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August 20, 1996

HAND DELIVERED

Susan Hugo
Alameda County Health Care Services Agency
Hazardous Materials Division
1131 Harbor Bay Parkway
Alameda, CA 94502

Sum Arigala
Regional Water Quality Control Board
2101 Webster Street
Oakland, CA 94612

Re: **Croley & Herring Investment Company**
Site: 5800 Christie Avenue, Emeryville, California

Dear Ms. Hugo and Mr. Arigala:

Enclosed is the draft Groundwater Conditional Case Closure Request. The revised draft Closure Request seeks full closure of the case with respect to VOCs and conditional closure with continued groundwater monitoring for BTEX in Monitoring Well 4.

As discussed, because of the continued elevated levels of benzene in the vicinity of MW-4, we are requesting continued semi-annual groundwater monitoring of MW-4, only, for BTEX.

As you know, Croley & Herring Investment Company is in the process of finalizing a settlement with its tenants with regard to the VOC contamination. Furthermore, Croley & Herring is in the process of refinancing the property. We would therefore appreciate your immediate attention to this groundwater case closure request.

Very truly yours,

WENDEL, ROSEN, BLACK & DEAN, LLP

Christine K. Noma

CKN:pmm

cc: Steve Croley
Richard Herring
Walter Loo

DRAFT

GROUNDWATER CASE CLOSURE REQUEST

5800 CHRISTIE AVENUE, EMERYVILLE, CALIFORNIA

AUGUST 1996

SUBMITTED TO:

MS. SUSAN HUGO
ALAMEDA COUNTY HEALTH CARE SERVICES
HAZARDOUS MATERIALS DIVISION
1131 HARBOUR BAY PARKWAY,
ALAMEDA, CALIFORNIA 94502

PREPARED FOR :

CROLEY & HERRING INVESTMENT COMPANY
353 BEACON RIDGE LANE,
WALNUT CREEK, CALIFORNIA 94596

PREPARED BY:

ETS ENVIRONMENT & TECHNOLOGY SERVICES
2081 15TH STREET,
SAN FRANCISCO, CALIFORNIA 94114
TELEPHONE: 415-861-0810
FACIMILE: 415-861-3269

ETS *ENVIRONMENT & TECHNOLOGY SERVICES*

2081 15TH STREET, SAN FRANCISCO, CALIFORNIA 94114
PHONE 415-861-0810 *FAX 415-861-3269*

August 15, 1996

Ms. Susan Hugo, Alameda County Health Care Services
Mr. Sum Arigala, San Francisco Bay Area RWQCB

Subject: Draft Groundwater Conditional Case Closure Request
5800 Christie Avenue, Emeryville, California

Dear Ms. Hugo and Mr. Arigala:

As per our meeting and discussions on March 18, 1996 at the ACHCS office, this letter presents the draft groundwater case conditional closure request for the subject site.

INTRODUCTION

Environment & Technology Services(ETS) was retained by Croley & Herring Investment Company to perform the soil and groundwater monitoring and remediation for the facility located at 5800 Christie Street in Emeryville, California. The subject facility is currently leased to an electronic merchandise retailer, The Good Guys.

SOIL REMEDIATION

Prior to leasing, soil contamination was identified at the subject facility. The contaminated soil was removed with the exception of that which was underlying the building because of health and safety concerns. The removed soil was bioremediated on-site and properly disposed of with the approval of the regulatory agencies. See soil remediation and Closure Report 7/21/89.

A vapor extraction system(VES) was installed immediately adjacent to the northeastern side of the building to mitigate the residual volatile hydrocarbons contained in the soil. The residual volatile organic chemicals(VOCs) were remediated from an average VOCs concentration of about 660 ppm to a satisfactory level at an average of 0.82 ppm in soil.

A soil closure plan was submitted(11/15/91) and approval of closure was received on 1/21/92 after submittal of confirming soil sampling results. The soil vapor extraction system was decommissioned and the Bay Area Air Quality Management District was notified on 12/16/91. The final VES closure report was completed on August 29, 1992.

GROUNDWATER REMEDIATION

In late 1992, ETS initiated an in-situ groundwater biotreatment system in the vicinity of EW-1. It was particularly effective on the treatment of the chlorinated solvents which was treated to non-detect (1/94 monitoring report on EW-1). The groundwater remediation activities ended in late 1993.

The in-situ groundwater biotreatment system was implemented through electrolysis, electro-osmosis and electrochemical processes. A full report of the electrochemical treatment and the biotreatment processes is set forth in the Groundwater Remediation Progress Report dated February 23, 1993 prepared by ETS Environment and Technology Sercives. Attachment A includes excerpts from said groundwater remediation progress report.

GROUNDWATER MONITORING PROGRAM

As part of the site activities, a groundwater monitoring program was implemented. Previous groundwater monitoring events were conducted on November 6, 1989, February 20, 1990, May 31, 1990, September 7, 1990, December 4, 1990, April 16, 1991, July 3,1991, October 12, 1991, January 26, 1992, April 8, 1992, July 15,1992, October 19, 1992, January 11, 1993, March 29, 1993, July 7, 1993, October 8, 1993, January 19, 1994, September 18, 1995, January 6, 1996 and March 25, 1996 respectively. A total of 20 groundwater monitoring events were conducted. The groundwater flow direction remained in the same general direction, flowing towards the southwest.

AIR MONITORING PROGRAM

An indoor vapor monitoring system Sentry Monitor Model 5000 was installed by the "Good Guys" electronic store in 1989 through March, 1993. No significant level of "methane calibrated standard" was detected for the monitoring period. The vapor monitor system is capable of detecting volatile compounds such as BTEX(see attached specification sheet). The vapor monitoring system was allowed to be disconnected in March, 1993 with the concurrence of Mr. Brian Oliva of Alameda County Health Care Services, March 15,1993 correspondence. The Good Guys store have confirmed that no VOCs alarm or detection was ever recorded. See Attachement B.

SUMMARY OF REMEDIATION CONCLUSIONS

MW-1 and MW-2 located at the southern and western corners of the site have never detected any chlorinated solvents or BTEX.

Table 1 presents a summary of analytical results of well EW1 for BTEX. Table 1a presents a summary of analytical results of well EW-1 for VOCs. EW1 is located in the back alley. Table 2 presents the groundwater quality of well MW4 for BTEX. Table 2a presents the groundwater quality of well MW-4 for VOCs.

The chlorinated solvents detected in EW1 were bioremediated to ND in 1/94, subsequently, a year later the level rose due most probably to soil and groundwater agitation resulting from extensive subsurface investigation effort (late 1994) from the adjacent (Lathrop Property) site. Approximatey 30 soil borings and monitoring wells were drilled on the Lathrop property, adjacent to the property line.

Since then, the chlorinated solvents in well EW-1 have dropped off steadily from 3.15 ppm to 0.86 ppm to 0.179 and to 0.099 ppm over the last four consecutive monitoring events.

Groundwater samples were also taken from wells located on the adjacent Lathrop property. Table 3 presents the results of groundwater quality in wells C-1, C-2 and C-3 for BTEX. Table 3a presents the results of groundwater quality in wells C-1, C-2 and C-3 for VOCs. All of the Lathrop wells have shown ND levels of chlorinated solvents. Wells C-1 and C-2 were non-detect in BTEX on all monitoring events.

There is no sign of downgradient or off site migration of the chlorinated solvents as indicated by NDs in MW-4 and C3(Table 2a and 3a).

Also, while elevated level of gasoline was detected in EW1 which may have originated from the adjacent Lathrop property, the levels have decreased from 13 ppm to 1.3 ppm for the last four monitoring events. The level of benzene in EW-1 has been ND for the last five monitoring events.

MW4 located at the south east corner of the site detected elevated levels of BTEX compounds in the sample and analysis. The suspected sources of the BTEX compounds may have originated from the upgradient closed underground storage tank, former roof manufacturing plant(Pabco/Paraffin Paint Company now known as Fibreboard Corporation) or from an upgradient Chevron asphalt manufacturing plant. Well MW4 is located very close to underground utility lines along Powell Street which may serve as migration conduits from upgradient sources.

Conditional site closure, closure of chlorinated solvents(VOCs) at EW-1 with continued semi-annual monitoring of MW-4 for BTEX is appropriate for the reasons set forth below.

GROUNDWATER CLOSURE RATIONALE

Chlorinated Solvents Plume

The chlorinated solvents have been detected only in well EW-1 and it therefore it appears that the chlorinated solvent plume is confined to the alleyway near well EW-1.

There is no evidence of off-site migration because of non-detect readings at wells C-1, C2 and C3, located in Lathrops property(see Table 3).

There is no off-site migration downgradient because of non-detect readings at well MW-4.

The chlorinated solvents have demonstrated a continuous declining trend in the last four monitoring episodes.

The source of the chlorinated solvents spill had been removed and remediated. The soil in the vadose zone soil detected less than 1 ppm of total VOCs. The groundwater in EW-1 contains less than 0.099 ppm of total chlorinated solvents.

It is ETS' opinion that the chlorinated solvents in the shallow groundwater on site have been effectively bioremediated and require no further remedial action.

Gasoline and BTEX Plume

Wells MW-1, MW-2, C1 and C2 have never detected any gasoline or BTEX in the groundwater.

The BTEX detected in EW-1 is very low, and the levels in MW-4 and C3 were fairly consistent in value, 14 and 21 ppm TPHg and, 0.86 and 1.05 ppm benzene, respectively.

During the site investigation effort in 1993 for the Days Inn property, no detectable level of gasoline or BTEX were found in three downgradient temporary wells on the Days Inn property. The Days Inn property is located immediately downgradient of the site across the Powell Street. The groundwater analysis results of the Days Inn property is attached as Attachment C. It is apparent that natural biodegradation of the gasoline and BTEX in groundwater occurred while in transit.

The land in the surrounding area has historically been industrial, and the Shellmound Street area is primarily zoned for commercial and light industrial

use. The site previously was used for light industrial and warehouse use, and is presently occupied by a retail store, The Good Guys.

Shallow groundwater occurs at the site at 3-1/2 to 6-1/2 feet depth to water table. Bay mud is encountered at approximately 10 feet bgs. The site lies within 1/3 mile of the bay, and located on historic fill material. Prior to fill operations in the late 1800s, the site was part of the bay. See historic Sandborn maps. Attachment D.

The total dissolved solids concentration in EW-1 and MW-4 were at 2,590 and 1,040 ppm ,respectively, on 7/11/96. These levels are above the EPA Secondary Drinking Water standards. It is therefore unlikely that the groundwater will be used as a drinking water source.

The gasoline and BTEX in the shallow groundwater on site require no further remedial action. This conclusion generally follows the recommendations of the Lawrence Livermore Laboratory study(10/1995)

But, because of the elevated levels of benzene in MW-4 and the uncertainty as to the source of the BTEX, continued semi-annual groundwater monitoring of MW-4 for BTEX should be conducted to verify the effectivenes of passive bioremediation.

RECOMMENDATIONS:

1. Based upon the successful remediation of VOCs in the vicinity of the EW1, closure of EW1 is therefore recommended.

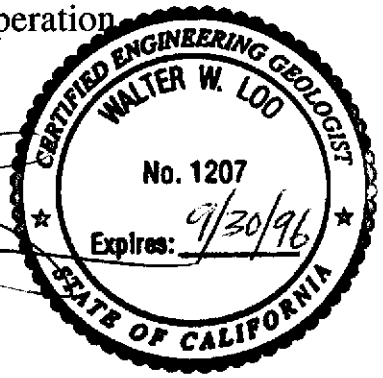
2. As to the elevated levels of benzene which remain in the groundwater in the vicinity of MW4, it is recommended that continued semi-annual groundwater monitoring of MW-4 for BTEX should be conducted to verify the effectivenes of passive bioremediation.

3. Finally, MW2 and MW3 which have been measured for groundwater elevation levels only, should be closed.

Request is therefore made for conditional site closure subject to the continued groundwater monitoring of MW-4.

Please contact me if you have any question about this request. Thank you for continue prompt response and cooperation.

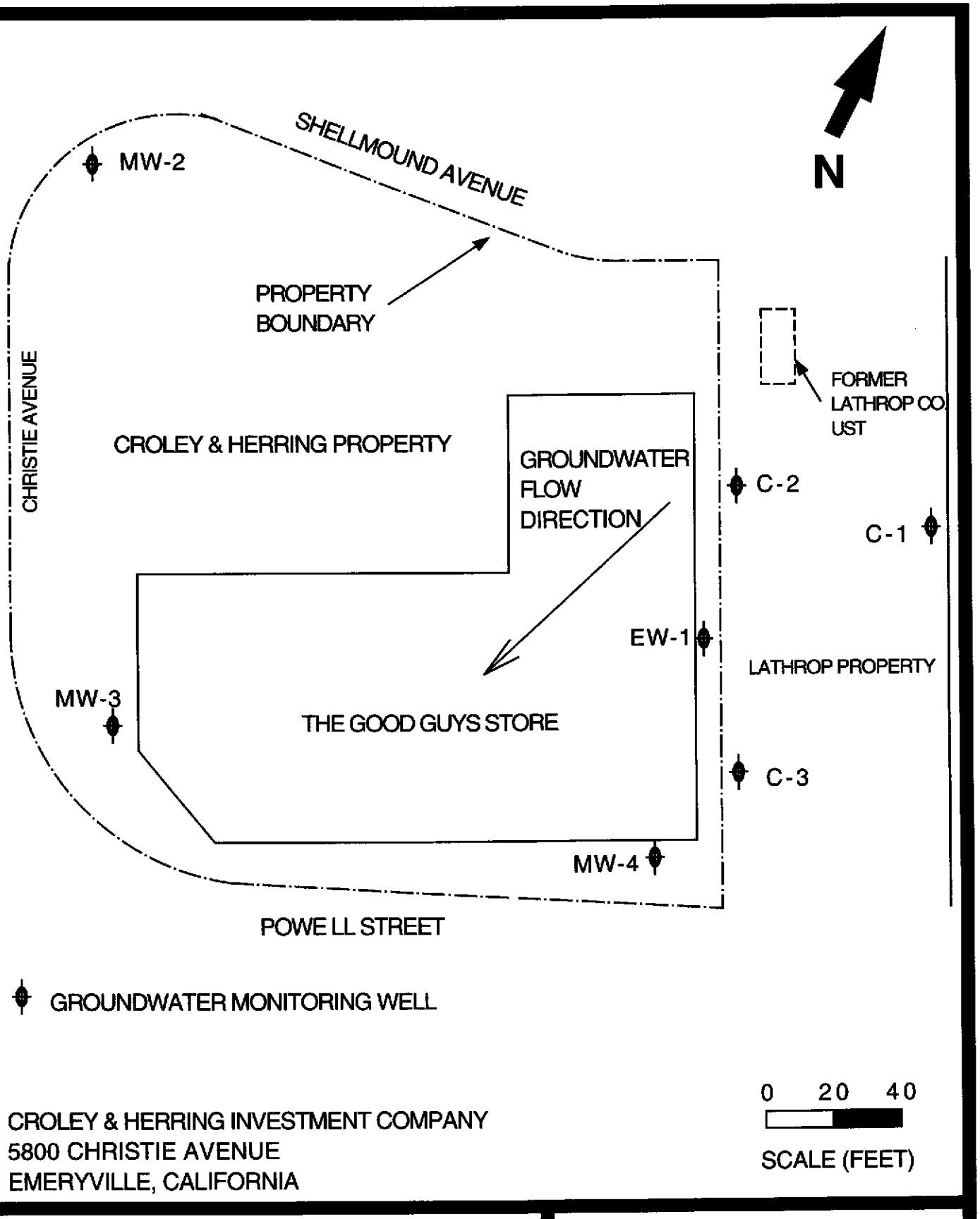
Sincerely,



Walter W. Loo, CEG 1207
President

CC: Mr. Dick Herring, President
Croley & Herring Investment Company
353 Beacon Ridge Lane,
Walnut Creek, California 94596

Ms. Christine K. Noma
Wendel Rosen Black & Dean
1111 Broadway, 24th Floor
Oakland, CA 94607



CROLEY & HERRING INVESTMENT COMPANY
5800 CHRISTIE AVENUE
EMERYVILLE, CALIFORNIA

ETS
ENVIRONMENT & TECHNOLOGY SERVICES

FIGURE 1
GENERAL SITE MAP

TABLE 1

SUMMARY OF GROUNDWATER QUALITY(BTEX)
5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

CONCENTRATIONS IN MG/L

WELL EW-1

COMPOUNDS	7/7/93	10/8/93	1/19/94	1/25/95	9/18/95	1/6/96
BENZENE	ND	ND	0.022	0.026	ND	ND
TOLUENE	3.6	11	4.3	5.0	0.62	1.2
XYLENES	ND	0.081	0.07	0.048	0.015	0.033
ETHYLBENZENE	ND	ND	0.012	0.009	ND	ND
MTBE	NA	NA	NA	NA	NA	NA

COMPOUNDS	1/29/96	3/25/96	7/11/96
BENZENE	ND	ND	ND
TOLUENE	1.1	0.55	5.87
XYLENES	0.043	0.011	0.013
ETHYLBENZENE	ND	ND	0.055
MTBE	NA	NA	ND

TABLE 1a

SUMMARY OF QUARTERLY GROUNDWATER QUALITY(VOCs)
MONITORING WELL EW-1
5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

CONCENTRATIONS IN MG/L

COMPOUNDS	7/7/93	10/8/93	1/19/94	1/25/95	9/18/95	1/6/96	3/25/96
HALOCARBONS	1.7	1.81	ND	3.15	0.86	0.179	0.099
PCE	ND	ND	ND	ND	ND	ND	ND
TCE	ND	ND	ND	0.95	0.04	0.013	ND
1,1 DCE	ND	ND	ND	ND	ND	ND	ND
1,2 DCE	ND	ND	ND	0.4	ND	ND	ND
1,1,1 TCA	ND	0.21	ND	ND	ND	ND	ND
1,1 DCA	1.7	1.6	ND	1.8	0.11	0.08	0.039
1,2 DCA	ND	ND	ND	ND	ND	ND	ND
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND
CHLOROETHANE	ND	ND	ND	ND	0.19	0.06	0.032
MET. CHLORIDE	ND	ND	ND	ND	ND	ND	ND
BROMO DCA	ND	ND	ND	ND	0.02	ND	ND
1,2 DCPROPANE	ND	ND	ND	ND	0.5	0.026	0.028

7/96
2

NA NOT ANALYSED
ND NOT DETECTED OR BELOW DETECTION LIMITS
VOCs VOLATILE ORGANIC COMPOUNDS (TPH PLUS TOX)

TABLE 2

SUMMARY OF GROUNDWATER QUALITY(BTEX)
5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

CONCENTRATIONS IN MG/L

WELL MW-4

COMPOUNDS	7/7/93	10/8/93	1/19/94	1/25/95	9/18/95	1/29/96
BENZENE	0.8	0.29	0.21	1.4	0.57	0.75
TOLUENE	0.28	0.22	0.025	0.27	0.11	0.11
XYLENES	0.3	0.2	0.037	0.28	0.096	0.14
ETHYLBENZENE	0.27	0.12	0.035	0.56	0.16	0.24
MTBE	NA	NA	NA	NA	NA	NA

COMPOUNDS	3/25/96	7/11/96
BENZENE	1.0	0.86
TOLUENE	0.15	0.076
XYLENES	0.22	0.24
ETHYLBENZENE	0.38	0.13
MTBE	NA	ND

TABLE 2a

SUMMARY OF QUARTERLY GROUNDWATER QUALITY(VOCs)
MONITORING WELL MW-4
5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

CONCENTRATIONS IN MG/L

COMPOUNDS	7/7/93	10/8/93	1/19/94	1/25/95	9/18/95	3/25/96
HALOCARBONS	ND	0.06	ND	ND	ND	ND
PCE	ND	ND	ND	ND	ND	ND
TCE	ND	ND	ND	ND	ND	ND
1,1 DCE	ND	ND	ND	ND	ND	ND
1,2 DCE	ND	ND	ND	ND	ND	ND
1,1,1 TCA	ND	0.005	ND	ND	ND	ND
1,1 DCA	ND	ND	ND	ND	ND	ND
1,2 DCA	ND	0.055	ND	ND	ND	ND
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND
CHLOROETHANE	ND	ND	ND	ND	ND	ND
MET. CHLORIDE	ND	ND	ND	ND	ND	ND
BROMO DCA	ND	ND	ND	ND	ND	ND
1,2 DCPROPANE	ND	ND	ND	ND	ND	ND

* BTEX DO NOT MATCH GASOLINE PATTERN
NA NOT ANALYSED
ND NOT DETECTED OR BELOW DETECTION LIMITS
VOCs VOLATILE ORGANIC COMPOUNDS (TPH PLUS TOX)

TABLE 3

SUMMARY OF GROUNDWATER QUALITY(BTEX)
5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

CONCENTRATIONS IN MG/L

WELL C-1

COMPOUNDS	7/11/96
BENZENE	ND
TOLUENE	ND
XYLENES	ND
ETHYLBENZENE	ND
MTBE	ND

WELL C-2

COMPOUNDS	7/11/96
BENZENE	0.004
TOLUENE	ND
XYLENES	ND
ETHYLBENZENE	ND
MTBE	ND

WELL C-3

COMPOUNDS	1/29/96	3/25/96	7/11/96
BENZENE	3.6	2.90	1.05
TOLUENE	0.55	0.49	0.113
XYLENES	0.39	0.36	0.187
ETHYLBENZENE	0.39	0.41	0.116
MTBE	NA	NA	ND

NA NOT ANALYZED
ND NOT DETECTED OR BELOW DETECTION LIMITS

TABLE 3a

SUMMARY OF QUARTERLY GROUNDWATER QUALITY(VOCs)
MONITORING WELLS C-1, C-2, AND C-3
5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

CONCENTRATIONS IN MG/L

COMPOUNDS	1/29/96			3/25/96		
	C1	C2	C3	C1	C2	C3
HALOCARBONS	ND	ND	ND	ND	ND	ND
PCE	ND	ND	ND	ND	ND	ND
TCE	ND	ND	ND	ND	ND	ND
1,1 DCE	ND	ND	ND	ND	ND	ND
1,2 DCE	ND	ND	ND	ND	ND	ND
1,1,1 TCA	ND	ND	ND	ND	ND	ND
1,1 DCA	ND	ND	ND	ND	ND	ND
1,2 DCA	ND	ND	ND	ND	ND	ND
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND
CHLOROETHANE	ND	ND	ND	ND	ND	ND
MET. CHLORIDE	ND	ND	ND	ND	ND	ND
BROMO DCA	ND	ND	ND	ND	ND	ND
1,2 DCPROPANE	ND	ND	ND	ND	ND	ND

NA NOT ANALYSED
ND NOT DETECTED OR BELOW DETECTION LIMITS
VOCs VOLATILE ORGANIC COMPOUNDS (TPH PLUS TOX)

ETS *ENVIRONMENT & TECHNOLOGY SERVICES*

2081 15TH STREET, SAN FRANCISCO, CALIFORNIA 94114
PHONE 415-861-0810 *FAX 415-861-3269*

July 19, 1996

Mr. Sum Arigala,
San Francisco Bay Area RWQCB VIA FAX (510)286-1380

Subject: Groundwater Monitoring Data Summary July 1996
5800 Christie Avenue, Emeryville, California

Dear Mr. Arigala:

As per you requested, please find one copy (5 pages) of the groundwater monitoring data summary for the July 11 1996 sampling at the subject facility.

Table 1 and 2 summarize groundwater quality for each of monitoring wells and Figure 1 is the general site map for groundwater monitoring well locations.

Please contact me if you have any question about this summary.

Sincerely,

Joseph Tan for

Walter W. Loo, RG CEG CHG
President

CC: Ms. Susan Hugo, Alameda County Health Care Services
Miss. Christine Noma, Wendel, Rosen, Black & Dean, LLP

TABLE 1

SUMMARY OF GROUNDWATER QUALITY
5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

CONCENTRATIONS IN MG/L

WELL EW-1

COMPOUNDS	7/7/93	10/8/93	1/19/94	1/25/95	9/18/95	1/6/96
BENZENE	ND	ND	0.022	0.026	ND	ND
TOLUENE	3.6	11	4.3	5.0	0.62	1.2
XYLENES	ND	0.081	0.07	0.048	0.015	0.033
ETHYLBENZENE	ND	ND	0.012	0.009	ND	ND
MTBE	NA	NA	NA	NA	NA	NA

COMPOUNDS	1/29/96	3/25/96	7/11/96
BENZENE	ND	ND	ND
TOLUENE	1.1	0.55	5.87
XYLENES	0.043	0.011	0.013
ETHYLBENZENE	ND	ND	0.055
MTBE	NA	NA	ND

TPHg ?

WELL MW-4

COMPOUNDS	7/7/93	10/8/93	1/19/94	1/25/95	9/18/95	1/29/96
BENZENE	0.8	0.29	0.21	1.4	0.57	0.75
TOLUENE	0.28	0.22	0.025	0.27	0.11	0.11
XYLENES	0.3	0.2	0.037	0.28	0.096	0.14
ETHYLBENZENE	0.27	0.12	0.035	0.56	0.16	0.24
MTBE	NA	NA	NA	NA	NA	NA

COMPOUNDS	3/25/96	7/11/96
BENZENE	1.0	0.86
TOLUENE	0.15	0.076
XYLENES	0.22	0.24
ETHYLBENZENE	0.38	0.13
MTBE	NA	ND ✓

WELL C-1

COMPOUNDS	7/11/96
BENZENE	ND
TOLUENE	ND
XYLENES	ND
ETHYLBENZENE	ND
MTBE	ND

TPHg

WELL C-2

COMPOUNDS	7/11/96
BENZENE	0.004
TOLUENE	ND
XYLENES	ND
ETHYLBENZENE	ND
MTBE	ND

WELL C-3

COMPOUNDS	1/29/96	3/25/96	7/11/96
BENZENE	3.6	2.90	1.05
TOLUENE	0.55	0.49	0.113
XYLENES	0.39	0.36	0.187
ETHYLBENZENE	0.39	0.41	0.116
MTBE	NA	NA	ND

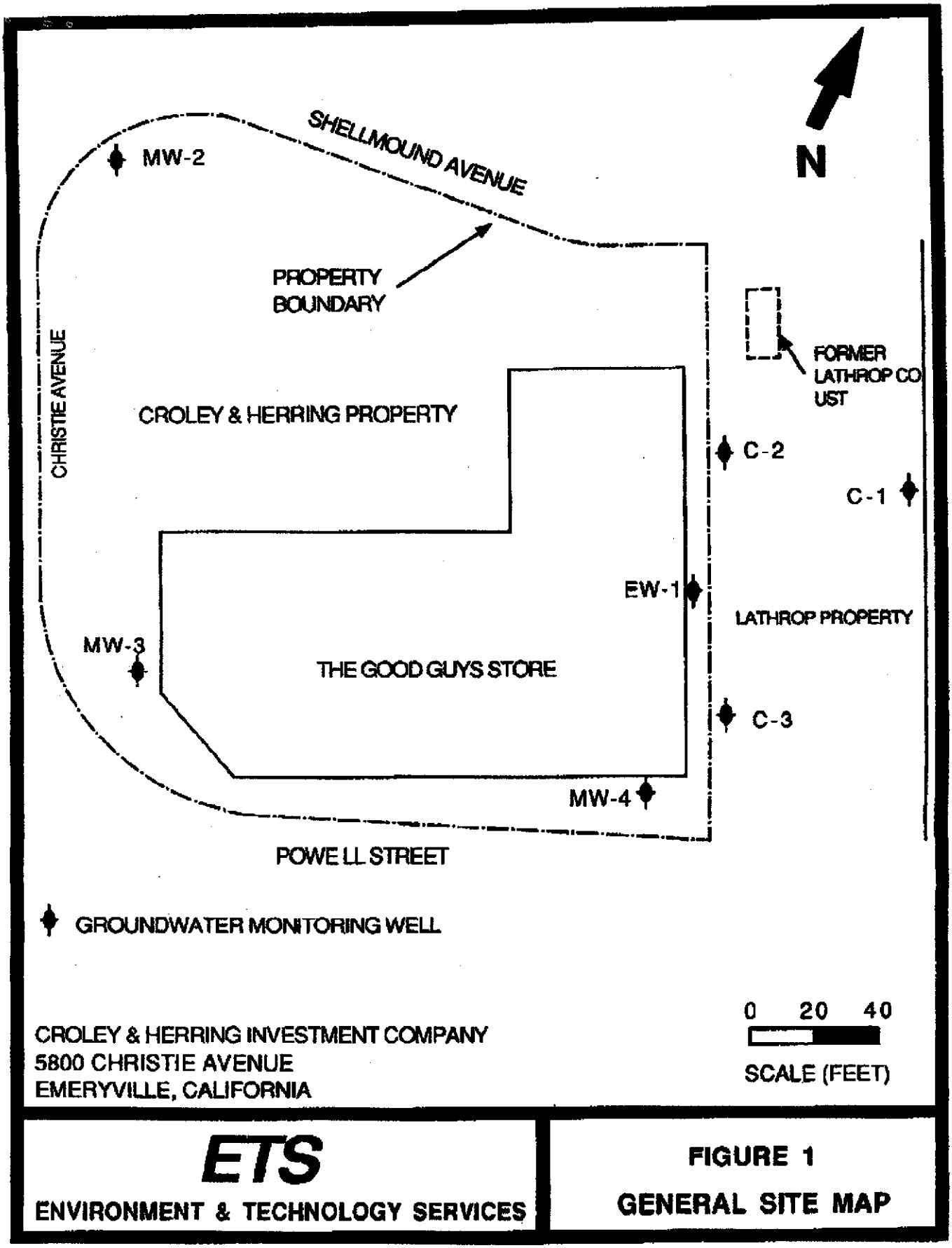
NA NOT ANALYZED
ND NOT DETECTED OR BELOW DETECTION LIMITS

TABLE 2

SUMMARY OF GROUNDWATER QUALITY
5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

TOTAL DISSOLVED SOLID (TDS) IN MG/L

	7/11/96
EW-1	2,590.00
MW-4	1,040.00
C1	1,350.00
C2	12,200.00
C3	492.00
AVERAGE	3,534.40



CROLEY & HERRING INVESTMENT COMPANY
5800 CHRISTIE AVENUE
EMERYVILLE, CALIFORNIA

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FIGURE 1
GENERAL SITE MAP

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER
DATE SAMPLED: 07/11/96
REPORTED TO: MR. DICK HERRING
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269
DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE ANALYZED: 07/11-17/96
DATE REPORTED: 07/17/96

SAMPLE I.D.: C-1 LAB I.D.: 960711-6

EPA 602 FOR PURGEABLE AROMATICS ANALYSIS; UNIT: UG/L (PPB)

PARAMETER	SAMPLE RESULT	DETECTION LIMIT X1
Benzene	ND	1
Toluene	ND	1
Ethylbenzene	ND	1
Xylenes, Total	ND	2
MTBE	ND	2

COMMENTS

ND = The concentration is below the detection limit or non-detected

Data Reviewed and Approved by: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL:(510)939-1118
PROJECT: CHIC
MATRIX: WATER DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96 DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: C-2 LAB I.D.: 960711-7

EPA 602 FOR PURGEABLE AROMATICS ANALYSIS; UNIT: UG/L (PPB)

PARAMETER	SAMPLE RESULT	DETECTION LIMIT X1
Benzene	4	1
Toluene	ND	1
Ethylbenzene	ND	1
Xylenes, Total	ND	2
MTBE	ND	2

COMMENTS

ND = The concentration is below the detection limit or non-detected

Data Reviewed and Approved by: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96 DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: C-3 LAB I.D.: 960711-8

EPA 602 FOR PURGEABLE AROMATICS ANALYSIS; UNIT: UG/L (PPB)

PARAMETER	SAMPLE RESULT	DETECTION LIMIT X1
Benzene	1,050	1
Toluene	113	1
Ethylbenzene	187	1
Xylenes, Total	116	2
MTBE	ND	2

COMMENTS

ND = The concentration is below the detection limit or non-detected

Data Reviewed and Approved by: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96 DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: MW4 LAB I.D.: 960711-9

EPA 602 FOR PURGEABLE AROMATICS ANALYSIS; UNIT: UG/L (PPB)

PARAMETER	SAMPLE RESULT	DETECTION LIMIT X1
Benzene	860	1
Toluene	76	1
Ethylbenzene	240	1
Xylenes, Total	130	2
MTBE	ND	2

COMMENTS

ND = The concentration is below the detection limit or non-detected

Data Reviewed and Approved by: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER
DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96
DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING
DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: C1 LAB I.D.: 960711-1

PARAMETER	SAMPLE RESULT, MG/L	D.L. (X1)	EPA METHOD
TOTAL DISSOLVED SOLIDS (TDS)	1,350	10	160.1

COMMENTS

MG/L = PPM
D.L. = DETECTION LIMIT
ND = BELOW THE DETECTION LIMIT OR NON-DETECTED

DATA REVIEWED AND APPROVED BY: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96 DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: C2 LAB I.D.: 960711-2

PARAMETER	SAMPLE RESULT, MG/L	D.L. (X1)	EPA METHOD
TOTAL DISSOLVED SOLIDS (TDS)	12,200	10	160.1

COMMENTS

MG/L = PPM
D.L. = DETECTION LIMIT
ND = BELOW THE DETECTION LIMIT OR NON-DETECTED

DATA REVIEWED AND APPROVED BY: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER
DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96
DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING
DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: C3 LAB I.D.: 960711-3

PARAMETER	SAMPLE RESULT, MG/L	D.L. (X1)	EPA METHOD
TOTAL DISSOLVED SOLIDS (TDS)	492	10	160.1

COMMENTS

MG/L = PPM
D.L. = DETECTION LIMIT
ND = BELOW THE DETECTION LIMIT OR NON-DETECTED

DATA REVIEWED AND APPROVED BY: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER
DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96
DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING
DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: MW4 LAB I.D.: 960711-4

PARAMETER	SAMPLE RESULT, MG/L	D.L.(X1)	EPA METHOD
TOTAL DISSOLVED SOLIDS (TDS)	1,040	10	160.1

COMMENTS

MG/L = PPM
D.L. = DETECTION LIMIT
ND = BELOW THE DETECTION LIMIT OR NON-DETECTED

DATA REVIEWED AND APPROVED BY: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER
DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96
DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING
DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: EW1 LAB I.D.: 960711-5

PARAMETER	SAMPLE RESULT, MG/L	D.L.(X1)	EPA METHOD
TOTAL DISSOLVED SOLIDS (TDS)	2,590	10	160.1

COMMENTS

MG/L = PPM
D.L. = DETECTION LIMIT
ND = BELOW THE DETECTION LIMIT OR NON-DETECTED

DATA REVIEWED AND APPROVED BY: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

Enviro - Chem, Inc.
1214 E. Lexington Avenue, Pomona, CA 91766 Tel (909) 590-5905 Fax (909) 590-5907

LABORATORY REPORT

CUSTOMER: CROLEY & HERRING CO., 353 BEACON RIDGE LANE, WALNUT CREEK, CA 94596 TEL(510)939-1118
PROJECT: CHIC
MATRIX: WATER
DATE SAMPLE REC'D: 07/11/96 (ETS)
DATE SAMPLED: 07/11/96
DATE ANALYZED: 07/11-17/96
REPORTED TO: MR. DICK HERRING
DATE REPORTED: 07/17/96
MR. WALTER LOO/ETS (FAX:310-498-2479) (415)861-3269

SAMPLE I.D.: EW1 LAB I.D.: 960711-10

EPA 602 FOR PURGEABLE AROMATICS ANALYSIS; UNIT: UG/L (PPB)

PARAMETER	SAMPLE RESULT	DETECTION LIMIT X1
Benzene	ND	1
Toluene	5,870	1
Ethylbenzene	13	1
Xylenes, Total	55	2
MTBE	ND	2

COMMENTS

ND = The concentration is below the detection limit or non-detected

Data Reviewed and Approved by: _____

CAL-DHS ELAP CERTIFICATE No.: 1555

ENVIRO-CHEM, INC. LABORATORIES
1214 E. Lexington Ave.
Pomona, CA 91766
(909) 590-5905 • Fax: (909) 590-5907

CHAIN of CUSTODY RECORD

Lab Project # _____

CA-DHS ELAP CERTIFICATE # 1555

DATE: _____

PAGE: _____ of _____

REPORT TO: WALTER Loo (ETS)	PROJECT NAME: CHIC	TURN AROUND TIME DESIRED: ☐ Same Day ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☒ 1 Week ☐ Standard (2 Weeks) ☐ Others: _____ Confirmed By: _____
STREET: 2203 OHIO AVE	PROJECT CONTACT: WALTER Loo	
CITY: LONG BEACH STATE: CA ZIP: 90806	SAMPLER(S) SIGNATURE:	
TEL: (310)9850830 FAX: (310)4982479		
SHIPPING INFORMATION:	AFTER ANALYSES, SAMPLES ARE TO BE: ☒ DISPOSED OF ☐ STORED (30 days) ☐ RETURNED TO CLIENT ☐ OTHER:	
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature) Jessica Lin	DATE: 7/11/96 TIME: 9:36 AM
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE: TIME:
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE: TIME:

SAMPLE I.D.	LAB I.D.	SAMPLING DATE/TIME	MATRIX	Nº of Containers	ANALYSIS REQUESTED	SAMPLE RECEIVED CONDITION	Sample Stored Location
C1	960711-1		Water	1 L	TDS	chilled	
C2	-2						
C3	-3						
MW4	-4						
EW1	-5						
C1	-6		Water	2 40ml	BTEX MTBE		
C2	-7						
C3	-8						
MW4	-9						
EW1	-10						

DISTRIBUTION: WHITE WITH REPORT • YELLOW TO COURIER

ATTACHMENT A

EXCERPTS GROUNDWATER REMEDIATION PROGRESS REPORT FEBRUARY 28, 1993

GROUNDWATER REMEDIATION PROGRESS REPORT

5800 CHRISTIE AVENUE,
EMERYVILLE, CALIFORNIA

FEBRUARY 28, 1993

SUBMITTED TO:

MR. BRIAN OLIVA
ALAMEDA COUNTY HEALTH CARE SERVICES
HAZARDOUS MATERIALS DIVISION
80 SWAN WAY, ROOM 200
OAKLAND, CALIFORNIA 94621

MR. RICHARD HIETT
BAY AREA REGIONAL WATER QUALITY
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2101 WEBSTER STREET, SUITE 500
OAKLAND, CALIFORNIA 94612

PREPARED FOR :

CROLEY & HERRING INVESTMENT COMPANY
448 THARP DRIVE,
MORAGA, CALIFORNIA 94556

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2081 15TH STREET,
SAN FRANCISCO, CALIFORNIA 94114
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C-0563

4.0 ELECTROCHEMICAL TREATMENT

Electrolysis and electro-osmosis are known electrochemical processes but little of the known technology have been applied in the remedial treatment of hazardous wastes. In-situ electrolysis can be applied in both permeable and impermeable media in the subsurface. It can be used as an in-situ neutralization process for pH control. It can also be used for electrochemical oxidation of organic compounds. In-situ electro-osmosis can only be applied with the presence of silty and clayey material in the subsurface. The mechanics of the electro-osmosis process is to cause imbalance of charge bonds in clayey material which results in clay compaction and chemcial desorption. The compaction and desorption processes will reduce the cleanup time and are particularly successful in the desorption of organic chemicals from clayey materials. In 1987, the electro-osmosis technique was applied to remove gasoline hydrocarbons in soils, (Van Doren and Bruell, 1987). A bench scale experiment was conducted to remove benzene using electro-osmosis. The laboratory study demonstrated the electro-osmostic process on removal of benzene from a water-saturated clay. Experimental results for benzene removal were compared with values predicted using a one-dimensional transport model which incorporated advection, dispersion and adsorption of the contaminant. The results indicated that electro-osmosis behaved as a hydraulic gradient and completely flushed benzene from the clay soil with pH decreased at the anode. Porosity of soil decreased in the vicinity of the anode but remained unchanged at the cathode. The electro-osmosis process proved to be an effective means of removing a contaminant from a relatively impermeable material.

An experiment was tried to desorb the organic chemicals from the clayey material and oxidize them in places near well EW-1 by the application of direct electrical current flow in the subsurface without pumping the groundwater. The experiment showed successful control of the flow of groundwater in the area and the total volatile organic compounds(VOCs) at one time reached below 4 ppm due to the induced electrochemical reactions between electrodes. **In particular, the benzene concentration was electrochemically oxidized to non-detect or less than 0.0005 mg/l.** The degree of the effectiveness and success on the halocarbons(TOX) cannot be assessed at this time because the readings were interfered with by the spreading of the upgradient gasoline plume.

However, the in-situ electrochemical treatment was effect where the underlying groundwater contains dissolved gasoline and hydrocarbons(BTEX) in the clayey Bay Mud. Three(3) electrode wells were installed for electrochemical treatment and groudwater sampling purposes.

During electrochemical treatment, groundwater samples in each of the wells were taken periodically. The samples were analyzed for pH, dissolved oxygen, temperature, and electrical conductivity in the field. These samples were also sent to a certified laboratory and analyzed for gasoline constituents, halocarbons, and other inorganic parameters. The electrical potential was supplied by a direct current electricity converter at 30 volts and a current of 7 amperes. No water was extracted from any of these wells throughout the demonstration period except for sampling. The initial concentration of TPH as gasoline and benzene in groundwater were 1.9 to 65 ppm and 0.002 to 1.2 ppm respectively. **After three(3) months of continuous passive in-situ electrochemical treatment, the TPH as gasoline and benzene were cleanup to less than 1.0 ppm and less than 0.0005 ppm respectively.** Cleaned up

5.0 BIOTREATMENT OF VOCs

Prevailing chlorinated solvents such as trichloroethene(TCE) and trichloroethane(TCA) can be found at most hazardous waste sites but there is no effective remedy to eliminate these compounds in a cost effective and timely manner. The pump and treat remediation method is only treating the symptoms of the problem in groundwater. The contaminated source area in soil or aquifer matrix is often neglected in site characterization and remediation efforts. Therefore, there are very few of these chlorinated solvents contaminated sites which have obtained case closure. The objective of this report is to demonstrate that such case closure can be obtained with known advanced biodegradation process.

Bioremediation can be defined as the utilization of naturally occurring bacteria to degrade hazardous organic compounds into non-hazardous compounds by the enhancement of the microbial ecology. The key parameters for the enhancement of the aerobic microbial ecology in soil and groundwater are oxygen, temperature, moisture and nutrients.

Successful laboratory demonstration of biodegradation of trichloroethene (TCE) by methanotrophic bacteria columns was achieved by EPA Ada Laboratory in 1985(Wilson, et al). In 1987, EPA Gulf Breeze Laboratory has successfully demonstrated the biodegradation of TCE by Pseudomonas putida through an aromatic pathway(Nelson, et al). In 1989, ETS successfully demonstrated the first field closure of the biodegradation of TCE and trichloroethane(TCA) together with toluene in soil through heat and nutrient enhancement by the growth of Bacilli and Pseudomonas fluorescens(Loo, 1991). In 1991, Standford University has demonstrated partial success on the biodegradation of TOX in groundwater by methanotrophic bacteria at Moffet Field, California(Roberts, et al). In 1988, a co-metabolic process was demonstrated in the laboratory on the biodegradation of TCE using glucose as a co-substrate which is non-toxic and non-hazardous(Vandenbergh, et al).

The biodegradation of chlorinated solvents (TOX) is a highly sought after solution to the widespread soil and groundwater contamination problems. However, most of the knowledge of biodegradation of TOX are found only in research laboratories. ETS is the pioneer in the applications of biodegradation of TOX in the field and had demonstrated this process two times at this site.

Underlying the site, there are indications that strong biodegradation activities are taking place in the subsurface. Prescribed amounts of glucose was added to the groundwater underlying the area to stimulate cometabolic biodegradation of the chlorinated solvents. The results of groundwater analysis showed reduction of the chlorinated solvents since the addition of the glucose.

This report presents the results of the successful demonstration of the glucose co-metabolic process on various chlorinated solvents(TOX) under the following conditions:

* **Laboratory bench scale** demonstration of TOX co-metabolic biodegradation using various sugar based co-substrate;

* **Ex-situ field demonstration** of the glucose co-metabolic process on TOX using granular activated carbon as the media;

* **In-situ passive biotreatment demonstration** of the glucose co-metabolic process on TOX in the silty and clayey Bay Mud "aquifer".

The glucose co-metabolic process is not only safe to use but also environmentally appealing because there is no addition of any toxic or hazardous chemicals into the subsurface.

5.1 LABORATORY BENCH SCALE DEMONSTRATION

A groundwater sample was collected from well EW1 of a property at Emeryville, California(Figure 1). The water was analysed for total heterotroph bacteria and specific bacteria identification. The total heterotrophic plate count is 2.12×10^5 CFU/ml. The predominant bacteria was identified as **Acidovorax facilis** by GC-FAME and **Alcaligenes faecalis Type II** by BIOLOG(Appendix A).

The GC-FAME microbial identification system is a fully automated gas chromatographic analytical system which identifies bacteria based on their unique fatty acid profiles. Because no subjective tests are required, the naming is highly objective and reproducible. All bacteria have a unique fatty acid composition. It is possible, using GC-FAME (Gas Chromatography Fatty Acid Methyl Ester) to identify bacteria to species and even subspecies on the basis of their fatty acid content. More than 300 fatty acids and related compounds have been found in bacteria analyzed in the laboratory. This large

number of fatty acids creates great 'naming' power within the system.The five steps to prepare GC ready extracts from a pure bacterial cultures are harvesting, saponification, methylation, extraction and base wash. The process removes the fatty acids from the cells and suspends them in a hexane base. This suspension is then injected into the GC where a flame detects the fatty acids. Each time a fatty acid is detected a peak is recorded on a chromatogram. By analyzing the peaks the GC data base can identify your bacteria. The data bases used to analyze the chromatograms consist of more than 60,000 analyses of strains obtained from experts and from culture collections. The cultures were collected from around the world to avoid potential geographic bias. Because the data bases are open ended the number of species in them is large and growing. The GC Microbial Identification System uses an external calibration mixture. This provides a quality control check throughout the analysis. The GC-FAME method of bacterial identification is by itself a precise method of bacterial identification.

The Biolog Microplate System for microbial identification and characterization by carbon source pattern recognition. The microplate technique allows us to characterize bacteria by 95 different carbon utilization tests on a single microplate. Each well in the microplate contains a carbon food source and a tetrazolium dye As the bacteria consume the carbon source in a well, the dye turns purple. Each species of bacteria creates a distinct pattern of purple dots that is recognized by the Biolog Microplate reader. To identify a given bacterial species, the bacteria (suspended in saline) are added to the microplate wells . The plates are incubated for 24 hours. and read in our microplate reader at 590 nm. The intensity of the purple color in each well is compared to a negative control well so that any purple color recorded above the control level is read as positive for the given carbon source. The dot pattern that results is the unique identification "signature" for the bacterial strain. The microplates are available for Gram negative (GN), Gram positive (GP) and E.coli/Salmonella (ES) Analysis. Custom analysis (MT) microplates are available and are particularly useful in performing Kinetic and Endpoint Assays We provide complete interpretation of all test results. The Biolog computer algorithms provide standardized settings which ensure repeatability and avoid any operator bias. We find the Biolog method to be excellent for strain characterization . When it is used in conjunction with the GC-FAME method, the combination.

The isolated bacteria was then used in the co-metabolic biodegradation of TCE with various sugars and their derivatives in an aerobic environment. The Kinetic and Endpoint assays enable us to measure the effectivness of specific bacteria to break down hydrocarbon contaminants such as gasoline,

(BTEX), diesel fuel, crude oil, pesticides, and other compounds (TCE, etc.). In all tests a 96 well microtiter plate is used to hold and incubate the bacteria in wells containing your contaminant(s) or a control medium. A dye present in the wells is activated by the microbe's oxidation of the carbon source. If your strains of bacteria utilize your contaminant(s), we will be able to measure that usage and growth by the color change and the increase in optical density of the well at 590 nm. In the Kinetics test, the optical densities are measured by a computerized optical reader every 10 minutes for 18 hours. Not only will this test tell you if your organism is using and breaking down the contaminant carbon sources, it will also tell you the rate at which the contaminant is being broken down. The Endpoint Assay is different only in that it does not tell you the rate at which the bacteria breaks down the contaminant. We use the same microtiter plates, incubated over night and the optical densities read once at 24 hours. This tells you whether or not your bacteria has broken down the carbon, and by how much, but not the rate at which it was done. The value of these tests is in their ability to project the effectiveness of a bacterium to break down a contaminant. This allows you to determine inexpensively the viability of bioremediation for a specific project. A Co-metabolic Study tells you which carbon sources will augment a bacterium's ability to breakdown a specific contaminant. Two microtiter plates, preloaded with 95 different carbon sources, are inoculated with the bacteria strain then the environmental contaminant is added to one plate. The plates are incubated, read and evaluated to determine which carbon source helped and which hindered the bacterium's ability to breakdown the contaminant.

The difference in growth activity for TCE with sugar and with sugar only will determine the stimulation efficiency of the particular sugar(Table 4). The following sugars and its derivatives have demonstrated superior co-metabolic stimulation on the biodegradation of TCE:

GLUCOSE-1-PHOSPHATE	2,3- BUTANEDIOL
URIDINE	ORNITHINE
TURINOSE	FRUCTOSE

5.2 EX-SITU FIELD DEMONSTRATION

This is a demonstration and closure of biodegradation of TOX in granular activated carbon(GAC) with the addition of glucose as a co-substrate. A total of ten 55-gallon drums of spent GAC were used for the demonstration. These spent GAC drums were used as emission control for a soil vapor extraction system (VES) established at 5800 Christie Street, Emeryville, California. The VES was closed in November, 1991. Due to the high

disposal cost of the GAC, the authors decided to decontaminated the volatile organic chemicals (VOCs) adsorbed on the 1500 pounds GAC which averaged about 100,000 ppm. The authors selected electrochemical oxidation of the VOCs (both TOX and gasoline) by the application electrolysis on the GAC. The electrolysis treatment has successfully reduced the VOC concentration by 99.9%. The gasoline compounds (BTEX) in the GAC was below detection limits after treatment. The residual TOX in the GAC after treatment was at 190.95 ppm which was not good enough for disposal to a Class III sanitary landfill.

A heat enhanced biodegradation process was employed to degrade the residual TOX in the GAC. Acidovorax facilis bacteria found in a nearby contaiminated groundwater monitoring well EW1 was introduced together with glucose, nutrient and hydrogen peroxide into the GAC. And the water in each GAC unit was circulated for about 2 weeks under full enhancement conditions. The TOX was biodegraded down to 0.79 ppm in the GAC. This reflects a 99.6% biodegradation efficiency. Table 5 presents the results of this ex-situ demonstration on various chlorinated solvents such as PCE, TCE, DCE, TCA, DCA, CHLOROFORM AND BROMODICHLOROMETHANE using the glucose co-metabolic biodegradation process. After passing the LC50 test, the cleaned, non-hazardous GAC was disposed to the West Contra Costa Landfill after regulatory approval.

5.3 IN-SITU PASSIVE BIOTREATMENT DEMONSTRATION

Based on the successful ex-situ demonstration, the process is extended to the subsurface via a passive in-situ biodegradation of a TOX contaminated aquifer. Figure 2 presents the in-situ biotreatment system. Figure 3 depicts a cross-sectional view of the in-situ biotreatment system.

Diluted solution of glucose and hydrogen peroxide was percolated through the system of steel perforated tubes below the shallow groundwater table. The solution was first introduced in September, 1992. After two rounds of quarterly sample analyses, TCE was biodegraded with better than 90% efficiency and DCE, TCA, DCA and vinyl chloride were completely biodegraded by this co-metabolic process. Table 6 presents a summary of this in-situ passive biotreatment demonstration results. This demonstration is still on going to date.

With TCE #1	With TCE #2	Ave With TCE		W/O TCE #1	W/O TCE #2	Ave W/O TCE	With - W/O TCE		Carbon source
1.607	1.544	1.5755		0.57	0.761	0.6655	0.91		Uridine
1.604	1.531	1.5675		0.661	0.689	0.675	0.8925	L-	Ornithine
1.611	1.614	1.6125		0.637	0.849	0.743	0.8695	2,3-	Butanediol
1.163	1.425	1.294		0.117	0.746	0.4315	0.8625		Turinose
1.367	1.696	1.5315		0.612	0.742	0.677	0.8545		Glucose-1-phosphate
1.161	1.544	1.3525		0.466	0.66	0.563	0.7895	D-	Fructose
1.151	1.627	1.389		0.54	0.719	0.6295	0.7595	a-	D-Lactose
1.152	1.623	1.3875		0.556	0.713	0.6345	0.753		Cellobiose
1.246	1.556	1.401		0.597	0.733	0.665	0.736		Hydroxy-L-proline
1.34	1.33	1.335		0.548	0.665	0.6065	0.7285		Glucuronamide
1.106	1.549	1.3275		0.549	0.654	0.6015	0.726	D-	Saccharic acid
1.095	1.463	1.279		0.527	0.611	0.569	0.71	L-	Arabinose
1.21	1.331	1.2705		0.552	0.573	0.5625	0.708		Maltose
1.364	1.364	1.364		0.637	0.689	0.663	0.701		Quinic acid

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TABLE 4

SUMMARY OF BENCH SCALE TCE CO-METABOLIC EVALUATION

TABLE 5

CO-METABOLIC BIODEGRADATION OF HALOCARBONS IN GRANULAR ACTIVATED CARBON

(All units in mg/Kg)

	BEFORE TREATMENT	AFTER TREATMENT
1,1 DCE	0.67	ND
cis 1,2 DCE	14.0	ND
1,1 DCA	3.8	0.16
CHLOROFORM	1.2	ND
1,1,1 TCA	89.0	ND
TCE	64.0	0.63
BROMODICHLOROMETHANE	18.0	ND
PCE	0.28	ND
TOX	190.95	0.79

Detection limit 0.005 mg/Kg

TOX DESTRUCTION EFFICIENCY 99.6%

C-0583

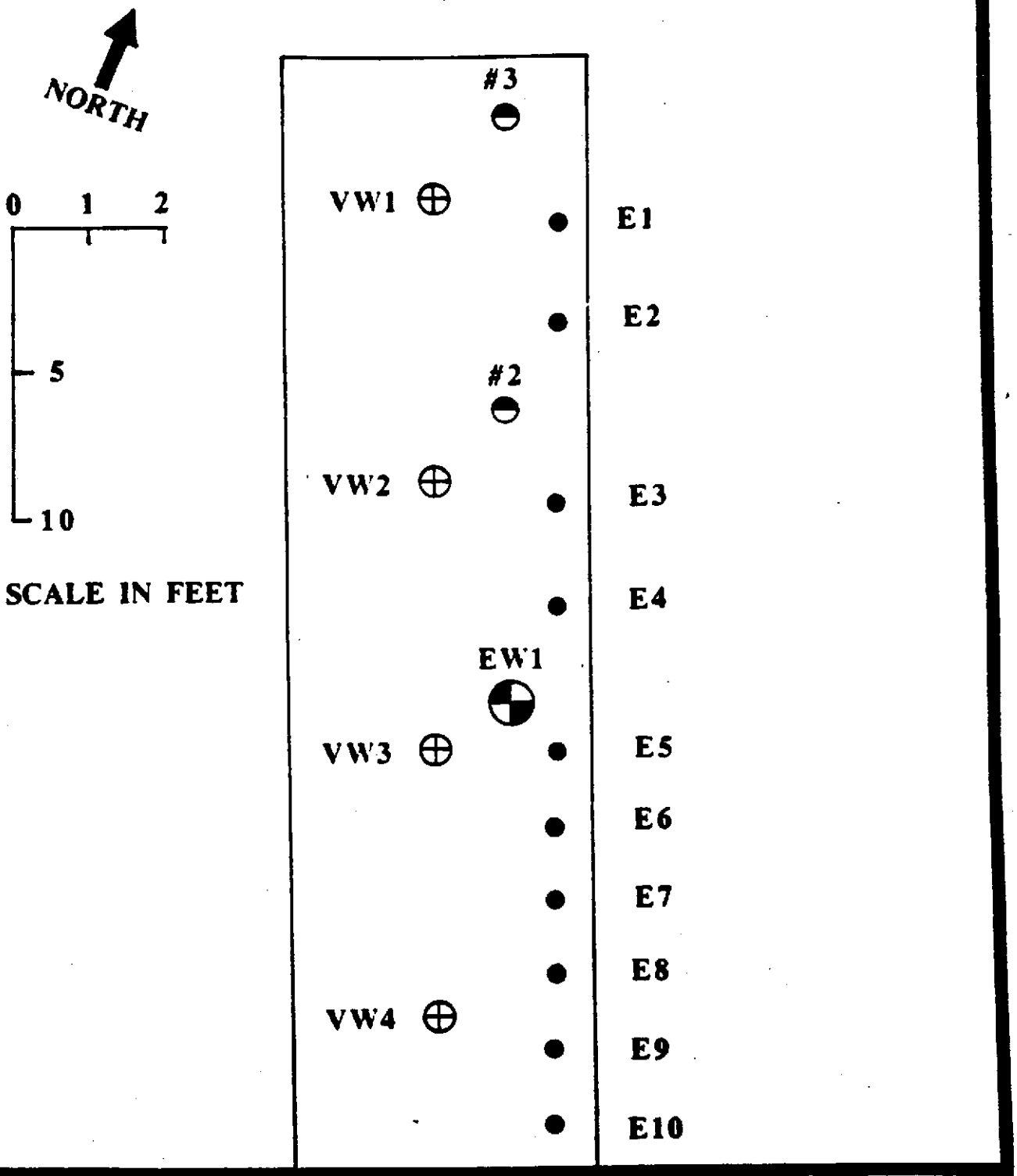

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FIGURE 2

IN-SITU TREATMENT SYSTEM

C-0584

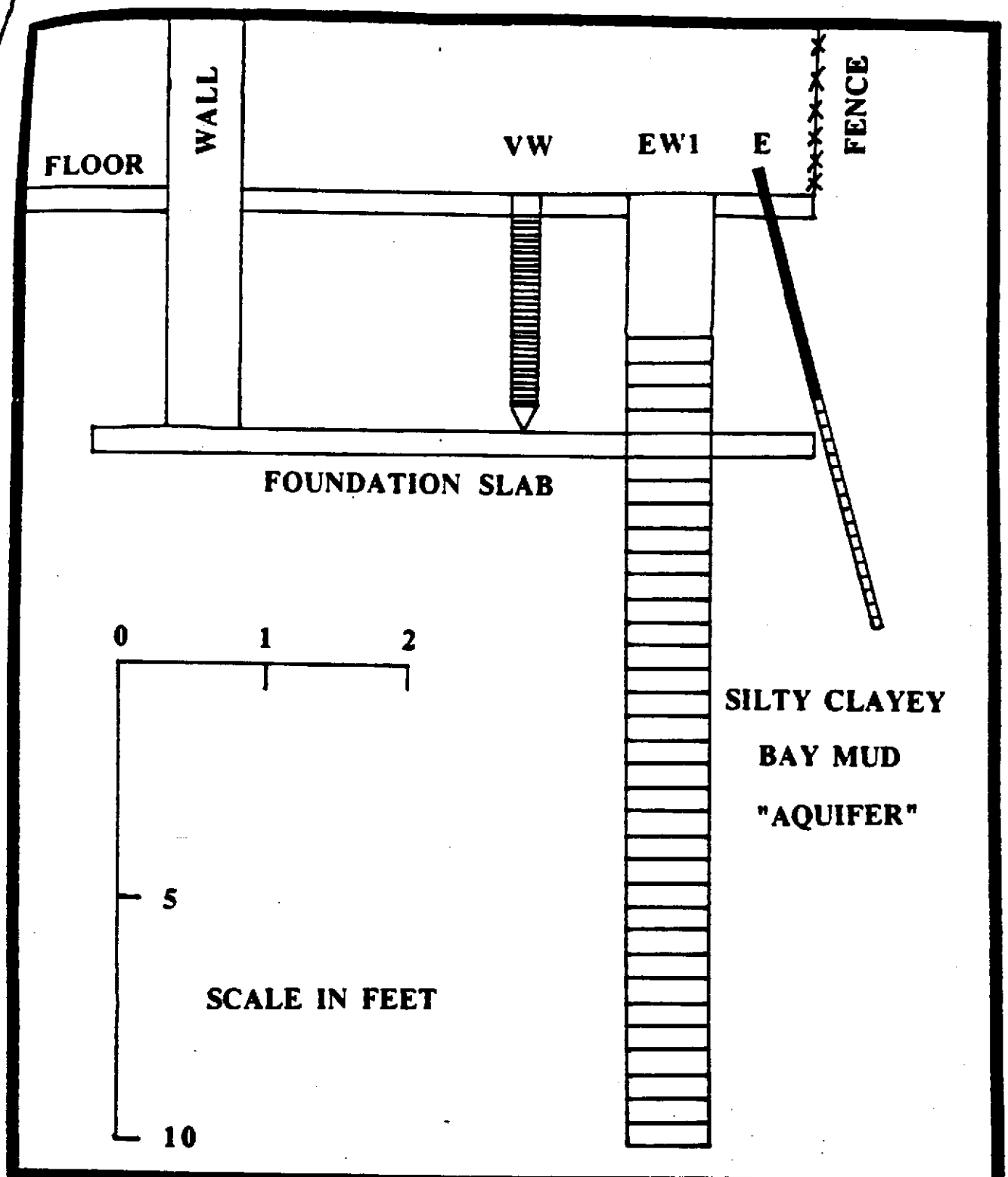

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FIGURE 3

CROSS-SECTION DIAGRAM

C-0585

TABLE 6

SUMMARY OF QUARTERLY GROUNDWATER QUALITY RESULTS OF WELL EW-1 5800 CHRISTIE AVENUE, EMERYVILLE, CALIFORNIA

CONCENTRATIONS IN MG/L

COMPOUNDS	7/15/92	10/19/92	1/11/93	DESTRUCTION EFFICIENCY
TPH as GASOLINE	100.0	26.0	20.0	80%
BENZENE	ND	ND	ND	---
TOLUENE	4.7	12.5	7.5	40%
XYLENES	ND	ND	ND	---
ETHYLBENZENE	ND	ND	0.075	NEGATIVE
HALOCARBONS	2.461	5.07	0.065	98.7%
PCE	ND	ND	0.042	NEGATIVE
TCE	0.68	0.27	0.023	96.6%
1,1 DCE	ND	4.8	ND	100%
1,2 DCE	0.6	ND	ND	100%
1,1,1 TCA	0.42	ND	ND	100%
1,1 DCA	0.6	ND	ND	100%
1,2 DCA	0.11	ND	ND	100%
VINYL CHLORIDE	0.15	ND	ND	100%
CHLOROETHANE	ND	ND	ND	---
MET. CHLORIDE	ND	ND	ND	---
TOTAL VOCs	102.461	31.07	20.065	80.4%

NA NOT ANALYSED
ND NOT DETECTED OR BELOW DETECTION LIMITS
VOCs VOLATILE ORGANIC COMPOUNDS (TPH PLUS TOX)

ATTACHMENT B

INDOOR VAPOR MONITORING RECORDS

the good guys!
AUDIO/VIDEO SPECIALISTS

April 15, 1996 **Via Federal Express**

Mr. Dick Herring
Croley & Herring Investments
353 Beacon Ridge Lane
Walnut Creek, CA 94593

RE: **The Good Guys**
Emeryville, CA

Dear Dick,

In response to your request for information regarding the methane detection system installed in The Good Guys Emeryville store, I am not aware of any instance where the system was activated by the release of methane gas.

If there is any further information you require, please feel free to contact me.

Sincerely,

Ted Meehan
Manager, Real Estate and Facilities

8.4 APPENDIX D - COMBUSTIBLE GAS SCALING FACTORS

NOTE: SCALING FACTORS ARE NOT FMRC APPROVED

For combustible gas monitoring, a calibration standard of Methane or Propane my be used in conjunction with scaling factors to cause *SENTRY* concentration display and alarm function in %LEL scale of another gas as follows:

GAS	METHANE FACTOR	PROPANE FACTOR
Acetaldehyde	60	92
Acetic Acid	54	102
Acetic Anhydride	46	120
Acetone	52	107
Acetylene	57	97
Alkyl Alcohol	51	108
Ammonia	126	44
n-Amyl Alchohol	33	169
Aniline	39	140
Benzene	41	136
Biphenyl	25	221
1,3-Butadiene	56	99
n-Butane	58	94
iso-Butane	52	107
Butene-1	45	122
cis-Butene-2	48	114
trans-Butene-2	51	109
n-Butyl Alcohol	34	161
iso-Butyl Alcohol	53	104
tert-Butyl-Alcohol	74	74
n-Butyl Benzene	31	176
iso-Butyl Benzene	32	173
n-Butyric Acid	38	145
Carbon Disulfide	18	312
Carbon Monoxide	75	73
Carbon Oxysulphide	93	59
Cyanogen	89	62
Cyclohexane	41	134
Cyclopropane	62	89
n-Decane	33	168
Diethylamine	49	113
Dimethylamine	58	96
2,3-Dimethylpentane	40	139
2,3-Dimethylpropane	40	139
Dimethylsulphide	43	127
1,4-Dioxane	45	124
Epichlorohydrin	45	123
Ethane	68	82
Ethyl Acetate	51	108
Ethyl Alcohol	73	76
Ethylamine	53	105
Ethyl Benzene	36	155
Ethyl Bromide	91	61
Ethyl Chloride	57	97
Ethylcyclopentane	40	139
Ethylene	71	78
Ethylenedichloride	66	83
Ethyleneoxide	52	107

GAS	METHANE FACTOR	PROPANE FACTOR
Diethyl Ether	46	119
Dimethoxyethane	42	133
Dimethyl Ether	63	88
Dimethylformamide	46	119
Ethyl Formate	44	125
Ethylmercaptan	56	98
n-Heptane	39	143
n-Hexane	37	150
Hydrazine	45	123
Hydrogencyanide	48	116
Hydrogen	77	72
Hydrogen Sulphide	41	136
Methane	100	55
Methyl Actetate	50	111
Methyl Alcohol	86	64
Methylamine	77	71
Methyl Bromide	90	62
Methyl Chloride	102	54
Methylcyclohexane	44	125
Methylenedichloride	93	59
Methylethylether	44	125
Methylethylketone	41	134
Methyl Formate	67	82
Methylmercaptan	61	91
Methylpropionate	51	108
Methyl n-propylketone	40	136
Napthalene	34	162
Nitromethane	34	162
n-Nonane	31	176
n-Octane	37	147
n-Pentane	46	120
i-Pentane	46	119
Propane	55	100
n-Propyl Alcohol	47	117
n-Propylamine	48	114
n-Propylchloride	50	111
Propylene	52	107
Propyleneoxide	46	121
iso-Propylether	44	127
Propyne	42	133
Toluene	40	137
Triethylamine	40	139
Trimethylamine	48	114
Vinylethylether	42	132
o-Xylene	36	154
m-Xylene	39	141
p-Xylene	39	141
JP-4 (Jet Fuel)	41	134

NOTES:

1. Base data source: EEV sensor specification catalog. (EEV claims some data is the result of specific tests, other data is empirically derived.)
2. Calculation and Conversion Method:
   Methane Factor is Base Data Normalized to Methane at 100.
   [Base Data of New Gas (x)/Base Data of Methane (112)]
   Propane Factor is Methane Data Normalized to Propane at 100.
   [Methane Factor for Propane (55)/Methane Factor of New Gas (y)]

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

RAFAT A. SHAHID, Assistant Agency Director

DEPARTMENT OF ENVIRONMENTAL HEALTH
Hazardous Materials Division
80 Swan Way, Rm. 200
Oakland, CA 94621
(510) 271-4320

March 15, 1993

Crowley & Herring Investment Co.
448 Tharp Drive
Moraga, CA 94556

Subject: 5800 Christie, Emeryville, CA 94608

Dear Mr. Herring:

This letter is in response to your request for this office to concur with the discontinuation of the methane gas monitoring in the "Good Guys" electronics store located at the above site. In light of the fact that since the installation of the Sierra Monitor Model 5000 Methane Gas Detection System in 1989, that the system has never indicated any significant levels of methane, this office concurs with your contention that the monitoring may be discontinued.

Please be advised that such monitoring is strictly voluntary, and has never be regulated by this office. The monitoring has taken place at the request of your lessee, the "Good Guys". If you have any questions concerning any possible health risks at the site I suggest you contact an industrial hygienist.

If, however, there is any change in the conditions noted at the site, please contact this office immediately. The number is (510) 271-4320.

Sincerely,

Brian P. Oliva

Brian P. Oliva, REHS, REA
Hazardous Materials Specialist

cc: Frank Verni, % The Good Guys, 5800 Christie, Emeryville, CA
Ed Howell/files

C-1472

TELSTAR ☆

1717 Solano Way • Unit 34 • Concord, California 94520 • (510) 671-2888 • FAX No. (510) 671-9507

February 10, 1993

The Good Guys
5800 Christie Ave.
Emeryville, CA 94608

Attn: Frank Verni
Subj: Gas Detection Calibrations
Ref: SR 5159

Dear Frank:

As you know, Telstar has been calibrating your Sierra Monitor Model 5000 Methane Gas Detection system at the Emeryville facility since November, 1989. We have experienced no problems with the system, other than the failure of the power supply that was repaired in November of 1991. We were never called out for any alarms on the system, and basically during our calibrations found no problems, other than the power supply.

If you have any questions, please contact me at 510-671-2888.

Sincerely,

June Johnson

Dan Mensing
Regional Manager

DM/jj

cc: Croley & Herring Inv. Co. % Dick Herring
Alameda County Health Dept. % Brian Oliva

C-1473

the good guys!

2/7/93

To Whom it May Concern —

This is to advise you that the Tekstan Unit in my store has not indicated any traces of methane (any gas) since July '91 which was my 1st day as Store Manager at Emeryville.

Any questions please call me at 510-547-6350

Frank J Verni
Store Mgr.

ATTACHMENT C

SHALLOW GROUNDWATER DATA

DAYS INN HOTEL SITE

1603 POWELL STREET
EMERYVILLE, CALIFORNIA

RESULTS OF THE SOIL AND GROUNDWATER SAMPLING AND ANALYSIS CONDUCTED AT THE DAYS INN HOTEL 1603 POWELL STREET EMERYVILLE, CALIFORNIA

May 27, 1993

Prepared for:

Bank of America
Environmental Services #4122
555 Anton Boulevard, Suite 1025
Costa Mesa, California 92626

Prepared By:

Saulius Germanas, RG
Senior Associate Geoscientist

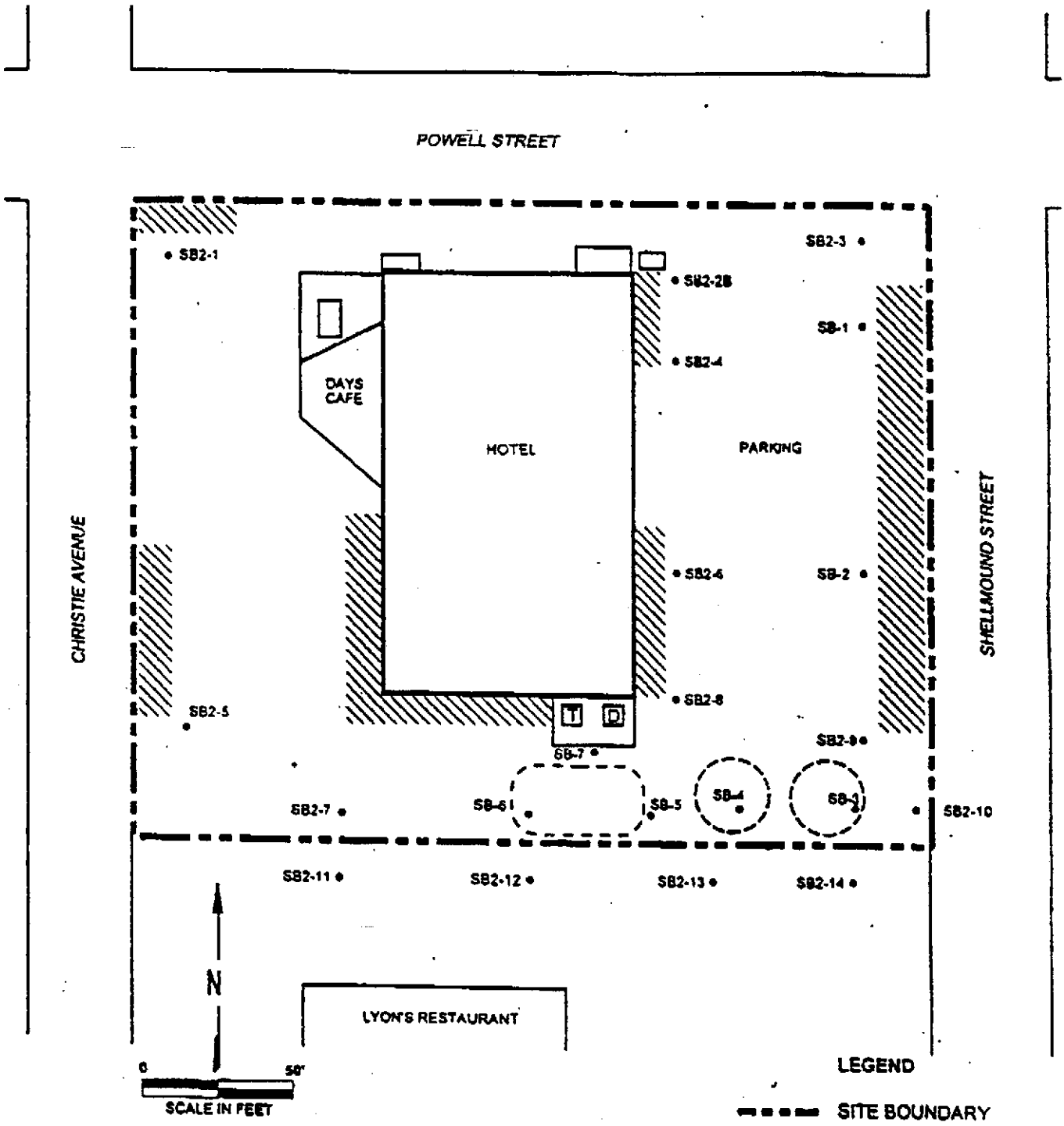
Reviewed By:

Jean M. Christensen, REA
Manager, Environmental Assessments
Supervising Geoscientist

0401dsb3

McLaren Hart sm
ENVIRONMENTAL ENGINEERING CORPORATION

FIGURE 3
SOIL BORING LOCATION
DAYS INN HOTEL
1603 POWELL STREET
EMERYVILLE, CALIFORN



REV: 03-25-93
Unit-Emeryll/5-93r3

McLaren Hart

Table 1
Groundwater Sample Analytical Results
Days Inn Hotel
1603 Powell Street
Emeryville, California

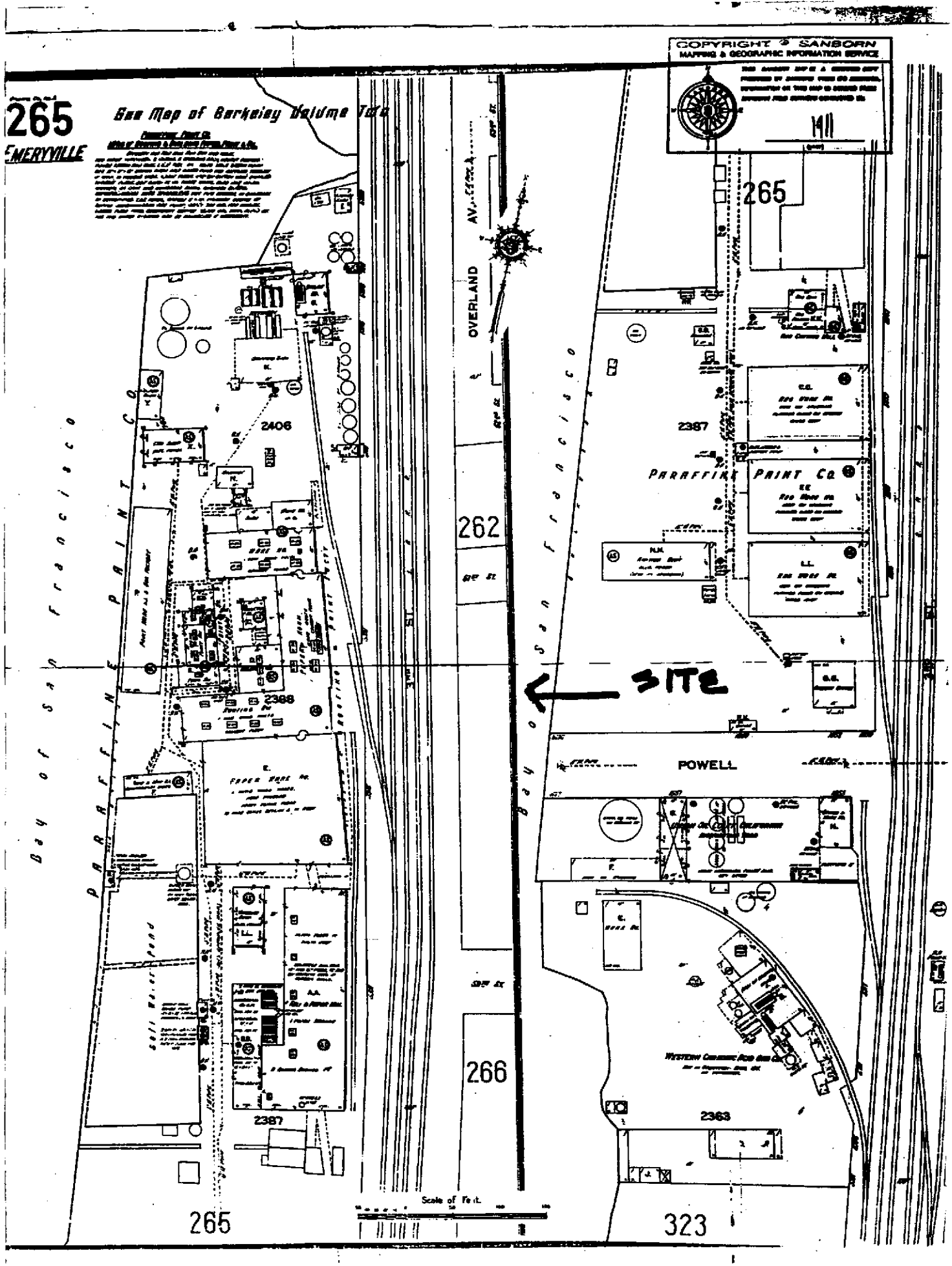
Boring Number	Date	LAB	Total Petroleum Hydrocarbons					Oil and Grease (ppm)	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)
			Gasoline (ppm)	Diesel (ppm)	Kerosene (ppm)	Motor Oil (ppm)	Jet Fuel (ppm)					
SB2-1	5/4/93	GEL	NA	<0.050	NA	NA	NA	7,506	<0.5	<0.5	<0.5	<0.5
SB2-2B	5/4/93	GEL	NA	9.270	NA	NA	NA	12	<0.5	<0.5	<0.5	451
SB2-2B (Dup)	5/4/93	MBT	<0.500	<0.500	<0.500	7.400	<0.500	NA	NA	NA	NA	NA
SB2-3	5/4/93	GEL	NA	<0.050	NA	NA	NA	<1	<0.5	<0.5	<0.5	<0.5
SB2-4	5/4/93	GEL	NA	<0.050	NA	NA	NA	126	<0.5	<0.5	<0.5	<0.5
SB2-5	5/5/93	GEL	NA	<0.050	NA	NA	NA	<1	<0.5	<0.5	<0.5	<0.5
SB2-5 (Dup)	5/5/93	MBT	<0.500	<0.500	<0.500	2.500	<0.500	NA	NA	NA	NA	NA
SB2-6	5/5/93	GEL	<0.050	<50	NA	NA	NA	2	<0.5	<0.5	<0.5	<0.5
SB2-7	5/5/93	GEL	<0.050	<50	NA	NA	NA	<1	<0.5	<0.5	<0.5	<0.5
SB2-8	5/4/93	GEL	9.30	273.60	NA	NA	NA	300	834.1	713.7	1,495.4	3,520.3
SB2-9	5/4/93	GEL	<0.050	<50	NA	NA	NA	<1	<0.5	<0.5	<0.5	<0.5
SB2-10	5/4/93	GEL	<0.050	<50	NA	NA	NA	46	<0.5	<0.5	<0.5	<0.5
SB2-11	5/5/93	GEL	<0.050	<50	NA	NA	NA	<1	<0.5	<0.5	<0.5	<0.5
SB2-12	5/5/93	GEL	<0.050	<50	NA	NA	NA	<1	<0.5	<0.5	<0.5	<0.5
SB2-12 (Dup)	5/5/93	MBT	<0.500	<0.500	<0.500	2.00	<0.500	NA	NA	NA	NA	NA
SB2-13	5/5/93	GEL	<0.050	<50	NA	NA	NA	<1	<0.5	<0.5	<0.5	<0.5
SB2-14	5/5/93	GEL	<0.050	<50	NA	NA	NA	<1	<0.5	<0.5	<0.5	<0.5
SB2-14 (Dup)	5/5/93	MBT	<0.500	<0.500	<0.500	6.00	<0.500	NA	NA	NA	NA	NA

< = Compound not detected at or above laboratory reporting limit
na = Not analyzed
(Dup) = Duplicate sample for analysis
GEL = Geochem Environmental Laboratories
MBT = MBT Environmental Laboratories
ppm = Parts per million
ppb = Parts per billion

ATTACHMENT D

HISTORIC

SANBORN MAPS


265
EMERYVILLE
Base Map of Berkeley Volume Two
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265
OVERLAND AV.
2406
2387
PARAFFINE PRINT Co
262
SITE
POWELL
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2363
Scale of Feet
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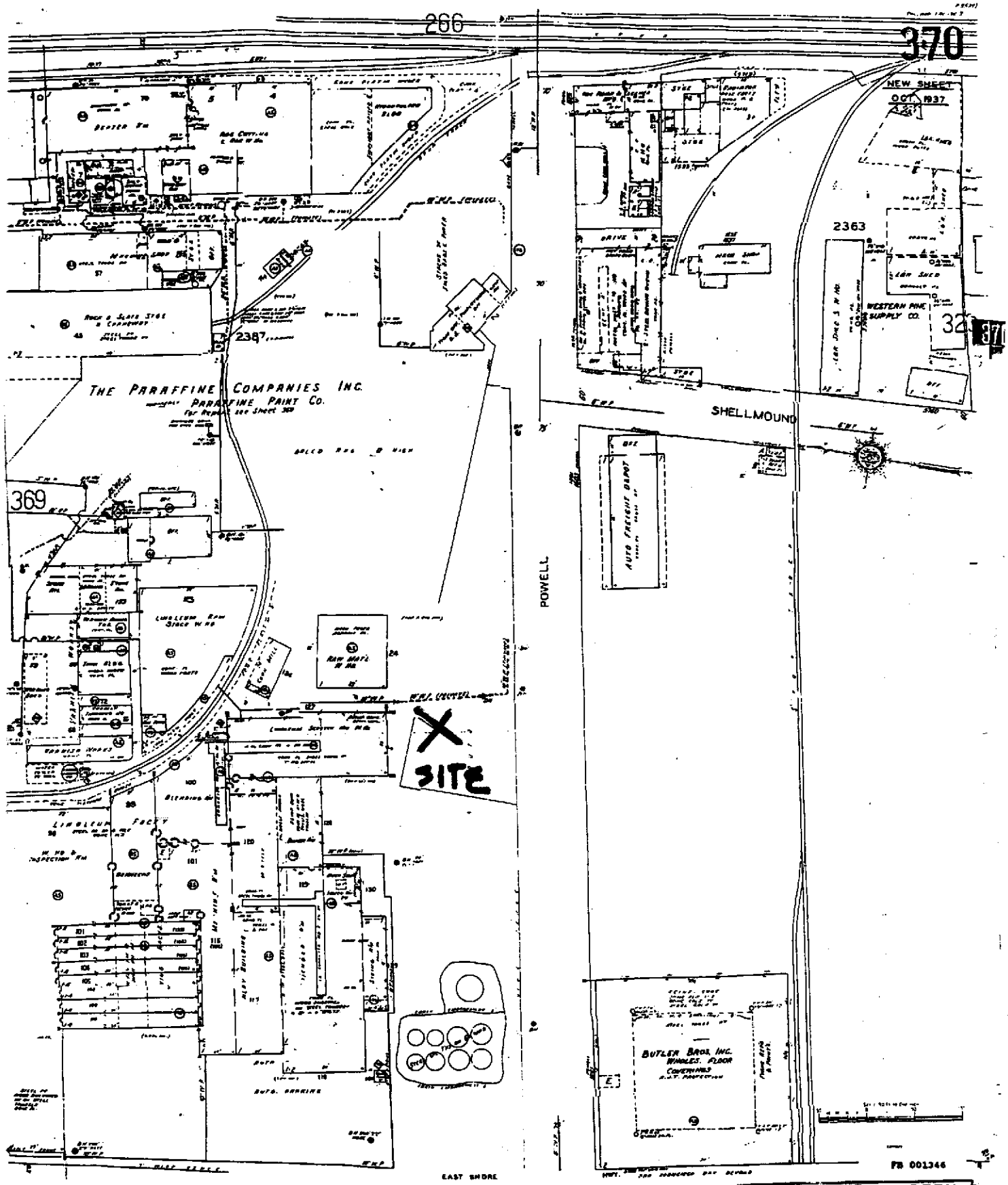

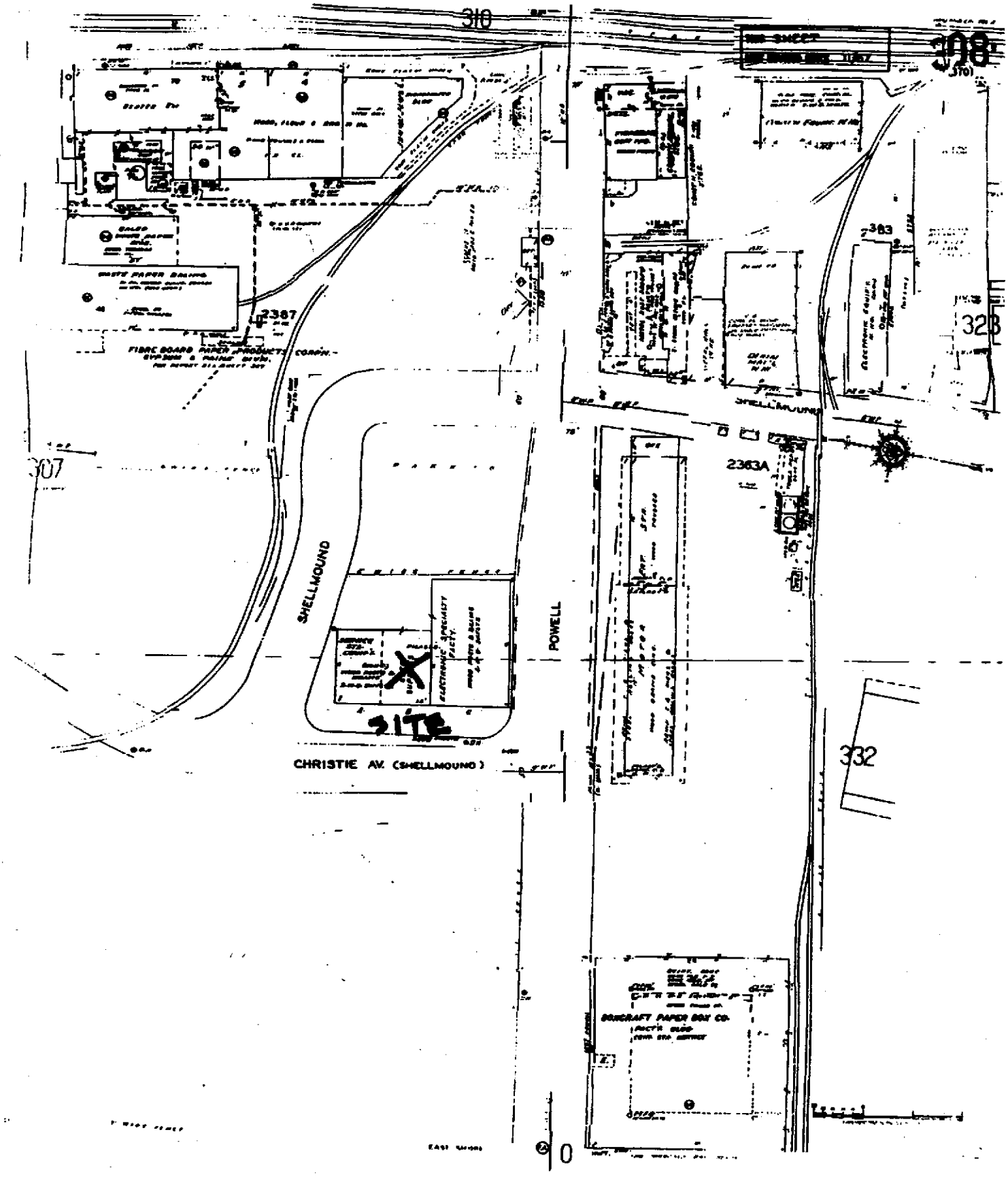
310
308
307
2387
383
328
2363A
SHELLMOUND
POWELL
SITE
CHRISTIE AV. (SHELLMOUND)
332
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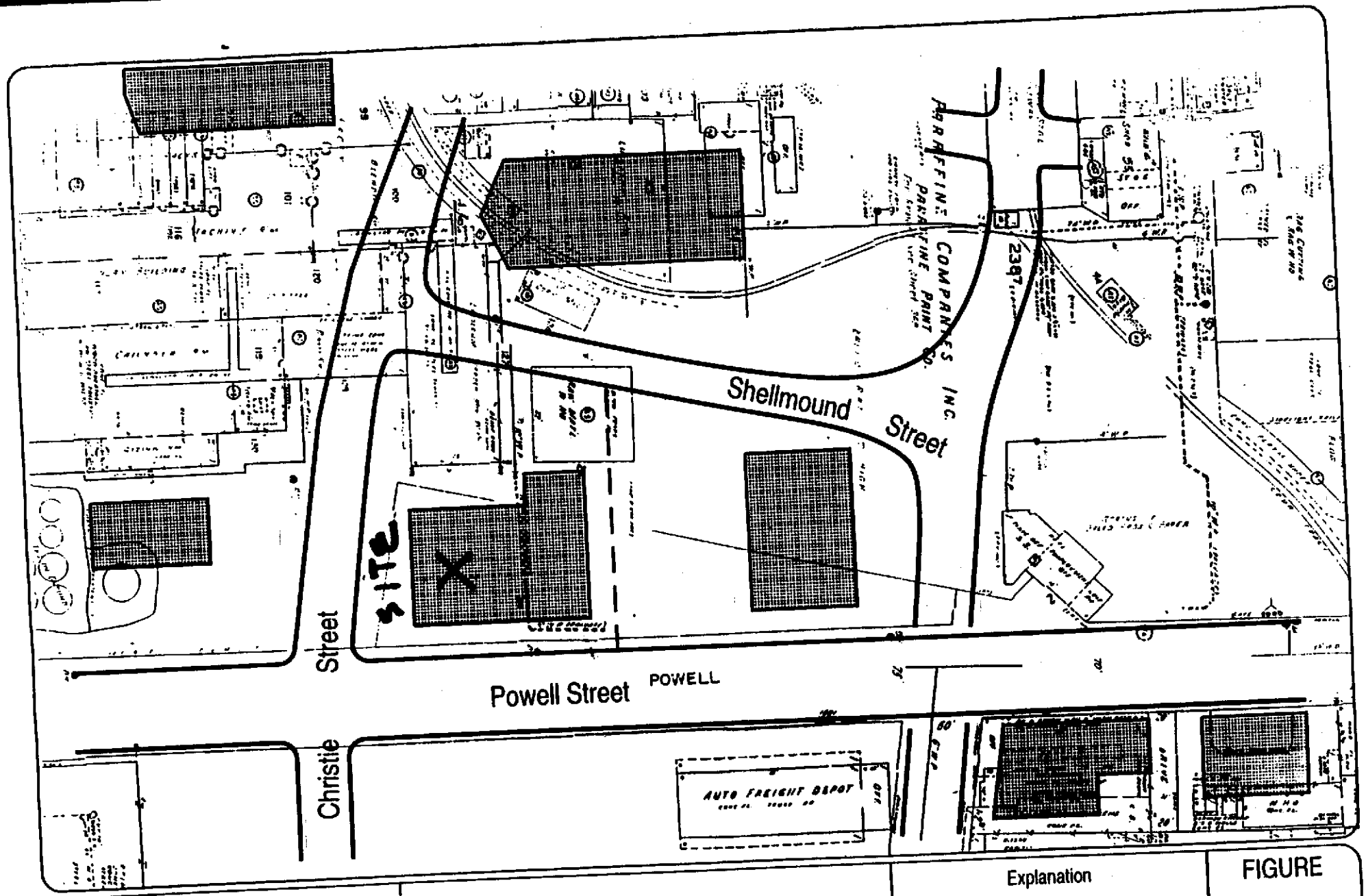

CAMBRIA
Environmental Technology, Inc.

Location of Structures Shown on 1951 Sanborn Map

5813-15 Shellmound Street
Emeryville, California

Explanation

Existing Building (1995)

FIGURE
2