Owens Brockway
Oakland, California

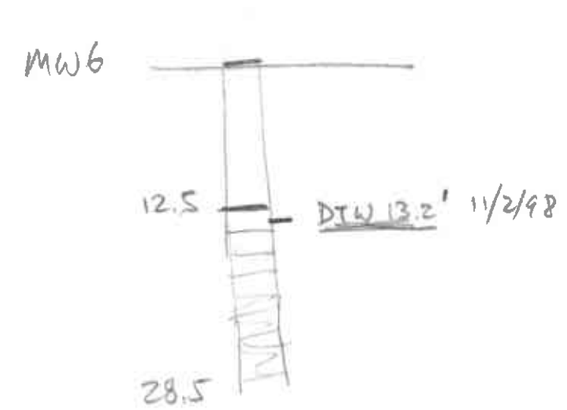
Groundwater Elevation Isocontours
September 1997

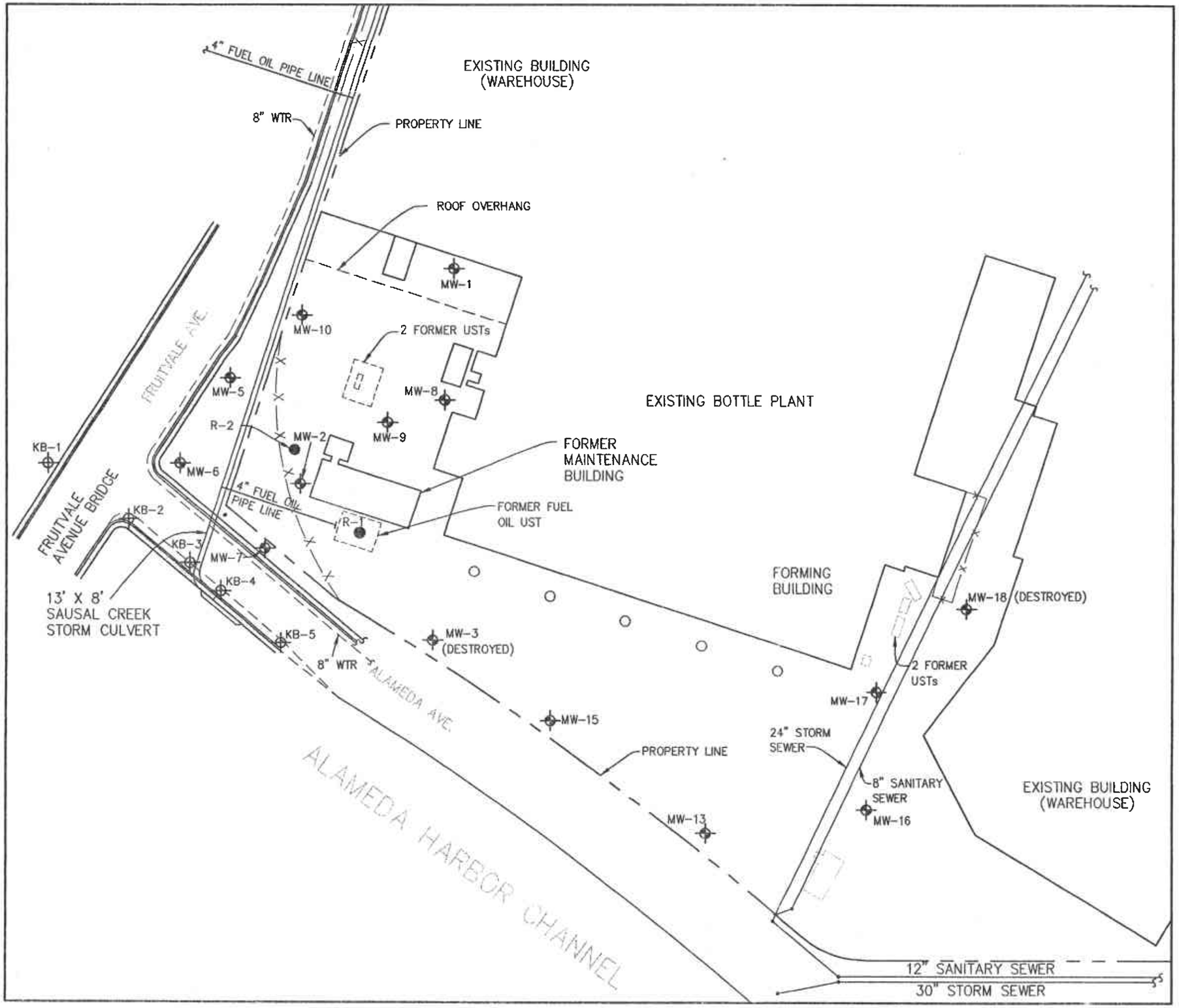
K/J 950007.10
November 1998
Figure 3

FILE: N:\95.isb\950007.10\Nov98f3.dwg.DWG 11/18/98 at 08:51

1/26/99 S. Stehling + Robert Nail present -

Site visit - the offsite borings will be advanced @ 12^{00}
2 of the 5 had been advanced (kB-5 & kB-4). Were going
to sample later when high tide. Dr. Her / Prasain
noticed Hc odor in kB-4.





N

0 50 100 200

Approximate Graphic Scale in Feet

LEGEND

MW-2	GROUNDWATER MONITORING WELL
R-1	PRODUCT RECOVERY WELL
KB-1	PROPOSED SOIL BORING

SOURCE

Site Plan for Soil and Groundwater Investigation, Exceltech, February 1987.

Kennedy/Jenks Consultants

Owens Brockway
Oakland, California

Proposed Soil Boring Locations

K/J 950007.10
November 1998

Figure 4

FILE: N:\95.isb\950007.10\Nov98f4.dwg,DWG 11/18/98 at 09:53

APPENDIX A

TYPICAL HYDRAULIC PUSH/DRIVE SAMPLING PROCEDURES

APPENDIX A
TYPICAL HYDRAULIC PUSH/DRIVE SAMPLING PROCEDURES
Standard Operating Guideline

INTRODUCTION

This guideline describes the equipment and procedures typically used by Kennedy/Jenks Consultants personnel for collecting soil and reconnaissance groundwater samples with a hydraulic push/drive system.

EQUIPMENT

1. Portable, hydraulic push/drive sampling system
2. 6-inch long, 1.75-inch O.D. stainless steel or brass liners and liner sealing materials (Teflon sheets, plastic end caps, Ziploc plastic bags)
3. Type II Portland cement
4. 1-inch O.D. Schedule 40 PVC screen (0.010-inch slot size)
5. 1-inch O.D. Schedule 40 PVC blank casing
6. 0.75-inch diameter stainless steel or Teflon bailer
7. PID organic vapor analyzer
8. Water level indicator
9. Temperature, specific conductivity and pH meters
10. Equipment cleaning materials
    a. Steam cleaner
    b. Generator
    c. Stiff-bristle brushes
    d. Buckets
    e. High-purity phosphate-free liquid soap
    f. Deionized water
    g. Rinsate collection system
11. Personal protective equipment
12. Appropriate groundwater sample containers
13. Chain-of-custody forms
14. Insulated sample storage container and ice substitute

TYPICAL PROCEDURES

1. Applicable drilling permits will be obtained prior to mobilization.
2. Sample locations will be cleared for underground utilities.
3. All downhole equipment will be steam cleaned prior to use at each location.
4. Soil borings will be advanced using a portable, hydraulic push/drive sampling system that simultaneously drives two nested, steel sampling rods into the ground to collect continuous soil cores.
5. As the sampling rods are advanced, the soil core will be collected in a 1-7/8-inch diameter, 3-foot long sample barrel, which is attached to the end of the inner rods. After being advanced 3 feet, the inner rods will be removed from the borehole with a hydraulic winch. The sampler (containing new liners) and inner rods will then be lowered back into the borehole to the previous depth and the rods are driven another 3 feet. This process will be repeated until the desired depth is reached.
6. The soil samples will be retained for lithologic logging and chemical analyses as described in the Work Plan. Headspace screening will be conducted by placing soil not selected for chemical analysis in an airtight container and allowing it to equilibrate for a minimum of 10 minutes. The headspace will be monitored in the container using a PID meter. The headspace concentration will be recorded on the boring log.
7. The soils will be classified in the field in approximate accordance with the visual-manual procedure of the Unified Soil Classification System (ASTM D-2488-93), and the Munsell Color Classification.
8. If required, soil samples will be collected at selected intervals for laboratory analysis. At these intervals, the ends of one or more of the soil sample liners will be covered with Teflon end sheets and plastic end caps, and labeled. Labels will document the sample designation, type, date and time of collection, collector(s), location, and any additional information.
9. If groundwater samples will not be collected, the soil borings will be grouted to the ground surface with a neat cement grout (Type II Portland cement) using the tremie method.
10. If groundwater samples will be collected, upon penetrating the uppermost groundwater surface during sampling, the sample barrel and inner rods will be removed and PVC well screen and casing will be installed within the outer drive casing to facilitate collection of a groundwater sample. The drive casing will be pulled up approximately 3 feet to expose the slotted PVC casing. Groundwater samples will then be collected from within the PVC casing with a 0.75-inch diameter Teflon or stainless steel bailer.
11. The depth to groundwater will be measured prior to groundwater sampling.
12. The sample will be drained directly from the bailer into sample containers. The containers will be labeled to document the sample designation, type, date and time of collection, collector(s), location, and any additional information.
13. After collecting the reconnaissance groundwater sample, decant groundwater into a clean container and record the following field parameters/observations:
    a. Temperature (°C)
    b. pH

c. Specific conductivity (µmhos/cm)

d. Visual turbidity

e. Depth to water

f. Color

g. Other observations (odors, free-phase product)

14. After sample collection, the boring will be grouted to ground surface with a neat cement grout (Type II Portland cement) using the tremie method.

EQUIPMENT CLEANING

1. Downhole equipment (rods, sampler) will be steam cleaned prior to each borehole.
2. Sampling equipment (sampler) will be steam cleaned or washed with a brush in a solution of high-purity phosphate-free soap and potable water, then rinsed with potable water followed by double rinsing with deionized water prior to each sampling run.
3. Downhole equipment and vehicles which warrant it, will be steam cleaned prior to leaving the Site at completion of sampling.

INVESTIGATION-DERIVED RESIDUALS

Soil cuttings will be placed in labeled 5-gallon DOT-approved pails with bolt-on covers. Decontamination water and groundwater residuals will be contained in labeled 55-gallon DOT-approved drums with bolt-on covers. All residuals generated during sampling activities will be stored at the Site pending receipt of laboratory analyses and proper disposal.

APPENDIX B

TYPICAL GROUNDWATER SAMPLING PROCEDURES

APPENDIX B
TYPICAL GROUNDWATER SAMPLING PROCEDURES
Standard Operating Guideline

INTRODUCTION

This guideline describes procedures typically followed by Kennedy/Jenks Consultants personnel during groundwater sampling of monitoring wells.

EQUIPMENT/MATERIALS

- Water level depth probe
- Centrifugal surface pump
- 1-inch dedicated PVC hose for each shallow monitoring well
- Laboratory-cleaned or sanitized disposable bailers with disposable cord
- Submersible pump
- Bottom-emptying bailer (2- or 4-inch diameter)
- Temperature and specific conductivity meter
- pH meter
- Appropriate glassware and sample containers
- Kennedy/Jenks' Groundwater Purge and Sample forms (F-43)

TYPICAL PROCEDURE

All data and information collected during this procedure shall be recorded on Kennedy/Jenks Groundwater Purge and Sample form (F-43).

1. Prior to groundwater sampling, make initial measurements of depth to static water level and total casing depth in all wells to be sampled. Calculate the total well volume of water for purge volumes for each well. Check monitoring well for nonaqueous phase liquid (NAPL) with a bailer, separate phase sounding probe or color indicator paste if applicable.
2. If NAPL is present, collect a sample of the product for potential laboratory analysis, bail the product from the well and allow the well to recover for approximately 24 hours. After the well has recovered, check for NAPL and collect a second sample of the product, if present, for potential laboratory analysis. Wells that contain NAPL should not be purged and sampled.
3. Initiate purging, using one of the following methods:
   a. A centrifugal surface pump with dedicated 1-inch I.D. clear flex suction hose with check valve, placed with the hose intake near the casing bottom, if the groundwater depth is less than approximately 25 feet.

b. Laboratory-cleaned or disposable bailers.

c. A submersible pump placed above or below the screen section if the water level is greater than 25 feet.

4. At the beginning of purging, and periodically afterwards, collect a sample of purged groundwater in a clean container and record the following field parameters/observations.

   a. Purge volume and time

   b. Temperature

   c. pH

   d. Specific conductance

   e. Depth to water

   f. Turbidity

   g. Color

   h. Other observations as appropriate (draw down in well during purge, presence of oil, odors)

5. For wells providing sufficient yield, continue purging until field parameters stabilize or at least three casing volumes are removed. Wells providing insufficient yield are purged dry once, allowed to recover to 80 percent of original water levels, and purged dry again. Wells with extremely low yields are purged dry only once.

6. Following purging, allow wells to recover to approximately 80 percent of original water levels and then collect samples.

7. Samples will typically be collected using clean bottom-employing bailers. Prior to sample collection, purge the bailer three times with water from the well. During sample collection, allow a 4- to 6-inch column of water to be purged from the bottom of the bailer before filling the appropriate sample containers. If the collected water is very turbid, or a bottom-emptying bailer is not used, carefully decant the water from the bailer into the appropriate sample containers. An attempt should be made to avoid agitation of the sample. When sampling for volatile organic compounds (VOCs), turn the bottle upside down to identify possible headspace. If bubbles occur, refill sample.

8. When multiple analyses will be performed, samples should be collected in order of decreasing sensitivity to volatilization (i.e., VOC samples first and metals last).

9. Collect groundwater samples using precleaned Teflon or stainless steel bailers, disposable bailer or precleaned Kemmerer (depth-specific) samplers. During sampling, record field parameters/observations as described in Step 4 on KENNEDY/JENKS form F-43. As required by anticipated analyses, label and fill containers according to the following guidelines.

   a. Total petroleum hydrocarbons (TPHs): 1L amber glass bottle.

   b. Benzene, toluene, xylene, and ethylbenzene (BTEX) compounds: three to six 40ml brown glass volatile organic analysis (VOA) vials with Teflon septa.

c. VOCs: three to six 40ml brown glass VOA vials with Teflon septa.

d. Metals and polychlorinated biphenyls (PCBs): 1L amber glass bottles. Samples will not be field-filtered of the samples can be filtered in the laboratory within 12 hours of collection. Otherwise, field filtering should be performed. Preserve the samples with the appropriate preservative, where applicable.

10. Ensure that each sample label documents sample, designation, type, date and time of collection, collector(s), location, and any additional information.

11. Complete chain-of-custody records and include them with the samples, which are to be transported to the laboratory in insulated containers at 4°C.

12. Each day, calibrate pH meters with buffer solutions and calibrate specific conductance meters using standard solutions.

QUALITY CONTROL/QUALITY ASSURANCE

1. Collect duplicate samples immediately after the original samples are collected. Approximately one duplicate sample is obtained for each quarterly sampling event or for each ten original samples. Purging is not performed between original sample collection and collection of duplicate samples. Original and duplicate samples are collected sequentially, without appreciable delay between collection cycles. Duplicate samples will be submitted to the laboratory blind (i.e., not identifying the samples as a duplicate).

2. Prepare rinsate field blanks by pouring deionized water over, around, and through the various sampling implements contacting a natural sample, including the bailer rope and filter. Rinsate field blank will be submitted to the laboratory blind (i.e., not identifying the sample as a blank).

3. The purpose of a transfer blank is to monitor for entrainment of contaminants into the sample form existing atmospheric conditions at the sampling location during the sample collection process. Transfer blanks will be routinely prepared when there is no rinsate blank collected. A transfer blank is prepared by filling sample containers with distilled or deionized water at a given sampling location. Transfer blank are analyzed for the same parameters as the environmental samples.

4. At least one type of field blank sample (rinsate or transfer) will be required per day of water sampling. All field blanks will be collected, preserved, labeled, and treated like any other sample. They shall be sent blind to the laboratory. In the field notebook, the samples will be noted as blanks (rinsate, transfer, trip).

5. Volatile organic samples are susceptible to contamination by diffusion of organic contaminants through the Teflon-faced silicone rubber septum of the sample vial. Therefore, trip blanks will be analyzed to monitor for possible sampling contamination during shipment. Trip blanks will be prepared by filling VOA vials from organic-free water and shipping the blanks with field containers. Trip blanks accompany the sample bottles through collection and shipment to the laboratory and are stored with the samples.

EQUIPMENT CLEANING

Prior to each sampling event, clean sampling equipment, including any purge bailers with high purity phosphate-free soap. After washing the equipment, rinse it with potable water and methanol and/or 0.1N nitric acid as appropriate. Double-rinse with deionized water. Onsite, one set of (dedicated) sampling implements is used per well. Prior to returning the sampling implements to the laboratory (for thorough cleaning), ensure that these items are cleaned onsite. For additional details, see SOG-2 - Equipment Decontamination. Disposable equipment (i.e., bailers) will be field cleaned and returned to the field equipment manager for disposal.

INVESTIGATION-DERIVED WASTES

Purge water is contained onsite, labeled, and placed in an appropriate container for disposition by the client.