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SEMI-ANNUAL CORRECTIVE ACTION ASSESSMENT INTERIM MEASURES PROGRESS REPORT FOR SITE 11 NSB KINGS BAY GA

10/1/1999

BECHTEL ENVIRONMENTAL

SEMIANNUAL CORRECTIVE ACTION ASSESSMENT/ INTERIM MEASURES PROGRESS REPORT MAY–SEPTEMBER 1999

SITE 11, OLD CAMDEN COUNTY LANDFILL NAVAL SUBMARINE BASE KINGS BAY, GEORGIA

Prepared for

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

Under Contract No. N62467-93-D-0936

Bechtel Job No. 22567

Prepared by

BECHTEL ENVIRONMENTAL, INC.
151 LAFAYETTE DR.
OAK RIDGE, TENNESSEE

October 1999

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REVISION 0

The work described and professional opinions rendered in this document, *Semiannual Corrective Action Assessment / Interim Measure Progress Report May - September 1999, Site 11, Old Camden County Landfill, U.S. Naval Submarine Base, Kings Bay, Georgia, October 1999, Revision 0,* were conducted and developed using commonly accepted procedures consistent with applicable standards of practice. The scope of services and activities described in this document were developed under the supervision of a professional geologist registered in the State of Georgia.

Mark A. Gage
Professional Geologist
State of Georgia License No. 001167
Expires December 31, 1999

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TABLES

ATTACHMENTS

1.0 INTRODUCTION

Bechtel Environmental, Inc. (Bechtel) has been contracted by the Department of the Navy, Naval Facilities Command, Southern Division, to provide remedial services as the Navy's Environmental Response Action Contractor. Under Delivery Order 109, Task 1, of the Prime Contract N62467-93-D-0936, Bechtel has been contracted to conduct Interim Measures for remediation of source area contaminated ground water at Site 11, Old Camden County Landfill at the Naval Submarine Base (NSB) Kings Bay.

This Semiannual Corrective Action Assessment Report summarizes the Interim Measures, monitoring activities, and remediation progress during May 1 to September 30, 1999. The report presents; (1) Phase 2 in-situ chemical oxidation treatment; (2) geoprobe investigation of a suspected source area immediately east and adjacent to injector I-14; (3) suspected source area excavation; (4) sampling and analyses; (5) overall status of remediation; and (6) projected work for the next reporting period.

2.0 SUMMARY OF ACTIVITIES

Activities during this period included Phase 2 in-situ, chemical oxidation treatment, geoprobe testing and groundwater analyses, and suspected source area excavation. Groundwater sampling and analyses of treatment area wells and injectors were conducted monthly. Analytical results are discussed in section 3.0.

2.1 PHASE 2 IN-SITU CHEMICAL OXIDATION

During May 20 to May 27, 1999, Bechtel and subcontractor Geo-Cleanse International, Inc. installed injectors I-24 through I-44 (Figure 1) to perform Phase 2 treatment. Areas targeted for Phase 2 treatment are east (upgradient) and west (downgradient) of the Phase 1 area of concern. These target areas show total chlorinated ethene concentrations either exceeding or close to exceeding the target concentration of 100 µg/L. The first injection event was performed during June 3 through 11, 1999. During this event, approximately 8,286 gallons of 50% hydrogen peroxide and an equivalent volume of ferrous iron catalyst were injected. The second injection event was performed during July 12 through 15, 1999 and involved approximately 2,964 gallons of 50% hydrogen peroxide and an equivalent volume of ferrous iron catalyst. To evaluate treatment performance, pre- and post-injection groundwater samples were collected and submitted to ENCO laboratory of Jacksonville, Florida for chlorinated hydrocarbon analysis. One pre–injection (May) and one post-injection (June) sampling were performed for the first injection, and two post-injection (July & August) samplings were performed for second injection. Groundwater samples were collected from two source area monitoring wells (KBA-11-34 & 36), selected source area injectors, five perimeter monitoring wells, and two recovery wells. The results are discussed in Section 3.0, Analytical Data. Details of Phase 2 treatment

are presented in the Final Effectiveness Evaluation Report Geo-Cleanse Treatment Program Phase II provided as Attachment 1.

2.2 GEOPROBE INVESTIGATION

A geoprobe investigation was performed to investigate the source of tetrachloroethylene (PCE) rebounding (increasing concentration) in injector I-14. Analytical results from the August 1999; post-treatment sampling showed PCE concentrations of 1600 µg/L and 2400 µg/L at I-14. These results were significantly higher than July's result of 110 µg/L.

Bechtel subcontracted with Probe Domain of Jacksonville, FL to provide the equipment and labor to collect groundwater samples at the area immediately east of I-14. Probe Domain subcontracted with Analytical Laboratories of Florida, Inc., of Cocoa, FL to provide a mobile laboratory for onsite sample analyses.

Bechtel arrived onsite on August 30, 1999 to layout a grid system for sample locations. Grid points were established at 5-ft intervals and in a north-south and east-west direction. Groundwater samples were collected at 16 locations, GP-1 through GP-16 (Figure 2). Probe Domain provided a truck mounted Geoprobe™ Model 5400 direct push machine for collecting groundwater samples. The equipment advanced an enclosed screen by pushing 1 ¼-inch outside diameter, 4-ft sections of steel rod to a depth of 30 to 33 ft below grade (bg). Once the depth of investigation was reached, the rods were pulled back, exposing a 3-ft, stainless steel, 0.004-inch wire wrapped screen. A ¼-inch inside diameter, polyethylene tube was positioned near the center of the screen and connected at the surface to a peristaltic pump. Approximately 2 gallons of groundwater were purged through the screen prior to collecting the sample. After purging, the lower end of the tube was removed from the screen and upper end disconnected from the peristaltic pump. The sample was then collected by allowing the groundwater to gently flow out the lower end of the tube and into the sample container. After collecting the initial sample from the lowest interval, the screen was pulled up the hole to the next sampling interval. A new piece of polyethylene tubing was positioned near the center of the screen and the purge and sample process was repeated. Groundwater samples were collected at depths of 21 - 24 ft, 24 - 27 ft, and 27 - 30 ft bg at each location. Additional samples from depths of 11 - 14 ft, 15 –18 ft, 18 –21 ft, and 30 – 33 ft were collected at selected locations as directed by Bechtel. After all samples were collected at a location, the screen was removed from the hole and the hole was backfilled with a cement grout.

Collected samples were immediately provided to the onsite mobile laboratory under chain of custody protocol. The samples were submitted for volatile organic analyses, targeting chlorinated ethenes using EPA method 8021. Specific compounds analyzed included tetrachloroethylene, trichloroethylene, cis-1,2-dichloroethene, trans 1-2-dichloroethene, 1,1-dichloroethene, vinyl chloride, benzene, and chlorobenzene. Two of the samples analyzed onsite were duplicated and sent to ENCO Laboratories for confirmation analyses. A maximum concentration of 99,000 µg/L was observed approximately 12-ft southeast of I-14 at a depth of 27 to 30 ft below grade.

Analytical results are summarized in section 3.2. A copy of the Geoprobe Investigation Report is provided as Attachment 2.

2.2 SOURCE AREA EXCAVATION

Excavation of the suspected source area near injector I-14 was approved by the Navy based on the results from the previous geoprobe investigation. On September 21, 1999, a 20-ft x 30-ft x 8-ft deep area immediately east of I-14 was excavated. All excavated material was placed on 10-mil poly sheeting to prevent contact with the ground surface. The material was visually inspected for containers and scanned with a photoionization meter to check for organic vapors. The excavation yielded several 5-gallon containers and one approximate 20-gallon container. All containers were either crushed or severely deteriorated except one 5-gallon container. The uncrushed 5-gallon container appeared to contain a gray-colored paint waste. The 20-gallon container contained a black sludge looking waste. Two samples of the waste were collected, one from a 5-gallon and one from the 20-gallon container, and submitted to ENCO Laboratories for chemical analyses. The results for the black waste showed PCE with the highest concentration of all compounds tested. The excavated containers were placed in a poly-drum overpack for disposal by the base public works contractor. All other material was returned to the excavation and compacted with the excavator, and a 2-foot layer of clean soil was placed on top of the refuse. A copy of the Source Area Excavation report is provided as Attachment 3.

3.0 ANALYTICAL DATA

This section provides a summary of the analytical results associated with sampling and analyses efforts for in-situ chemical oxidation, geoprobe investigation, and source area excavation activities. Sampling and analyses were conducted monthly during May through August to evaluate the performance of the in-situ chemical oxidation treatment. A one-time sampling and analyses was performed with the geoprobe and source area excavation. All samples were submitted to ENCO laboratories for chemical analyses. Quality assurance and quality control was maintained through collection of duplicate samples and ENCO's conformance with their Comprehensive Quality Assurance Manual for Contract Laboratory.

3.1 PHASE 2 IN-SITU CHEMICAL OXIDATION

Groundwater samples were collected from treatment area wells during pre- and post- phase 2 chemox treatment. Results are summarized in Table 1. Pre-treatment (May 20, 1999) results showed maximum concentrations of 5,000 µg/L of PCE and 5,885 µg/L of total chlorinated ethenes at location I-14. The highest pre-treatment concentrations of total chlorinated ethenes at the downgradient area (USGS wells) were 1,130 µg/L at USGS-1 and 1,080 µg/L at I-40. Concentrations in the downgradient area primarily consist of degradation product cis-1,2-dichloroethene. Analytical results from repeated sampling points showed post-treatment results for 55 of 56 sampling points were within the treatment goal of 100 µg/L total ethenes. The only exception was the results from injector I-14. Based on the rebound (increased concentration) of PCE at injector I-14, a previously unknown source of contamination is suspected in the area at I-

14. A detailed discussion of the Phase 2 analytical results is provided in the Geo-Cleanse report in Attachment 1. PCE and total chlorinated ethene concentration isopleths were developed and are presented and discussed in section 4.0 Status of Remediation.

3.2 GEOPROBE INVESTIGATION

PCE results using the mobile laboratory ranged from 2 to 99,000 ppb. The highest concentrations were observed at geoprobe location GP-10. GP-10 is located approximately 12-ft southeast of injector I-14. Groundwater samples at GP-10 were collected at depths of 11 to 14 ft, 15 to 18 ft, 21 to 24 ft, 24 to 27 ft, and 27 to 30 ft below grade. Results were 6,000 ppb at 11 to 14 ft, 11,000 ppb at 15 to 18 ft, 49,000 ppb at 21 to 24 ft, 85,000 ppb at 24 to 27 ft, and 99,000 ppb at 27 to 30 ft. Analytical results from samples collected 5 to 10 ft north, south, east, and west of GP-10 showed a significant reduction in tetrachloroethlyene concentration. Figures 3 through 7 display the distribution of PCE concentrations for the various depth intervals. These data are show the highest PCE concentrations observed at the site to date and indicate a previous unknown source area for groundwater contamination. A copy of the geoprobe investigation report is provided as Attachment 2.

3.3 SOURCE AREA EXCAVTION

Two waste samples were collected from containers and submitted to ENCO Laboratories for chlorinated hydrocarbons and TCLP analyses. Detectable compounds from a black, sludge looking waste were PCE at 14,000 µg/Kg, cis-1, 2 dichloroethylene at 3,800 µg/Kg, chlorobenzene at 3,000 µg/Kg, and creosol at 400 µg/Kg. Detectable compounds from a gray, sludge looking waste were chlorobenzene at 2,500 µg/Kg and lead at 8.7 µg/L. Complete analytical results are provided in Attachment 3. The compounds detected in the black waste are the primary contaminants found at the interim measure area. The low relative PCE concentrations (compared to 99,000 µg/L in the groundwater) suggest this waste is only a remnant of the waste that was probably buried at the site during the late 1970s to early 1980s. The source of the PCE in the groundwater appears to have seeped through the refuse and is pooled along a low permeable layer at a depth between 30 to 40 ft.

4.0 STATUS OF REMEDIATION

In-situ chemical oxidation treatment of the original source area has reduced the total chlorinated ethene concentrations to the target level of 100 µg/L. Levels at injector I-14 have rebounded and thereby indicate the presence of a previous unknown source area upgradient of I-14. Downgradient well KBA-11-13A, outside the original area of concern, exceeds the target level but concentrations are decreasing and the trend should continue as the treated upgradient water moves in this direction.

To illustrate the remediation progress, groundwater elevation maps, and PCE and total chlorinated ethene isopleths were developed for the pre- and post treatment sampling events. A calculation is also presented estimating the quantity of hazardous constituents eliminated.

4.1 GROUNDWATER

Depth to water measurements and water level elevations were calculated for the May, June, July, and August sampling events. Figures 8 through 11 depict the groundwater elevation and flow direction for this period. Generally, depth to water increased (lower water level) approximately 0.75 ft from May to August 1999. The groundwater flow direction is consistently to the west northwest.

Variations in the groundwater elevations for June and July (Figure 10) were observed and reflect disruption in the natural gradient due to the injection treatment during those months. For example, the July injection included upgradient injectors I-14, I-21, I-25, I-26, and I-27, and downgradient USGS piezometers, I-39, and I-41. Groundwater elevations at these treatment injectors were approximately 0.6 to 1.0 ft higher than nearby injectors which did not receive treatment. The August (Figure 11) gradient map (30 days after treatment) reflects a more relaxed or natural gradient for the water-table zone.

4.2 CHLORINATED CONSTITUENT ISOPLETHS

Chlorinated constituent isopleths were developed for PCE and total chlorinated ethenes for the May, June, July, and August 1999 sampling events. All PCE results which were less than the detection limit were assigned a value one-half of the detection limit. Figures 12 through 15 display the isopleths for PCE and Figures 16 through 19 display the isopleths for total chlorinated ethenes.

PCE Isopleths

May (Figure 12) pre-treatment results show a maximum 5,000 µg/L at I-14 and 1400 µg/L at I-27 located at the upgradient portion of the treatment area. The downgradient area shows 300 to 500 µg/L PCE in the vicinity of the USGS piezometers. Concentrations at the central portion of the area range from 1.5 to 250 µg/L (I-30). This shows the primary target areas of Phase 2 treatment at the upgradient and downgradient areas of the site. The central area was the main focus of the previous Phase 1 treatment.

June (Figure 13) post phase 2, first treatment shows a reduction in most PCE concentrations to less than 30 µg/L. Exceptions include sample points I-4, I-9, I-14, I-16, I-26, and USGS-14 and USGS-15.

July (Figure 14) post phase 2, second treatment shows all PCE concentrations below 30 µg/L with the exception of I-14. I-14 increased from 59 µg/L in June to 110 µg/L in July.

August (Figure 15) post phase 2, second treatment shows all PCE concentrations below 40 µg/L with the exception of I-16 (56 µg/L) and I-14 (2500 µg/L). PCE concentrations at I-14 continue to increase and implies a source upgradient of I-14.

Total Chlorinated Ethene Isopleths

May (Figure 16) pre-treatment total chlorinated ethene results show a maximum of 5,885 µg/L at I-14, mostly less than 100 µg/L in the central portion of the area, and 289 to 1080 µg/L at the downgradient area near the USGS piezometers and KBA-11-13A.

June (Figure 17) post phase 2, first treatment shows most results below the 100 µg/L target level with the exception of I-16 (212 µg/L) and I-21 (118 µg/L) at the upgradient area and I-39 (248 µg/L) and the USGS piezometers and KBA-1-13A (197 to 626 µg/L) at the downgradient area of the site. Total chlorinated ethenes at the downgradient area predominantly consist of degradation constituents cis-1,2-dichloroethene and trichloroethylene.

July (Figure 18) post phase 2, second treatment shows all results below 100 µg/L except I-14 (137 µg/L), I-21 (102 µg/L), and downgradient well KBA-11-13A (352 µg/L).

August (Figure 19) post phase 2, second treatment shows all results below 100 µg/L except I-14 (2,660 µg/L), and downgradient well KBA-11-13A (291 µg/L). Total chlorinated ethenes at KBA-11-13A have decreased approximately 12 percent from the previous month.

4.3 QUANTITY OF CHLORINATED HYDROCARBONS REMOVED

The estimated quantity of chlorinated hydrocarbons removed to date using both ex-situ treatment and in-situ chemical oxidation ranges from 140 to 265 lbs. This estimated was determined using the two calculation methods presented below. Method 1 uses dissolved plume dimensions and the average total dissolved chlorinated hydrocarbons throughout the plume. Method 2 uses the amount of dissolved chloride measured in the groundwater during in-situ chemical oxidation. Chloride is a degradation product from the oxidation of chlorinated hydrocarbons. Ex-situ treatment of 1,030,800 gallons using the onsite treatment facility was included in both estimates.

Method 1 - Several assumptions are required for the first method. The assumptions are based on the extent, thickness, and observed concentration of the dissolved plume.

Assumptions	Value
Plume length	200 ft
Width	90 ft
Average thickness	16 ft
Porosity	0.30
Average Total Chlorinated Hydrocarbon (TCH) Concentration	10,000 ppb

Calculation	
Vol. Contaminated Wtr = 18,000 sf * 16 ft (thick) * 0.30 (porosity) * 7.48 gal/cf	646,272 gal
Vol. Contaminated Wtr (ex-situ)	1,030,800 gal
Dissolved Cont. Mass (lbs) = 1,677,072 gal * 8.345 lbs/gal * 10,000 lbs TCH /1,000,000,000 lbs	**140 lbs**

Method 2 - Assumptions from above also apply to the second method.

Assumptions	Value
Plume length	200 ft
Width	90 ft
Average thickness	16 ft
Porosity (n_e)	0.30
Hydraulic conductivity (K) (typical well sorted sand)	28 ft/day
Groundwater gradient (I)	0.002
Flow velocity (V) = KI/ n_e	0.19 ft/day
Average chloride by mass of total chlorinated hydrocarbons	0.80
Additional ft Contaminated Water by Advection (0.19 ft/day * 25 days * 90 ft)	427.5 sf
Chloride increase during treatment	15 mg/L
Vol. Injected Fluids	46,620 gal

Calculation	
Vol. Cont. Wtr In-situ = 18,000 sf * 16 ft (thick) * 0.30 (porosity) * 7.48 gal/cf	646,272 gal
Vol. Contaminated Wtr (ex-situ)	1,030,800 gal
Vol. Cont. Wtr by Advection = 427.5 sf * 16 ft * 0.30 (porosity) * 7.48 gal/cf	15,349 gal
Total Cont. Wtr Treated = Vol. In-situ + Vol. Ex-situ + Vol. Advection - Injected Fluids	1,692,421 gal
Dissolved Contaminant Mass 1,692,421 gal * 8.345 lbs/gal * 15 lbs / 1,000,000 lbs * 1/.80	**265 lbs**

5.0 PROJECTED WORK FOR THE NEXT REPORTING PERIOD

Bechtel has prepared and submitted to the Navy a cost proposal for a Phase 3 treatment of the previously unknown source area near I-14. Contingent upon funding from the Navy, Bechtel and its subcontractor Geo-Cleanse will treat, using the in-situ chemical oxidation process, this new area. The work would include installation of additional injectors, chemical oxidation treatment, and pre- and post-treatment sampling and analyses. Results from this injection, if funded, will be provided in the next Progress Report. Pending funding for Phase 3 treatment, groundwater samples will be collected for evaluation of the effectiveness of the Interim Measures remediation during the next reporting period.

FIGURES

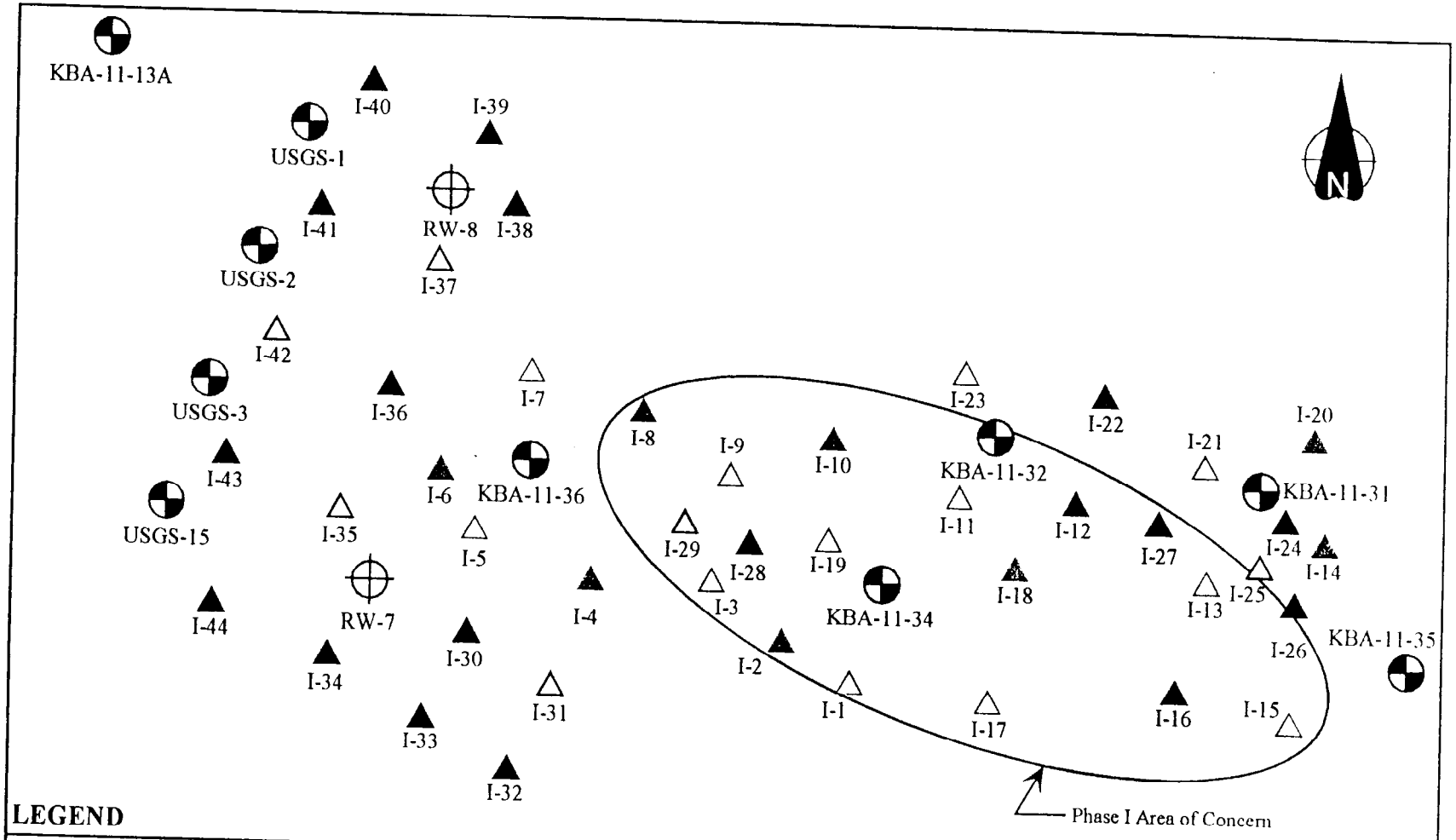


FIGURE 1. NSB Kings Bay Injector and Monitoring Well Location Map

Geo-Cleanse International, Inc.
4 Mark Road, Suite C
Kenilworth, NJ 07033

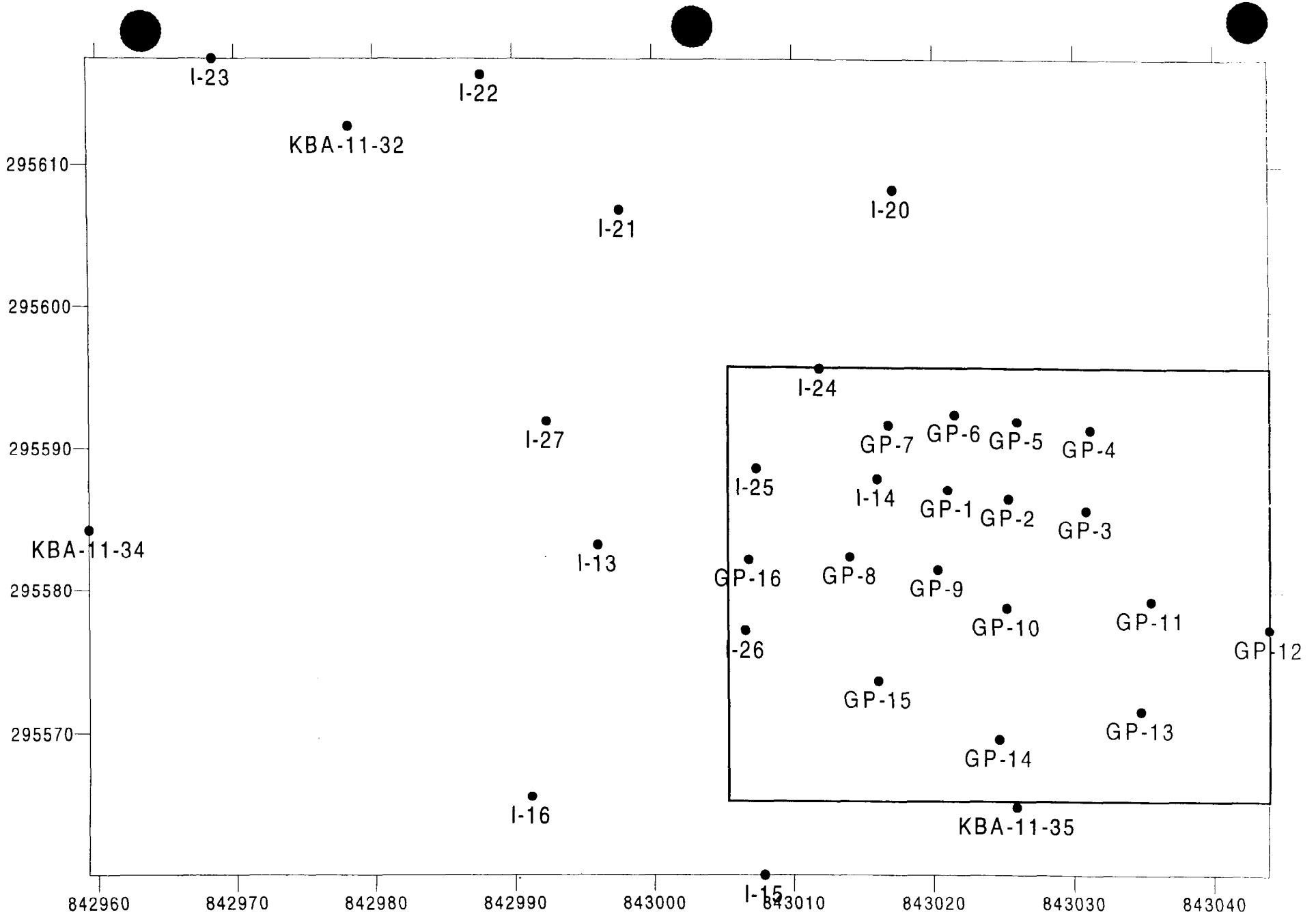


Figure 2 - Geoprobe (GP) Test Locations

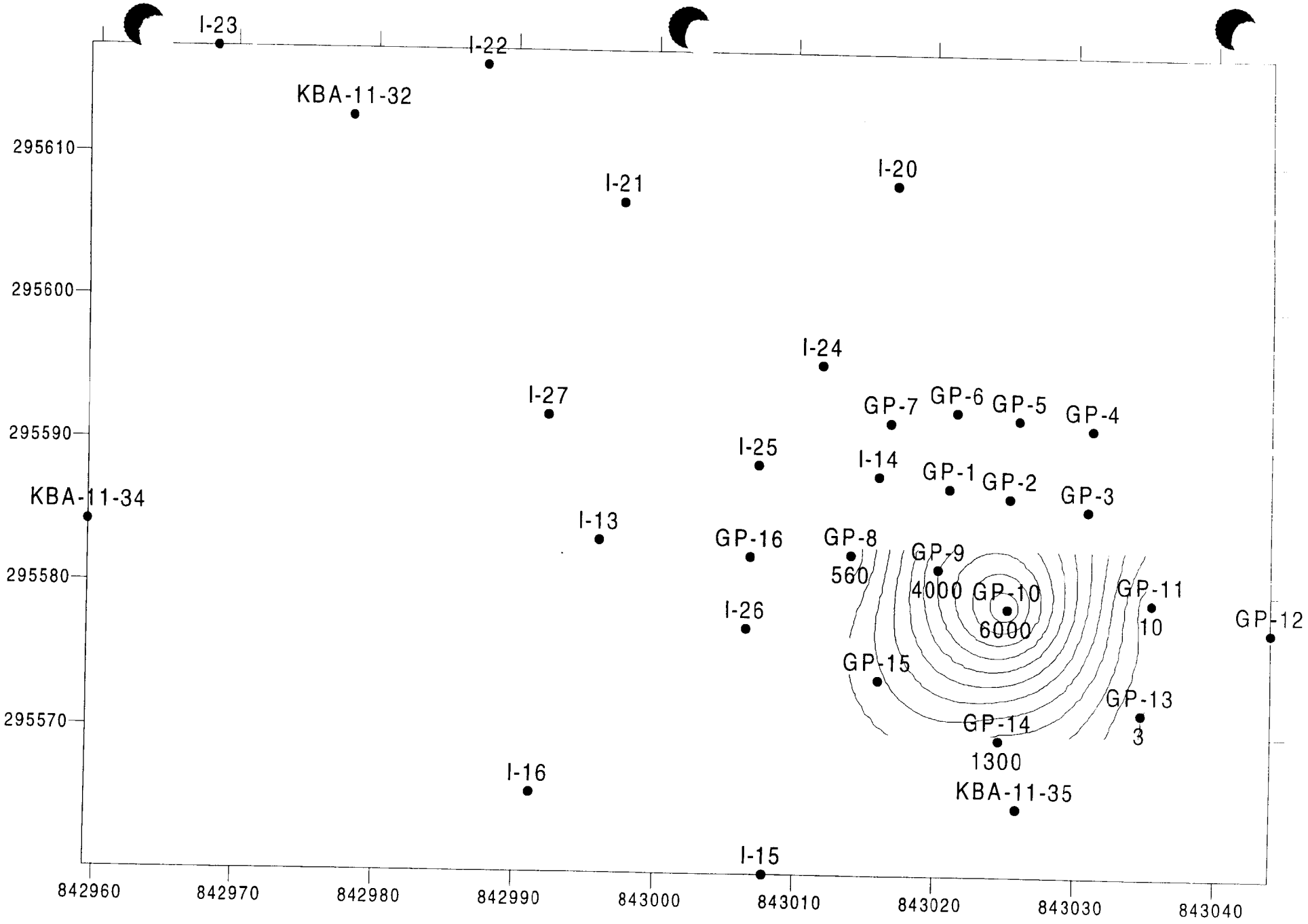


Figure 3 - PCE Concentrations (ppb) 11 - 14 ft

Contour Interval = 500 ppb

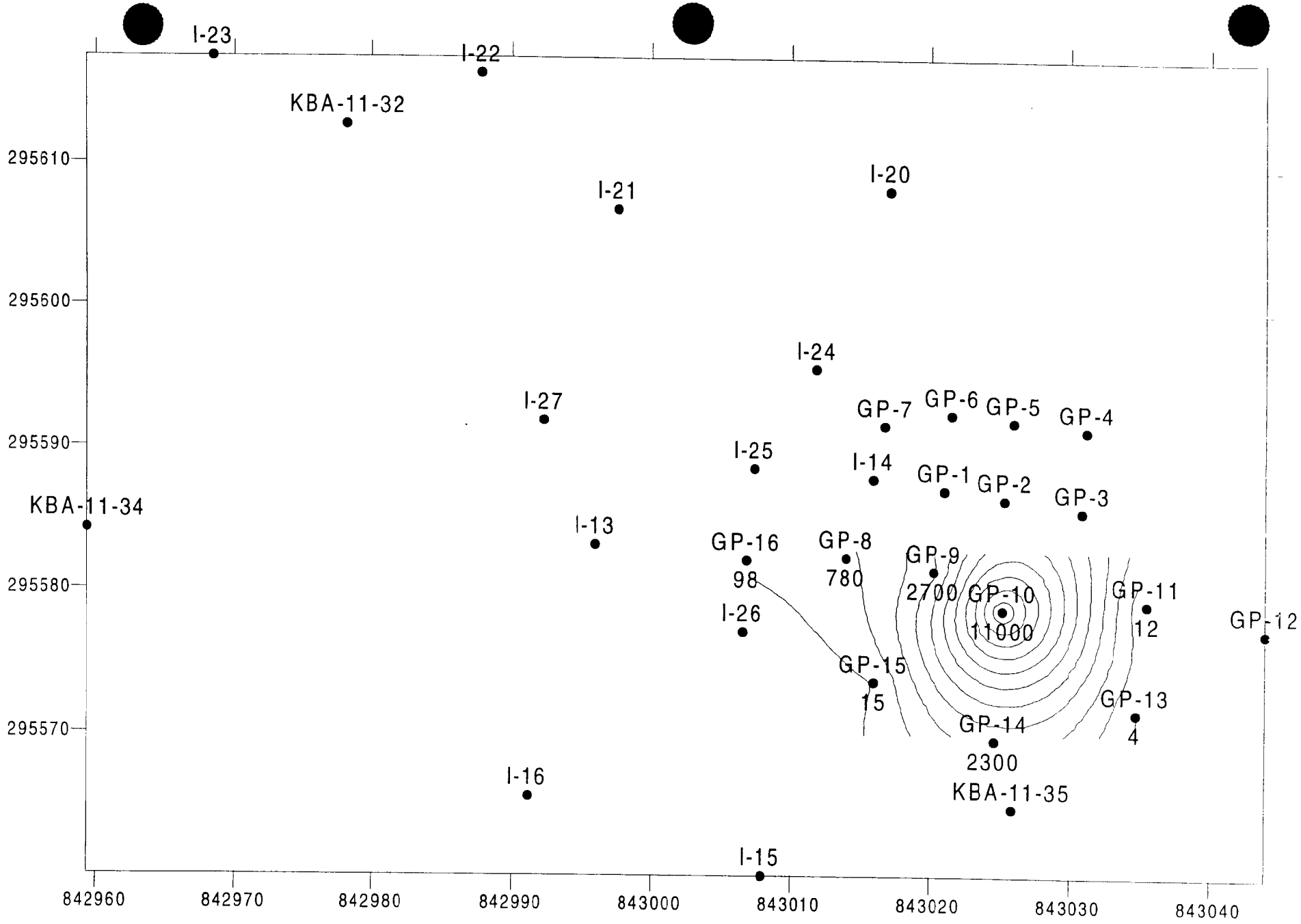


Figure 4 - PCE Concentrations (ppb) 15 - 18 ft

Contour Interval = 1000 ppb

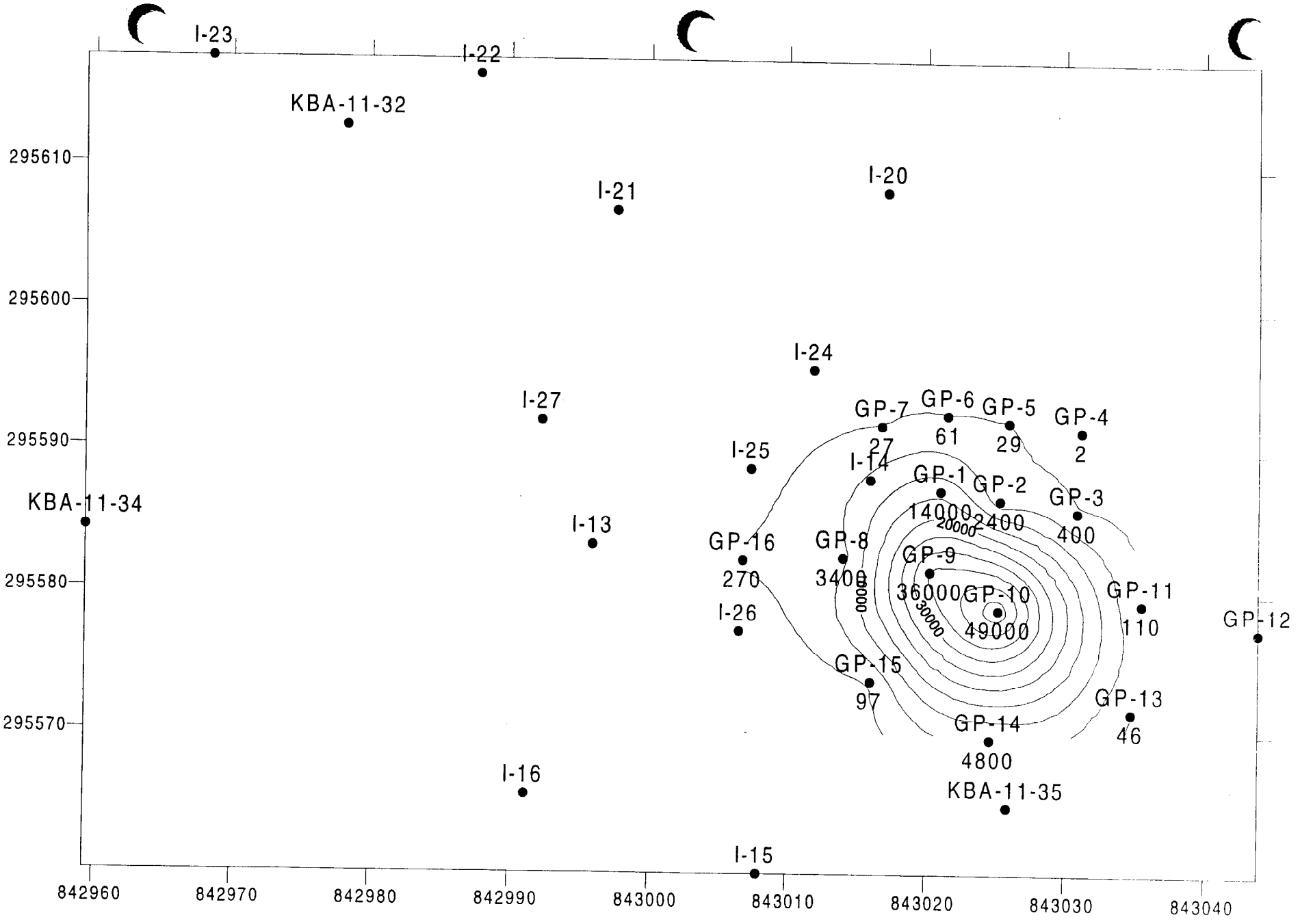


Figure 5 - PCE Concentrations (ppb) 21 - 24 ft

Contour Interval = 5000 ppb

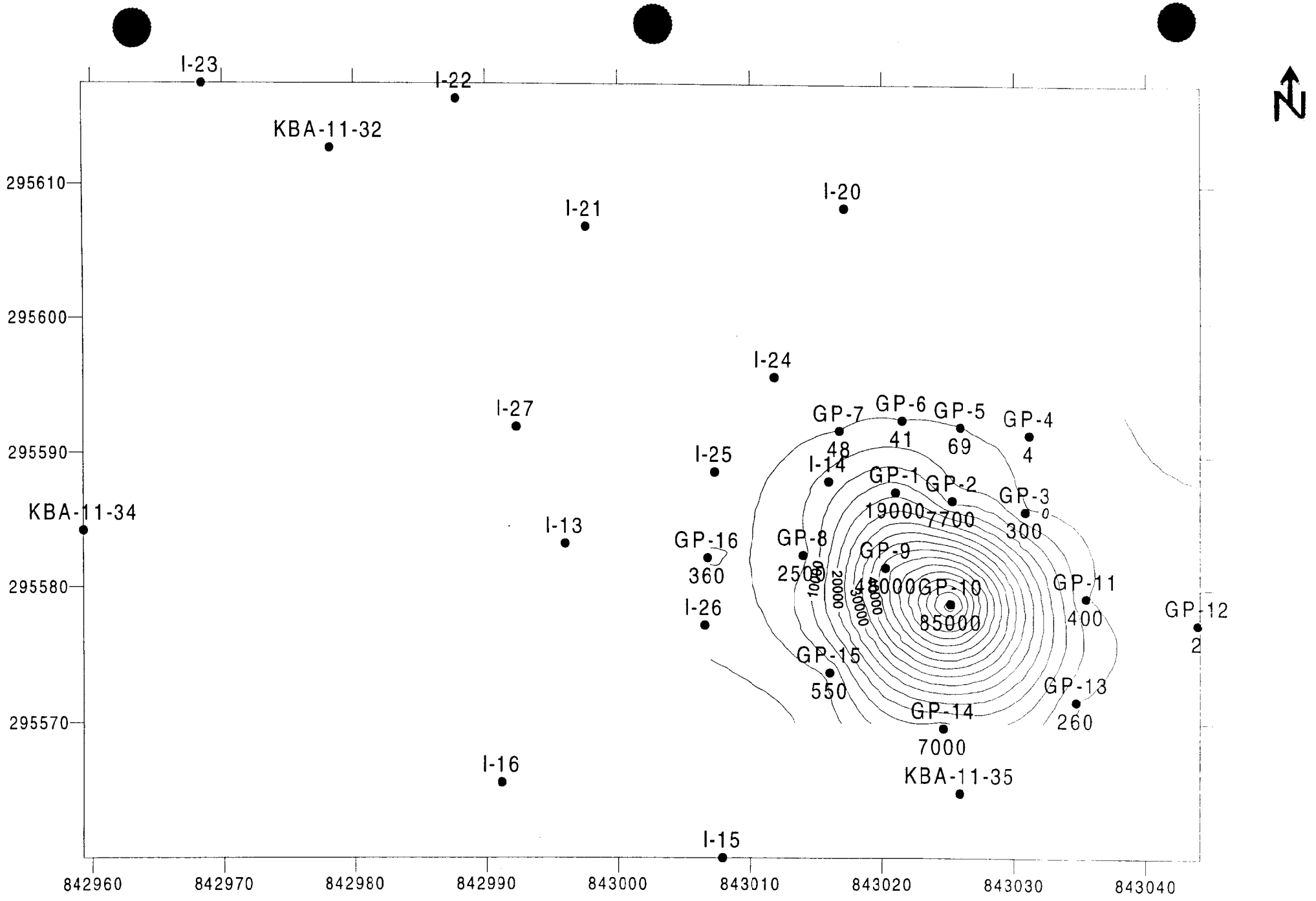


Figure 6 - PCE Concentrations (ppb) 24 - 27 ft

Contour Interval = 5000 ppb

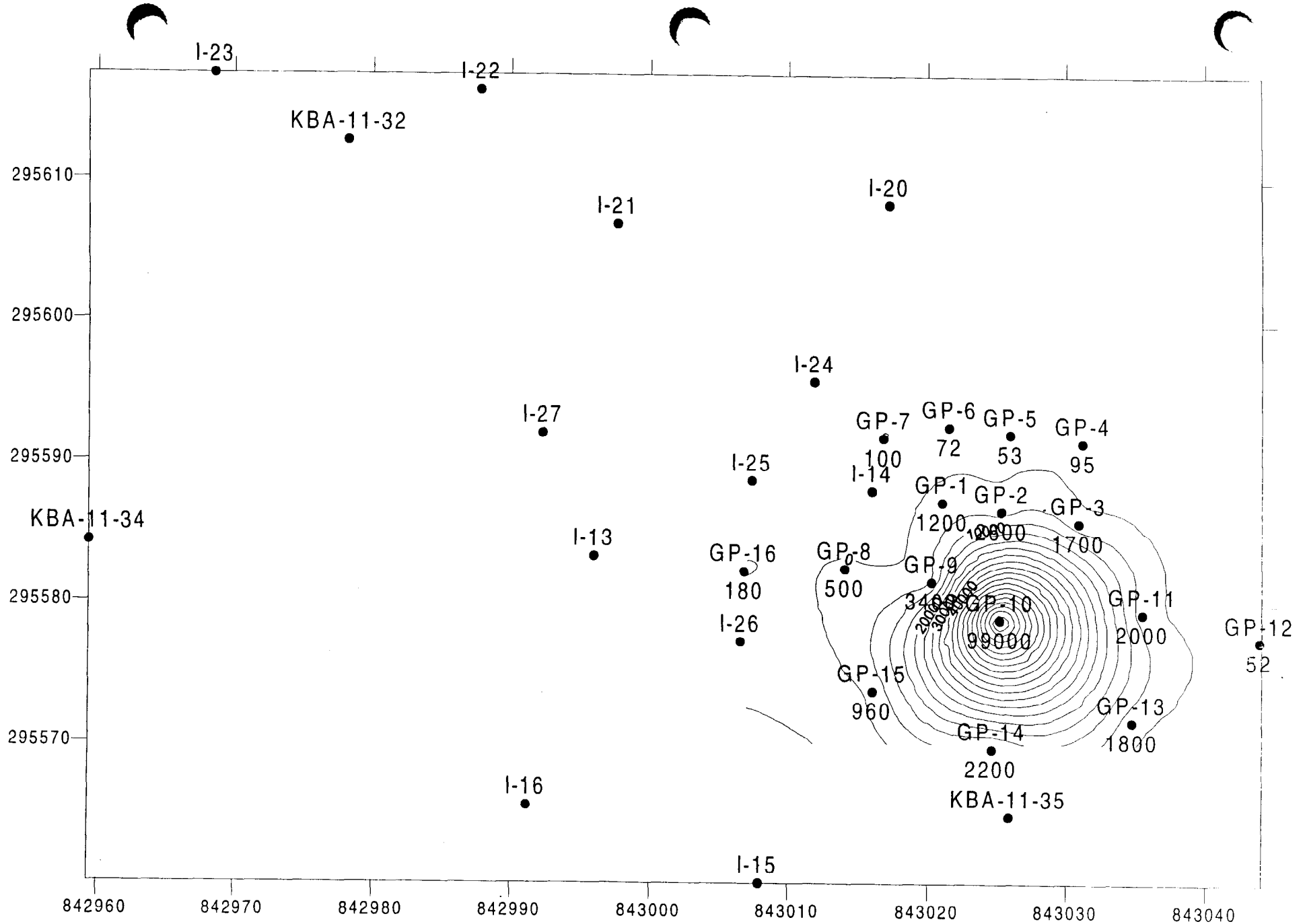


Figure 7 - PCE Concentrations (ppb) 27 - 30 ft

Contour Interval = 5000 ppb

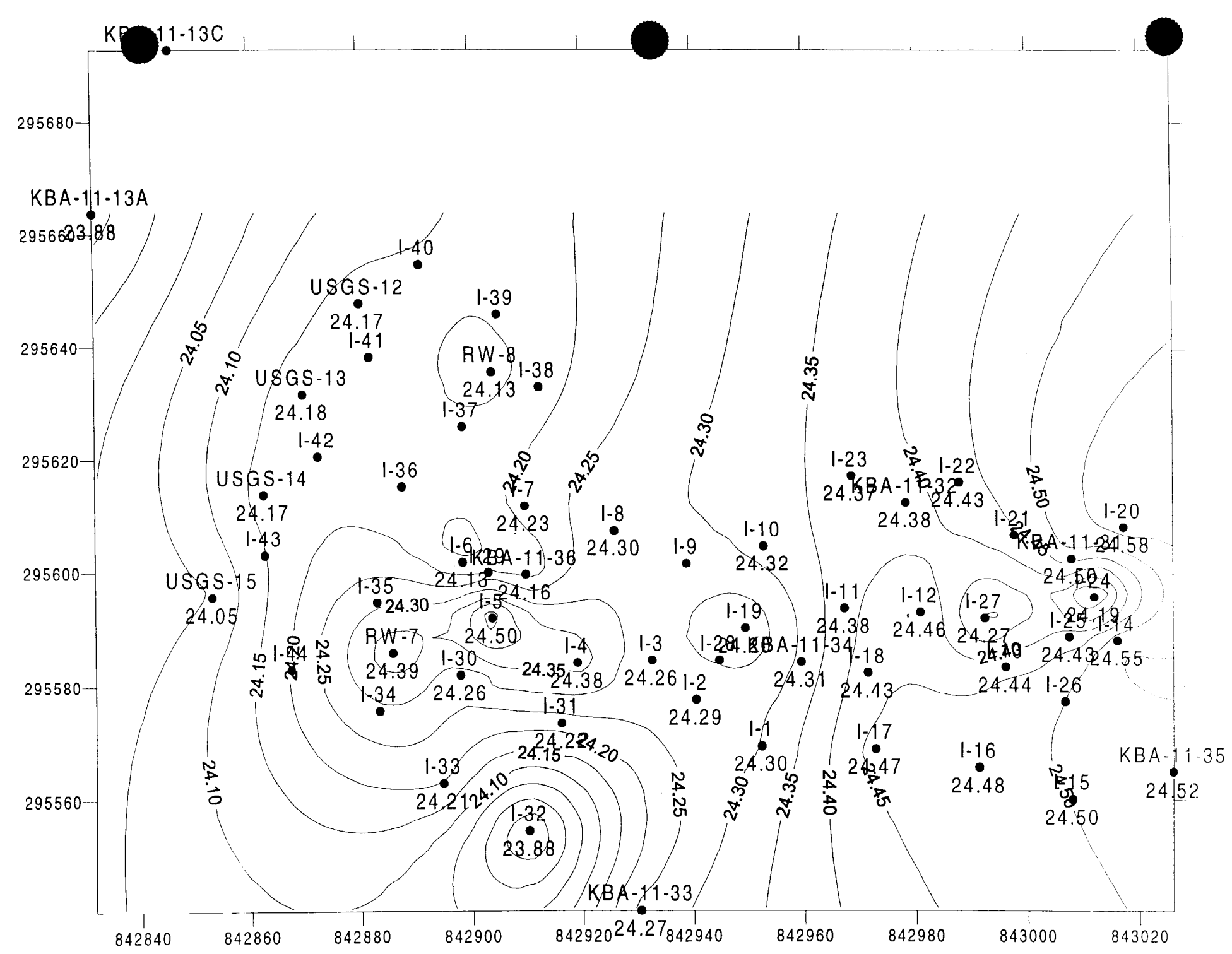


Figure - Groundwater Elevation Map - Pre Treatment, May 20, 1999 Contour Interval = 0.05'

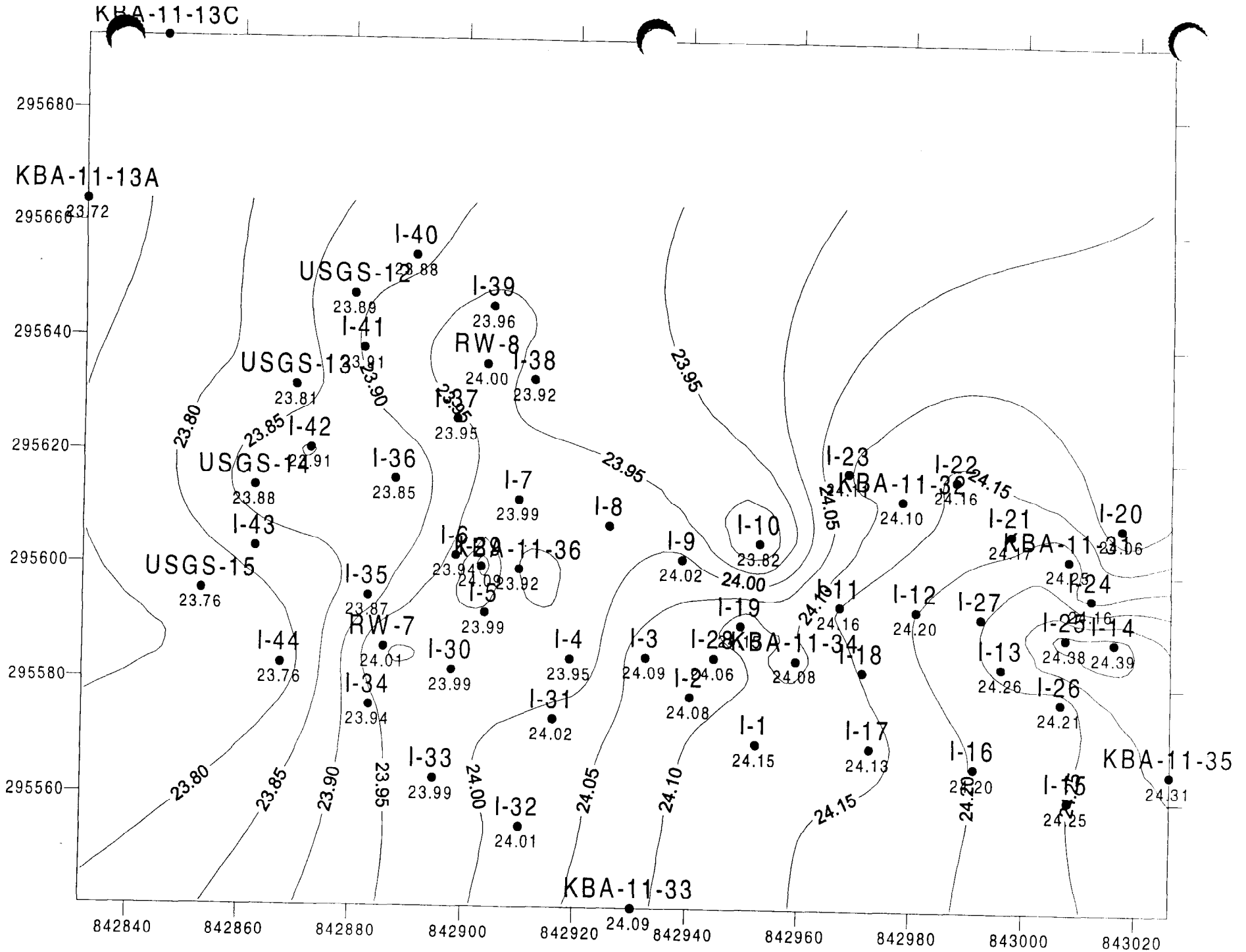


Figure 9 - Groundwater Elevation Map - Post Treatment 1, June 21, 1999

Contour Interval = 0.05 ft

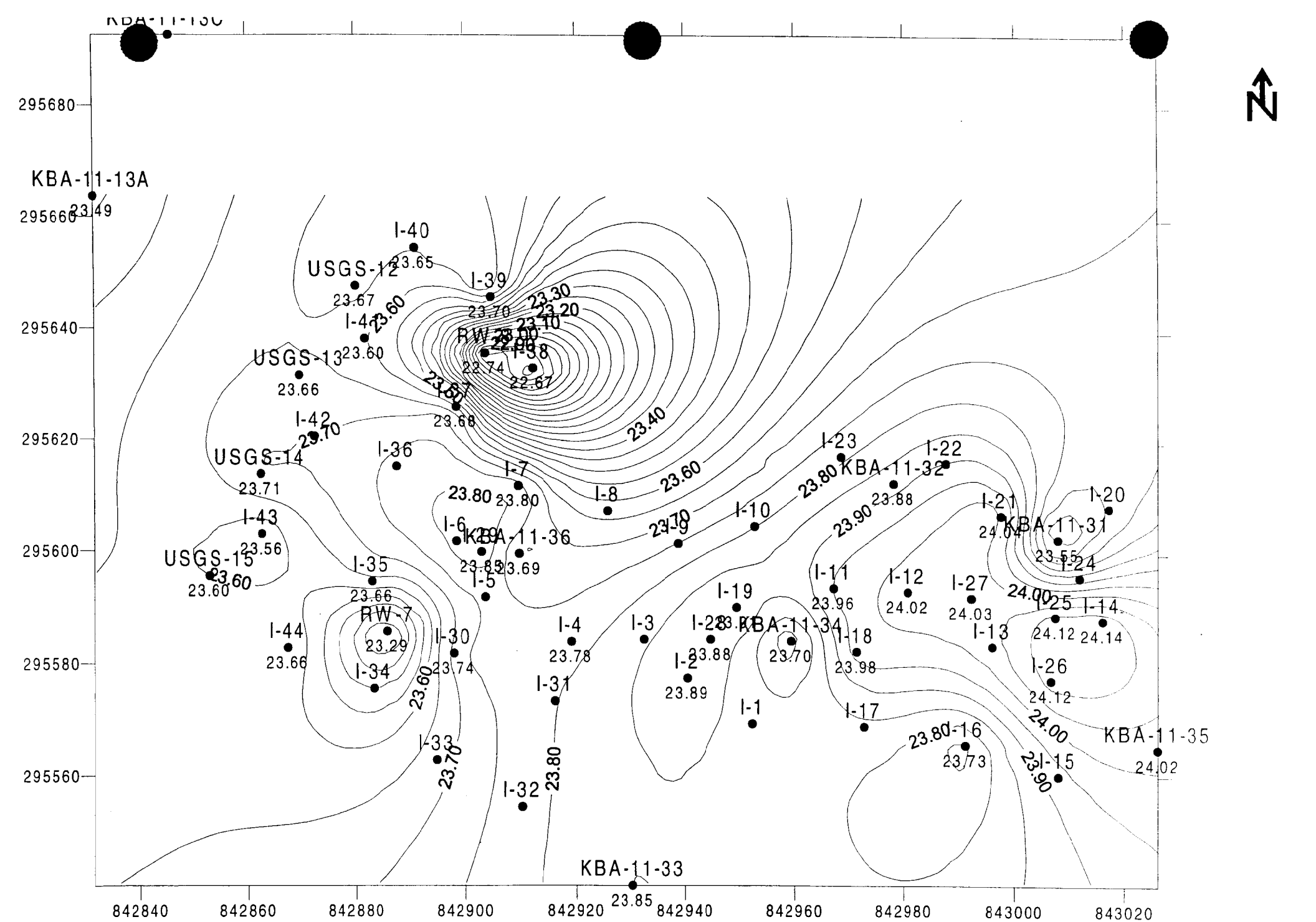


Figure) - Groundwater Elevation Map - Post Tre nent 2, July 26, 1999 Contour Interval . 0.05 ft

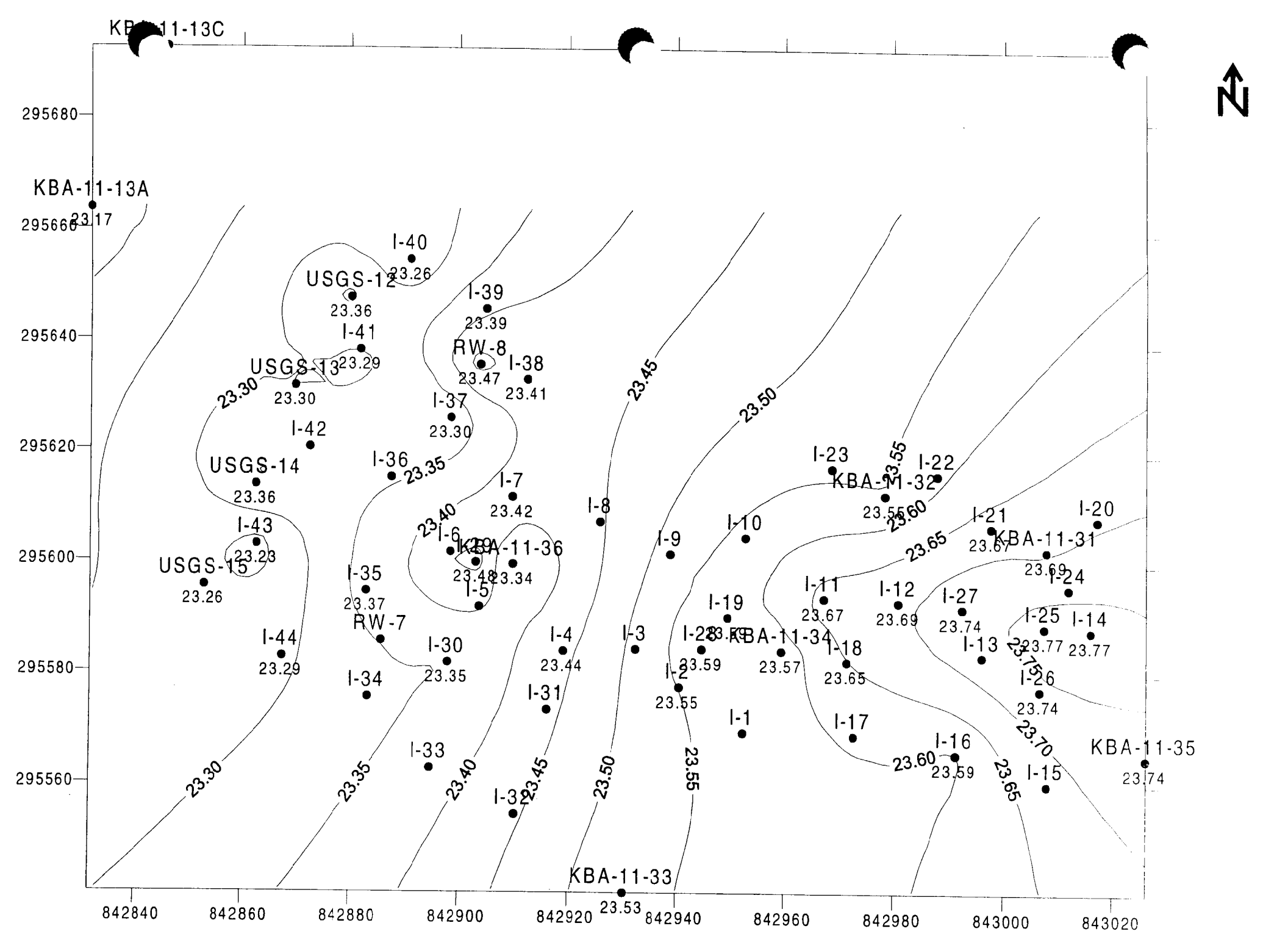
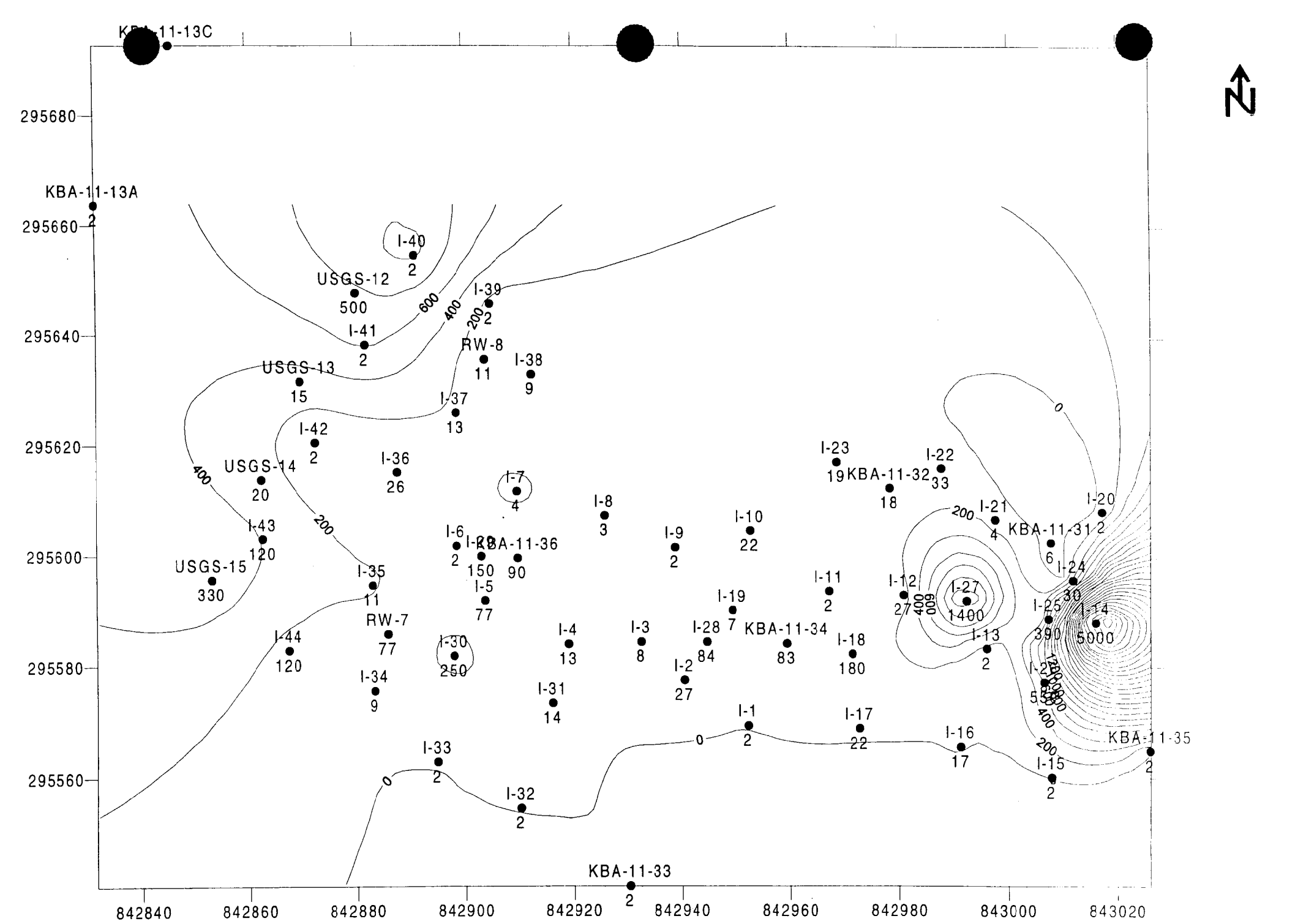


Figure 11 - Groundwater Elevation Map - Post Treatment 2, August 16, 1999 Contour Interval = 0.05 ft



Figu 12 - PCE Concentrations (ppb) - PreTrea .ent, May 20, 1999 Contour Interval = 20. ppb

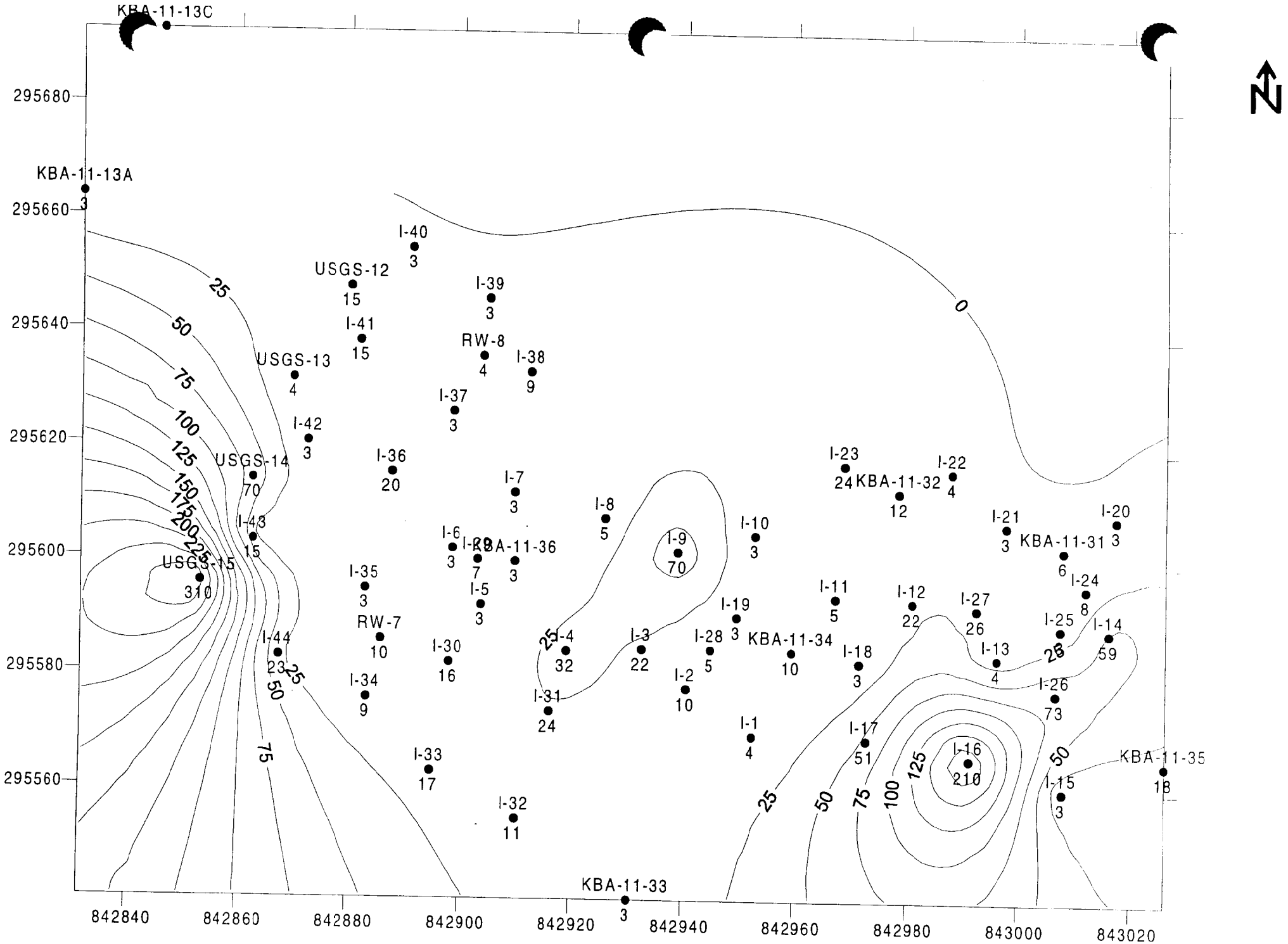


Figure 13 - PCE Concentrations (ppb) - Post Treatment 1, June 21, 1999

Contour Interval = 25 ppb

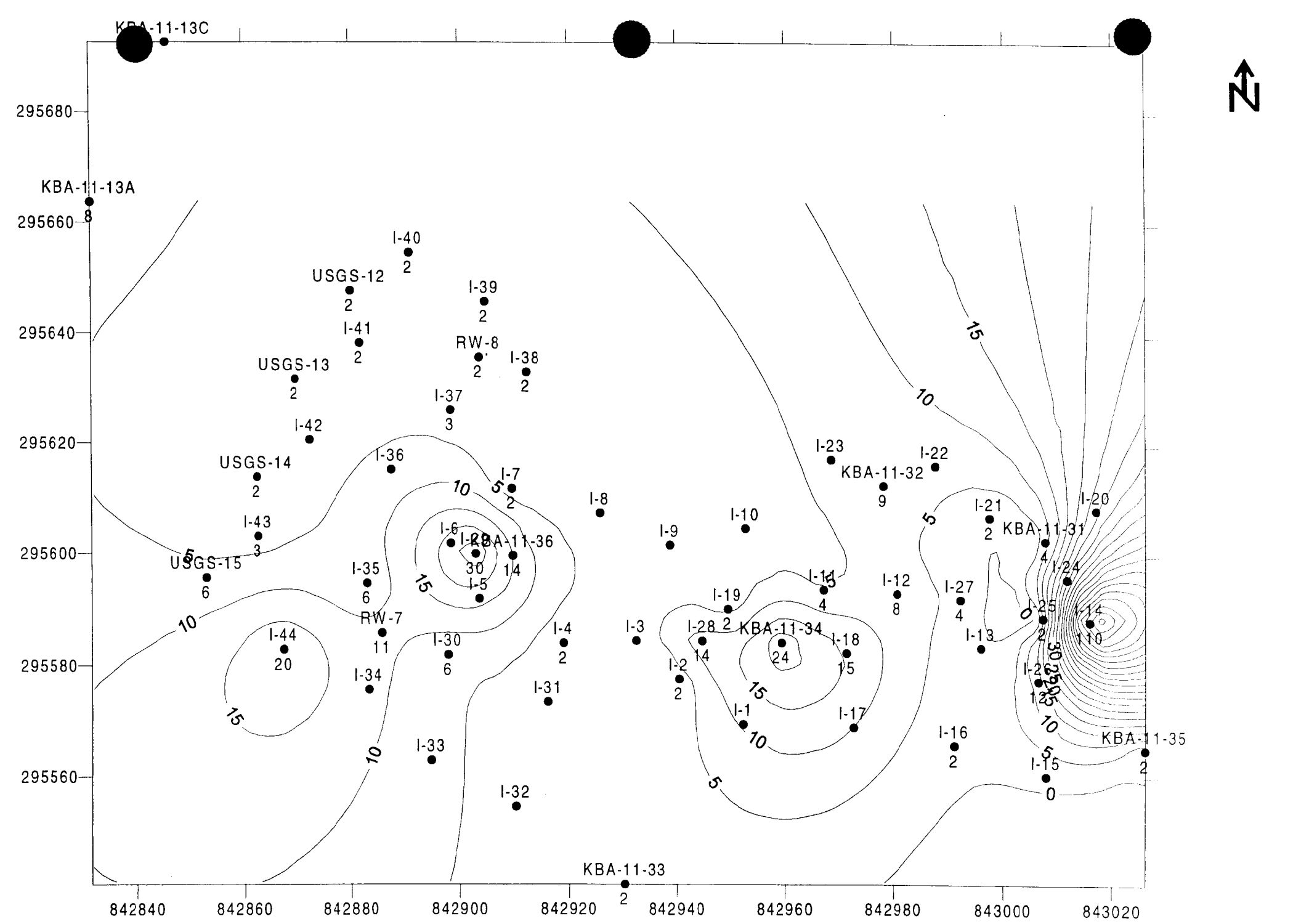


Figure 11 - PCE Concentrations (ppb) - Post Treatment 2, July 26, 1999 Contour Interv = 5 ppb

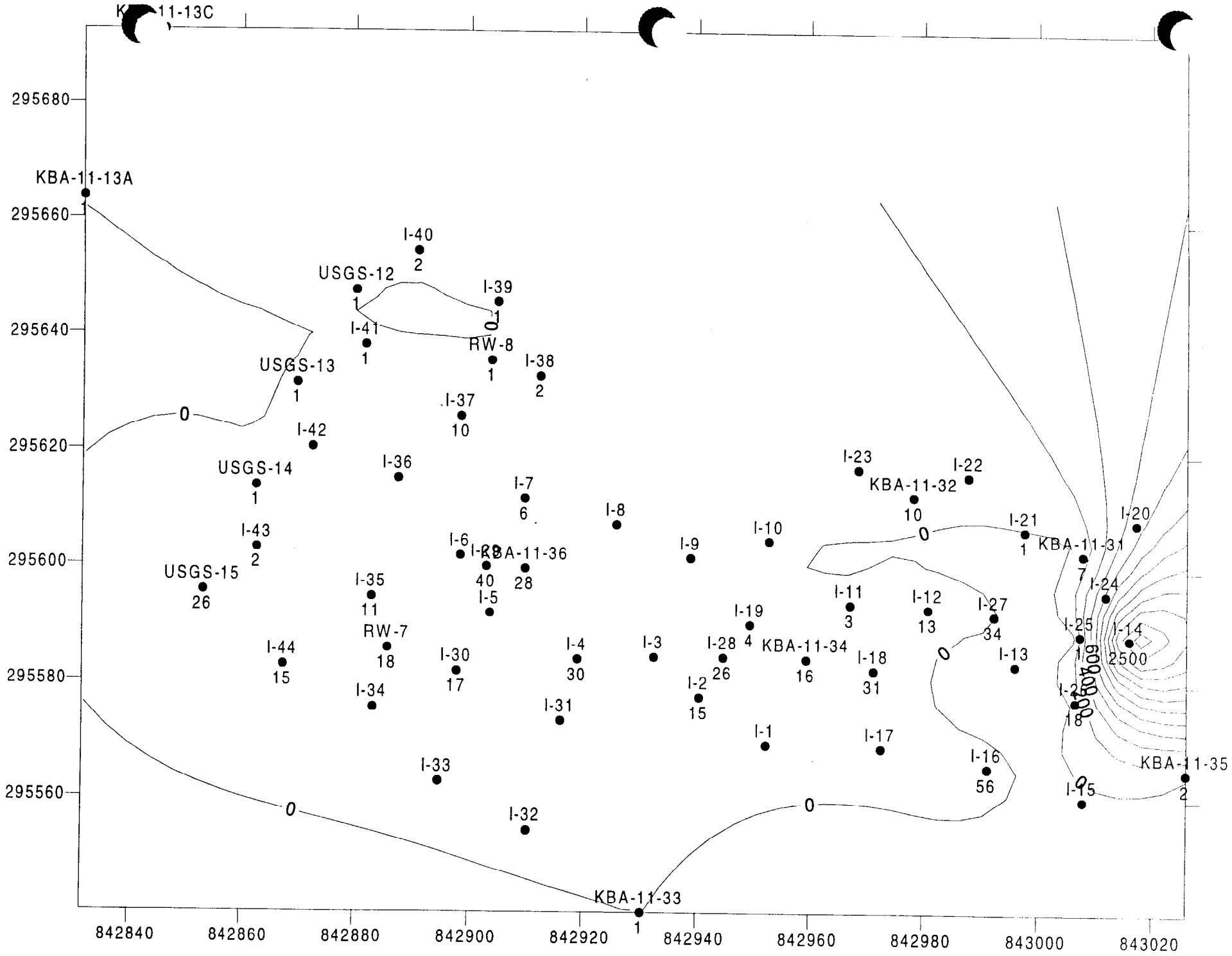


Figure 15 - PCE Concentrations (ppb) - Post Treatment 2, August 16, 1999 Contour Interval = 200 ppb

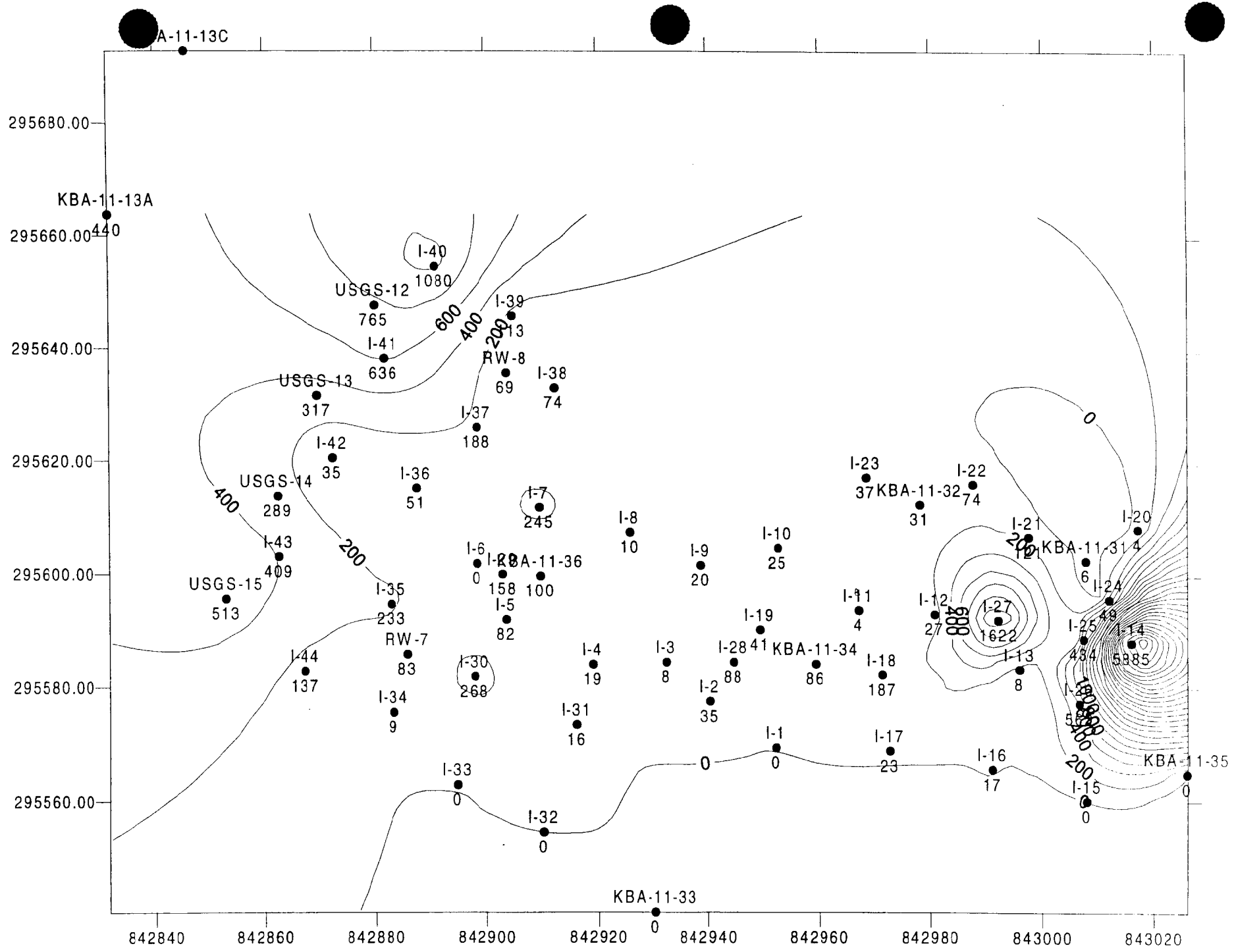


Figure 16 - Total Chlorinated Ethenes (ppb) - PreTreatment, May 20, 1999 Contour Interval = 200 ppb

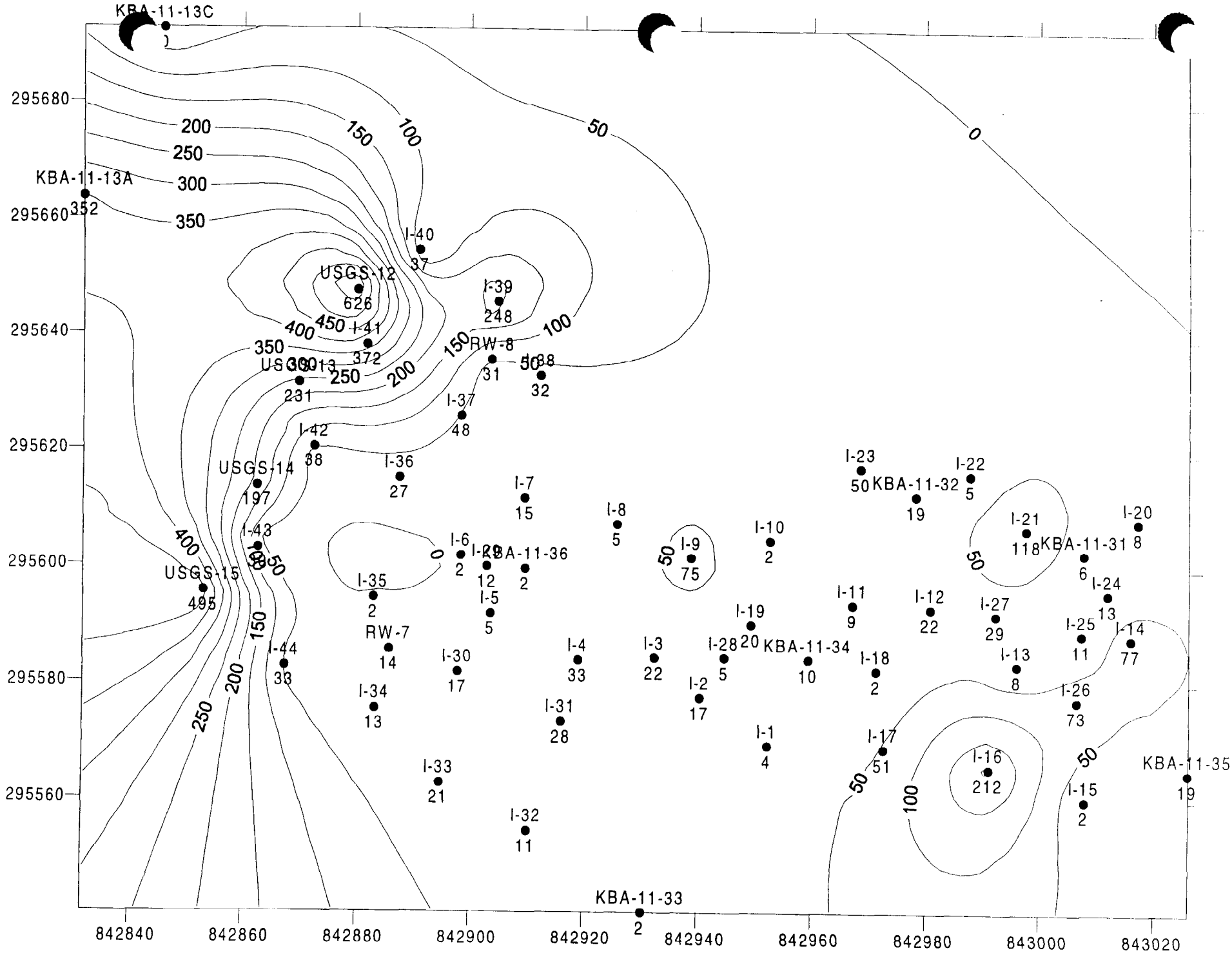


Figure 17 - Total Chlorinated Ethenes (ppb) - Post Treatment 1, June 21, 1999 Contour Interval = 50 ppb

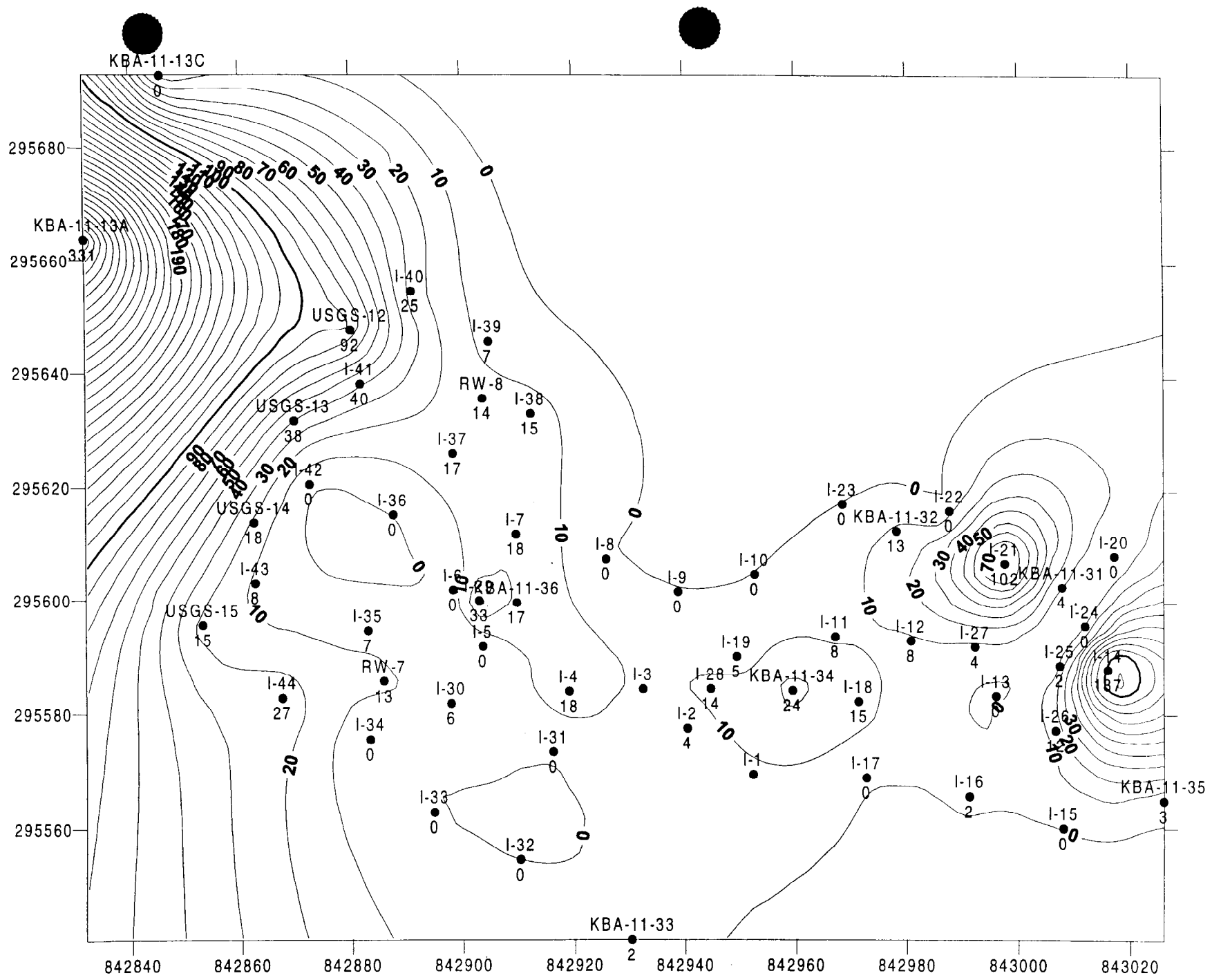


Figure 18 - Total Chlorinated Ethenes (ppb) - Post Treatment 2, July 26, 1999

Contour Interval = 10 ppb

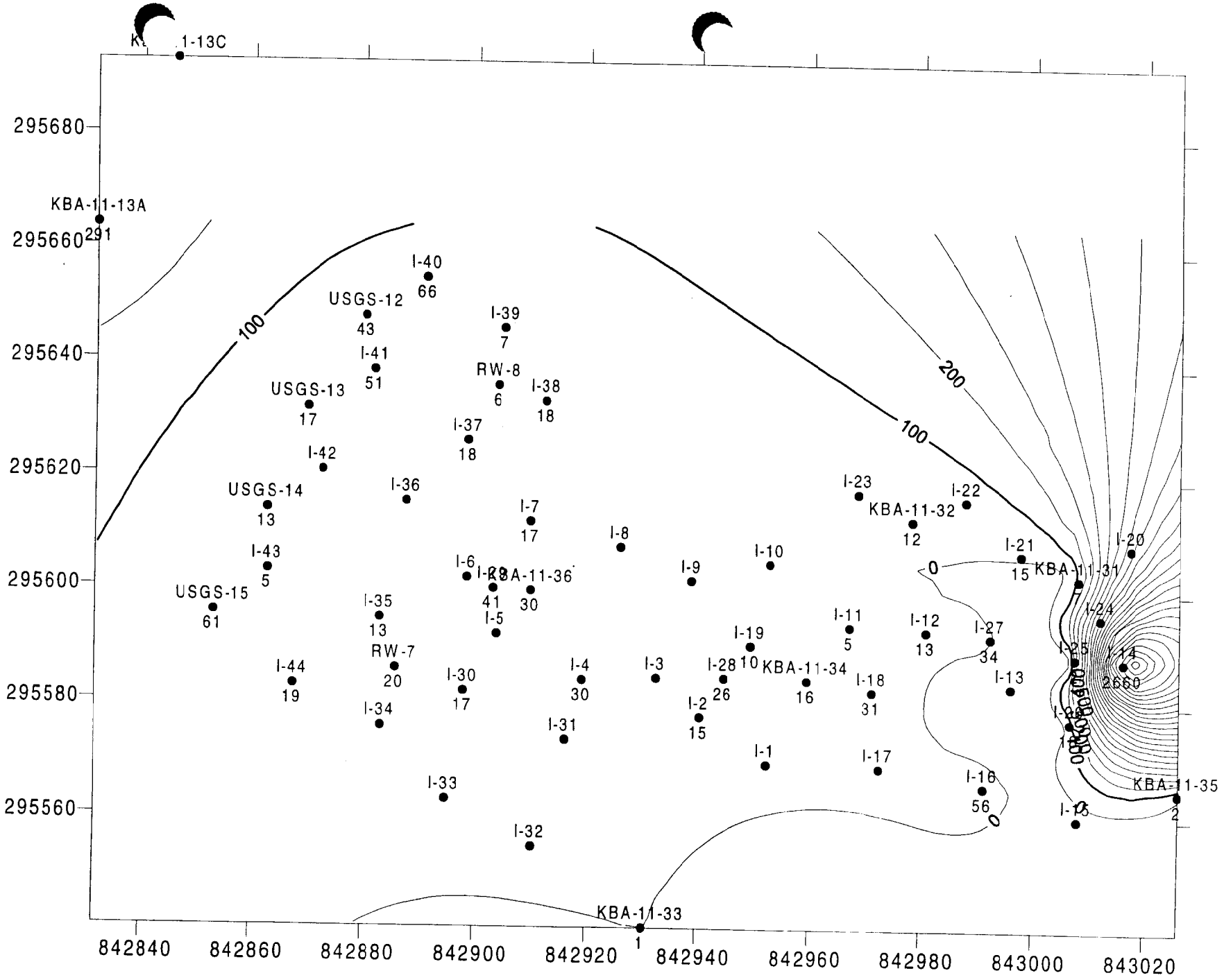


Figure 19 - Total Chlorinated Ethenes (ppb) - Post Treatment 2, August 16, 1999

Contour Interval = 100 ppb

TABLES

Table 1. NSB Kings Bay Groundwater Chlorinated Aliphatic Compound (CAC) Results

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
KBA-11-31	9/17/98	<1	9	6	2	17
	10/30/98	<1	1	7	<1	8
	11/6/98	1	<1	<1	<1	1
	11/24/98	8	7	2	<1	17
	12/22/98	12	12	6	<1	30
	1/27/99	14	15	4	<1	33
	2/18/99	23	17	5	<1	45
	3/15/99	15	12	7	<1	34
	5/20/99	69	57	73	5	204
	6/21/99	6	<1	<1	<1	6
	7/26/99	4	<1	<1	<1	4
	8/16/99	7	<1	<1	<1	7
KBA-11-32	9/17/98	3	91	30	9	133
	10/30/98	<1	110	54	4	168
	11/13/98	<1	<1	<1	<1	0
	11/24/98	4	9	3	<1	16
	12/22/98	7	13	5	<1	25
	1/27/99	9	17	5	<1	31
	2/18/99	6	8	3	<1	17
	3/15/99	11	11	4	<1	26
	5/20/99	18	13	<1	<5	31
	6/21/99	12	6	1	<1	19
	7/26/99	9	4	<1	<1	13
	8/16/99	10	2	<1	<1	12
KBA-11-33	9/17/98	<1	<1	<1	<1	0
	10/30/98	<1	<1	<1	<1	0
	11/24/98	<1	<1	<1	<1	0
	12/22/98	<1	<1	<1	<1	0
	1/27/99	<3	<1	<1	<1	0
	2/18/99	<1	<1	<1	<1	0
	3/15/99	<1	<1	<1	<1	0
	5/20/99	<3	<1	<1	<5	0
	6/22/99	<3	<1	<1	<1	0
	7/26/99	<3	<1	<1	<1	0
	8/16/99	<1	<1	<1	<1	0
KBA-11-34	9/17/98	3,200	350	8	<1	3,558
	9/17/98 (dup)	2,500	320	8	<1	2,828
	10/30/98	8,500	550	24	<1	9,074
	11/13/98	180	30	<5	<5	210
	11/24/98	200	19	<1	<1	219
	11/24/98 (dup)	130	15	<1	<1	145
	12/22/98	87	6	<1	<1	93
	1/27/99	83	7	<1	<1	90
	2/18/99	9	<1	<1	<1	9
	3/15/99	62	3	<1	<1	65
	3/15/99 (dup)	57	2	<1	<1	59
	5/20/99	83	3	<1	<5	86
	6/22/99	10	<1	<1	<1	10
	7/26/99	24	<1	<1	<1	24
	8/16/99	16	<	<1	<1	16

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
KBA-11-35	9/17/98	<1	<1	<1	<1	0
	10/30/98	<1	<1	<1	<1	0
	11/6/98	<1	<1	<1	<1	0
	11/24/98	<1	<1	<1	<1	0
	12/22/98	<1	<1	<1	<1	0
	1/27/99	<3	<1	<1	<1	0
	2/18/99	<1	<1	<1	<1	0
	3/15/99	<1	<1	<1	<1	0
	5/20/99	<3	<1	<1	<5	0
	6/21/99	18	1	<1	<1	19
	7/26/99	<3	<1	1	<1	1
	8/16/99	2	<1	<1	<1	2
KBA-11-36	9/17/98	7	440	60	5	512
	10/30/98	5	360	60	<1	424
	10/30/98 (dup)	4	330	59	1	394
	11/24/98	17	55	3	<1	75
	12/22/98	370	44	2	<1	416
	1/27/99	380	44	2	<1	426
	2/18/99	3	<1	3	<1	6
	3/15/99	51	3	<1	<1	54
	5/20/99	90	10	<1	<5	100
	6/22/99	<3	<1	<1	<1	0
	7/26/99	14	3	<1	<1	17
	8/16/99	28	2	<1	<1	30
KBA-11-13A	9/17/98	<1	24	160	78	262
	10/30/98	<10	16	130	10	156
	11/4/98	<3	15	5	28	48
	11/24/98	<1	16	100	22	138
	11/25/98	<5	16	79	26	121
	12/22/98	<1	14	230	22	266
	1/7/99	<5	<5	34	60	94
	1/27/99	<3	20	110	22	152
	2/18/99	<1	15	150	22	187
	3/15/99	<10	13	150	15	178
	4/7/99	<1	7	49	93	149
	5/20/99	<3	29	350	61	440
	6/23/99	<3	25	280	45	350
	7/26/99	<15	26	240	57	323
	8/17/99	<1	24	240	26	290
RW7	10/30/98	720	160	66	<1	946
	11/24/98	220	62	110	<1	392
	1/27/99[1]	<3	2	2	<1	4
	2/18/99	120	10	5	<1	135
	2/18/99 (dup)	120	10	6	<1	136
	3/15/99	69	10	7	<1	86
	5/20/99	77	6	<1	<5	83
	5/20/99 (dup)	76	6	<1	<5	82
	6/23/99	9	2	2	<1	13
	6/23/99 (dup)	10	2	2	<1	14
	7/27/99	11	2	<1	<1	13
	8/17/99	18	<1	<1	<1	18
	8/17/99 (dup)	18	2	<1	<1	20

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
RW8	10/30/98	<1	83	57	10	150
	11/24/98	<1	57	110	10	177
	1/27/99[1]	<3	2	2	<1	4
	2/18/99	5	17	110	7	139
	5/20/99	11	14	22	22	69
	6/23/99	4	4	23	<1	31
	7/27/99	<3	5	7	<1	12
	8/17/99	1	2	3	<1	6
USGS-1	8/6/98	<5	1,140	919	314	2,373
	11/4/98	<3	28	340	33	401
	11/25/98	<5	120	580	61	761
	1/7/99	<5	78	213	<5	291
	4/7/99	<1	198	731	64	993
	5/20/99[4]	500	240	25	<5	765
	5/26/99	<3	190	820	120	1,130
	6/23/99	<30	150	400	21	571
	6/23/99 (dup)	<30	170	420	21	611
	7/27/99	<3	13	77	<1	90
	8/17/99	<1	8	34	<1	42
USGS-2	8/6/98	<5	160	290	219	669
	11/4/98	<3	560	660	45	1,265
	11/25/98	<5	180	300	22	502
	1/7/99	<5	34	293	39	366
	4/7/99	<1	49	500	56	605
	5/20/99[4]	15	96	190	16	317
	6/3/99	<3	130	440	11	581
	6/23/99	4	57	170	<1	231
	7/27/99	<3	2	34	<1	36
	8/17/99	<1	3	13	<1	16
USGS-3	8/6/98	<5	45	328	327	700
	11/4/98	<3	350	1,300	74	1,724
	11/25/98	<5	260	860	26	1,146
	1/7/99	<5	290	1,070	64	1,424
	4/7/99	5	97	492	54	648
	5/20/99[4]	6	71	430	24	531
	6/3/99	20	130	130	9	289
	6/23/99	70	67	60	<1	197
	7/27/99	<3	1	15	<1	16
	8/17/99	<1	2	10	<1	12
USGS-15	11/4/98	<1	9	3	7	19
	11/25/98	<5	7	34	6	47
	1/7/99	<5	25	29	<5	54
	4/7/99	29	42	8	<1	79
	5/20/99[4]	<3	160	840	110	1,110
	6/3/99	330	170	13	<1	513
	6/23/99	310	160	25	<5	495
	7/27/99	6	7	2	<1	15
	8/17/99	26	28	7	<1	61
I-1	10/30/98	<1	<1	9	<1	9
	12/22/98	<1	<1	<1	<1	0
	3/16/99	<1	<1	<1	<1	0
	5/20/99	<3	<1	<1	<5	0
	6/22/99	4	<1	<1	<1	4

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-2	12/22/98	290	9	<1	<1	299
	1/27/99	4	<1	4	<1	8
	2/18/99	52	1	<1	<1	53
	3/16/99	230	3	<1	<1	233
	3/16/99 (dup)	250	4	<1	<1	254
	5/20/99	27	3	5	<5	35
	6/22/99	10	<1	7	<1	17
	7/27/99	<3	<1	2	<1	2
	8/16/99	15	<1	<1	<1	15
I-3	12/22/98	<1	<1	1	<1	1
	3/16/99	56	2	<1	<1	58
	5/20/99	8	<1	<1	<5	8
	6/22/99	22	<1	<3	<1	22
I-4	11/24/98	290	43	<1	<1	333
	12/22/98	900	30	1	<1	931
	1/27/99	230	18	17	<1	265
	2/18/99	97	2	<1	<1	99
	3/16/99	88	2	<1	<1	90
	3/16/99 (dup)	87	2	<1	<1	89
	5/20/99	13	3	3	<5	19
	6/22/99	32	1	<1	<1	33
	6/22/99 (dup)	21	<1	<1	<1	21
	7/27/99	<3	1	15	<1	16
	8/17/99	30	<1	<1	<1	30
	8/17/99 (dup)	6	<1	<1	<1	6
I-5	2/18/99	<1	<1	1	<1	1
	3/16/99	<1	<1	<1	<1	0
	5/20/99	77	4	1	<5	82
	6/22/99	<3	<1	3	<1	3
I-6	2/18/99	2	<1	<1	<1	2
	3/16/99	2	<1	<1	<1	2
	5/20/99	<3	<1	<1	<5	0
	6/22/99	<3	<1	<1	<1	0
I-7	2/18/99	<1	<1	210	3	213
	3/16/99	<1	<1	85	2	87
	5/21/99	4	1	240	<1	245
	6/22/99	<3	<1	13	<1	13
	7/27/99	<3	<1	16	<1	16
	8/16/99	6	1	10	<1	17
I-8	12/22/98	13	15	1	<1	29
	3/16/99	7	<1	<1	<1	7
	5/20/99	3	2	5	<5	10
	6/22/99	5	<1	<1	<1	5
I-9	12/22/98	9	1	37	1	48
	1/27/99	<3	1	13	<1	14
	3/16/99	8	3	12	<1	23
	5/20/99	<3	<1	20	<5	20
	6/22/99	70	3	2	<1	75
I-10	12/22/98	27	8	<1	<1	35
	1/27/99	25	4	<1	<1	29
	3/16/99	22	1	<1	<1	23
	5/20/99	22	3	<1	<5	25
	6/22/99	<3	<1	<1	<1	0

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-11	11/13/98	<1	<1	200	<1	200
	12/22/98	5	<1	66	<1	71
	12/22/98 (dup)	3	<1	57	<1	60
	2/18/99	1	<1	27	1	29
	3/16/99	<1	<1	10	<1	10
	5/21/99	<3	<1	4	<1	4
	6/21/99	5	<1	4	<1	9
	7/26/99	4	<1	4	<1	8
	8/16/99	3	<1	2	<1	5
I-12	11/13/98	170	44	<5	<5	214
	11/24/98	29	8	<1	<1	37
	12/22/98	76	2	<1	<1	78
	12/22/98 (dup)	65	1	<1	<1	66
	1/27/99	43	2	<1	<1	45
	2/18/99	25	<1	<1	<1	25
	3/16/99	44	<1	<1	<1	44
	5/20/99	27	<1	<1	<5	27
	6/21/99	22	<1	<1	<1	22
	7/26/99	8	<1	<1	<1	8
	8/16/99	13	<1	<1	<1	13
I-13	12/22/98	<1	<1	33	2	35
	1/27/99	<3	<1	14	<1	14
	2/18/99	<1	<1	79	<1	79
	2/18/99 (dup)	<1	<1	61	2	63
	3/16/99	6	<1	12	<1	18
	5/21/99	<3	<1	8	<1	8
	6/21/99	4	<1	4	<1	8
I-14	3/16/99	3,500	300	<10	<10	3,800
	3/31/99	3,200	200	<50	<50	3,400
	4/12/99	2,420	220	11	5	2,656
	5/20/99	5,000	870	15	<5	5,885
	5/20/99 (dup)	4,600	730	12	<5	5,342
	6/21/99	48	14	<1	<1	62
	6/21/99 (dup)	59	18	<1	<1	77
	7/26/99	110	26	<1	<1	136
	7/26/99 (dup)	110	27	<1	<1	137
	8/16/99	1,600	100	<50	<50	1,700
	8/16/99 (dup)	2,500	160	<50	<50	2,660
I-15	3/16/99	<1	<1	<1	<1	0
	5/20/99	<3	<1	<1	<5	0
	6/21/99	<3	<1	<1	<1	0
I-16	10/30/98	<1	<1	<1	<1	0
	12/22/98	71	<1	<1	<1	71
	1/27/99	33	<1	<1	<1	33
	3/16/99	140	<10	<10	<10	140
	3/31/99	68	<1	<1	<1	68
	5/20/99	17	<1	<1	<5	17
	6/21/99	210	2	<1	<1	212
	7/26/99	<3	<1	<1	<1	0
	8/16/99	56	<1	<1	<1	56
I-17	12/22/98	<1	<1	<1	<1	0
	3/16/99	4	<1	<1	<1	4
	5/20/99	22	<1	1	<5	23
	6/21/99	51	<1	<1	<1	51

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-18	12/22/98	16	<1	<1	<1	16
	3/16/99	96	3	<1	<1	99
	5/20/99	180	7	<1	<5	187
	6/21/99	<3	<1	<1	<1	0
	7/26/99	15	<1	<1	<1	15
	8/16/99	31	<1	<1	<1	31
I-19	12/22/98	<1	<1	100	<1	100
	2/18/99	<1	<1	110	2	112
	3/16/99	1	<1	8	2	11
	5/21/99	7	<1	34	<1	41
	6/22/99	<3	<1	18	<1	18
	7/26/99	<3	<1	3	<1	3
	8/16/99	4	<1	6	<1	10
I-20	3/16/99	<1	<1	<1	<1	0
	5/20/99	<3	3	1	<5	4
	6/21/99	<3	<1	6	<1	6
I-21	3/16/99	<1	<1	210	13	223
	5/21/99	4	<1	110	7	121
	6/21/99	<3	1	110	5	116
	7/26/99	<3	<1	100	<1	100
	8/16/99	<1	<1	14	<1	14
I-22	3/16/99	14	30	28	<1	72
	5/20/99	33	24	12	5	74
	6/21/99	4	1	<1	<1	5
I-23	3/16/99	6	8	4	<1	18
	5/21/99	19	13	5	<1	37
	6/22/99	24	21	5	<1	50
I-24	5/21/99	30	15	4	<1	49
	6/21/99	8	5	<1	<1	13
I-25	5/25/99	390	42	2	<1	434
	6/21/99	<3	<1	9	<1	9
	7/26/99	<3	<1	<1	<1	0
	8/16/99	<1	<1	1	<1	1
I-26	5/25/99	550	11	1	<1	562
	6/21/99	73	<1	<1	<1	73
	7/26/99	12	<1	<1	<1	12
	8/16/99	18	<1	<1	<1	18
I-27	5/21/99	1,400	220	2	<1	1,622
	6/21/99	26	3	<1	<1	29
	7/26/99	4	<1	<1	<1	4
	8/16/99	34	<1	<1	<1	34
I-28	5/24/99	84	4	<1	<1	88
	6/22/99	5	<1	<1	<1	5
	7/26/99	14	<1	<1	<1	14
	8/16/99	26	<1	<1	<1	26
I-29	5/25/99	150	8	<1	<1	158
	6/22/99	7	<1	5	<1	12
	7/27/99	30	3	<1	<1	33
	8/16/99	40	1	<1	<1	41
I-30	5/25/99	250	18	<1	<1	268
	6/22/99	16	1	<1	<1	17
	7/27/99	6	<1	<1	<1	6
	8/16/99	17	<1	<1	<1	17

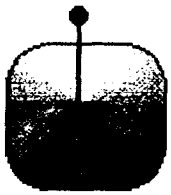
Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-31	5/26/99	14	1	1	<1	16
	6/22/99	24	3	1	<1	28
I-32	5/26/99	<3	<1	<1	<1	0
	6/22/99	11	<1	<1	<1	11
I-33	5/26/99	<3	<1	<1	<1	0
	6/22/99	17	3	1	<1	21
I-34	5/26/99	9	<1	<1	<1	9
	6/23/99	9	3	1	<1	13
I-35	5/27/99	11	49	150	23	233
	6/23/99	<3	<1	<1	<1	0
	7/27/99	6	1	<1	<1	7
	8/17/99	11	2	<1	<1	13
I-36	5/26/99	26	15	10	<1	51
	6/23/99	20	5	2	<1	27
I-37	5/27/99	13	5	170	<1	188
	6/22/99	<3	3	43	<1	46
	7/27/99	3	3	11	<1	17
	8/17/99	10	3	5	<1	18
I-38	5/27/99	9	34	31	<1	74
	6/23/99	9	15	8	<1	32
	7/27/99	<3	6	7	<1	13
	8/16/99	2	7	9	<1	18
I-39	5/27/99	<3	17	73	23	113
	6/23/99	<3	26	220	<1	246
	7/27/99	<3	3	2	<1	5
	8/17/99	<1	3	3	<1	6
I-40	5/27/99	<3	130	810	140	1,080
	6/23/99	3	22	12	<1	37
	7/27/99	<3	7	16	<1	23
	8/17/99	2	14	50	<1	66
I-41	5/27/99	<3	23	560	53	636
	6/23/99	<30	27	330	<10	357
	7/27/99	<3	6	32	<1	38
	8/17/99	<1	10	40	<1	50
I-42	5/27/99	<3	4	31	<1	35
	6/23/99	<3	3	33	<1	36
I-43	5/27/99	120	210	79	<1	409
	6/23/99	15	11	4	<1	30
	7/27/99	3	2	3	<1	8
	8/17/99	2	2	1	<1	5
I-44	5/27/99	120	16	1	<1	137
	6/23/99	23	8	2	<1	33
	7/27/99	20	7	<1	<1	27
	8/17/99	15	4	<1	<1	19

Notes:

1. Results for RW7 and RW8 on 1/27/99 are not considered valid due to inadequate purging prior to sample collection.
2. Total Chlorinated Aliphatics (CACs) = sum of tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride concentrations.
3. For computation of Total Chlorinated Aliphatics (CACs), all non-detect values were assumed to be zero.
4. Data are considered suspect, and the wells were re-sampled on 5/26/99 or 6/3/99.

ATTACHMENT 1

FINAL EFFECTIVENESS EVALUATION REPORT
GEO-CLEANSE TREATMENT PROGRAM PHASE II
NAVAL SUBMARINE BASE KINGS BAY
SITE 11, KINGS BAY GEORGIA



Geo-Cleanse International, Inc.

FINAL
Effectiveness Evaluation Report
Geo-Cleanse® Treatment Program

PHASE II

Naval Submarine Base Kings Bay
Site 11
Kings Bay, Georgia

Prepared for:
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October 1, 1999

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APPENDICES

1. INTRODUCTION

Geo-Cleanse International, Inc. (GCI), on behalf of Bechtel Environmental, Inc. (Bechtel), was contracted to perform an in-situ chemical oxidation treatment to address volatile organic constituents (VOCs) in groundwater at Site 11 of the Naval Submarine Base (NSB) Kings Bay in Kings Bay, Georgia. A Geo-Cleanse® Treatment at Site 11 was completed on February 14, 1999. Based upon the results of this treatment (referred to as Phase I), the scope of work was expanded to include additional areas and Phase II was completed on July 15, 1999. The current contracted tasks were performed as a modification under Bechtel Subcontract Agreement No. 22567-625-SC-0830, under Bechtel Job No. 22567 and Contract No. N62467-93-D-0936 with the Department of the Navy. The purposes of this Effectiveness Evaluation Report are to summarize the goals, describe the observations and results, and provide conclusions regarding the efficiency of the Phase II Geo-Cleanse® Treatment Program at Site 11. The following documents were reviewed in preparation for the Phase II Geo-Cleanse® Treatment:

- Bechtel Environmental, Inc. *Request for Proposal (RFP) 22567-625-SC-0830, In-Situ Chemical Oxidation Deployment, NSB Kings Bay, GA.* Dated July 17, 1998.
- Geo-Cleanse International, Inc. *Effectiveness Evaluation Report, Geo-Cleanse® Treatment Program, Naval Submarine Base Kings Bay Site 11, Kings Bay, Georgia.* Dated May 7, 1999.

The remainder of this Effectiveness Evaluation Report is organized as follows:

Section 1, Introduction (this section)— Further in Section 1 is a description of the site including geologic and hydrogeologic setting, nature and extent of VOC contamination, summary of Phase I results, an overview of the Geo-Cleanse® Process and application to contaminants reported at the site, and treatment goals.

Section 2, Treatment Program Operations and Observations— Describes the field operations conducted at the site, with summaries of all analytical and field data collected prior to, during, and after the field operations, hydrogen peroxide injection totals by location and date, and injector installation data.

Section 3, Treatment Program Results— Describes and interprets the analytical results generated by the treatment program, and evaluates overall treatment performance.

Section 4, Conclusions— Presents a summary of the Geo-Cleanse® Treatment Program at the site, describes lessons learned by application at the site, and draws conclusions regarding overall performance and success.

Section 5, References Cited— Presents a bibliographic list of references cited in the text.

1.1 Background

The NSB Kings Bay occupies approximately 16,168 acres in Camden County, Georgia. Site 11 is identified as the Old Camden County Landfill, which is now incorporated in the NSB (Figure 1). The Old Camden County Landfill was used for municipal waste disposal in the 1960's and 1970's. Waste was disposed by digging trenches and filling with waste. The trenches were then covered with fill. Tetrachloroethene was disposed in the landfill at some point during waste disposal operations, resulting in groundwater contamination at the site. The only facilities remaining in the area are part of ongoing environmental investigation and remediation activities.

The shallow soils in the region of NSB Kings Bay are typified as fine sands interbedded with silty and/or clayey fine sands and some medium sands, with water encountered at approximately 6 feet below grade. An unconfined surficial aquifer is approximately 90 ft thick in the vicinity of Site 11. Within the Site 11 area, the lithology of the surficial zone is described as gray to light brown, fine to medium quartz sand with intermittent gray clay lenses, extending to a depth of at least 50 ft below grade. Depth to water is approximately 6 ft below grade.

Site delineation within the treatment area, upon which the Phase I treatment program was designed, was derived from direct-push sampling of groundwater conducted in March 1997 and September 1997. Results indicated that chlorinated aliphatic compounds (CACs) were present in groundwater and that the impacted zone was primarily restricted to between 30 and 40 ft depth below grade, within a zone of relatively high transmissivity. The CACs reported and their maximum concentrations were 3,500 µg/L for tetrachloroethene (PCE), 1,600 µg/L for trichloroethene (TCE), 3,100 µg/L for cis-1,2-dichloroethene (cis-1,2-DCE), and 300 µg/L for vinyl chloride (VC). The

average total concentration of CACs (taken as the sum of PCE, TCE, cis-1,2-DCE, and VC concentrations) within the treatment area was estimated by Bechtel to be approximately 5,000 µg/L. Hydraulic conductivity was reported as 30 ft/day in the 30 ft to 40 ft depth interval, with flow direction generally to the northwest.

A Geo-Cleanse® Treatment Program was conducted in order to reduce CAC concentrations in groundwater within the source area at the site. Twenty-three specially-designed injectors, five monitoring wells, and two recovery wells were installed as part of the Geo-Cleanse® Treatment (Figure 1) under the State of Georgia Department of Natural Resources Injection Well Operating Permit #89. Four peizometers and one additional monitoring well were also previously installed at the site. Pre-treatment sampling indicated a maximum total CAC concentration of 9,074 µg/L (in monitoring well KBA-11-34) and an average total CAC concentration of 3,028 µg/L within the primary treatment area (analytical results are compiled in Table 1). Treatment was completed on February 14, 1999 after injection of 12,063 gallons of 50% hydrogen peroxide solution. Groundwater samples were collected from every monitoring well and injector within and adjacent to the treatment area. Overall, the cleanup objectives were met within the primary treatment area (identified in Figure 1), with a reduction to 9 µg/L of total CACs in KBA-11-34 (>99% reduction) and an average reduction in total CACs to 53 µg/L (98% reduction). However, injector I-14, located upgradient of the Phase I primary treatment area, yielded a post-treatment total CAC concentration of 3,800 µg/L. The PCE concentration in I-14 was 3,500 µg/L, indicative of the presence of a residual dense nonaqueous phase liquid (DNAPL) near I-14. In addition, relatively high CAC concentrations remained downgradient of the primary treatment area, particularly in the area of the four USGS peizometers (USGS-1, USGS-2, USGS-3, and USGS-15). Based upon these results, a Phase II treatment was proposed in order to target the upgradient area near I-14 and the downgradient area near the four USGS peizometers.

1.2 Overview of the Geo-Cleanse® Process and Application to the NSB Kings Bay Site

The Geo-Cleanse® Process is a patented, in-situ chemical oxidation process intended to reduce organic contaminant concentrations in soil and groundwater. The Geo-Cleanse Process® is an aggressive, pressurized injection of concentrated hydrogen peroxide and ferrous iron catalyst, which together are known as Fenton's reagent and generate a hydroxyl free radical that acts as the active oxidizing agent. The basic radical-producing reaction is characterized as:

$$H_2O_2 + Fe^{+2} \rightarrow OH\cdot + OH^- + Fe^{+3}$$

where H_2O_2 is hydrogen peroxide, Fe^{+2} is ferrous iron, OH· is hydroxyl free radical, OH^- is hydroxyl ion, and Fe^{+3} is ferric iron. The hydroxyl free radical generated by Fenton's reagent is a powerful, non-selective oxidant. Oxidation of an organic compound by Fenton's reagent is a rapid and exothermic (heat-producing) reaction. Rate constants for reactions of hydroxyl free radical with common environmental pollutants are typically in the range of 10^7 to 10^{10} $M^{-1}s^{-1}$ (e.g., Haag and Yao, 1992), and 100% mineralization is generally complete in minutes.

Site characterization data provided by Bechtel indicate that the primary CAC within the treatment area at the NSB Kings Bay site is PCE. Fenton's reagent oxidizes chlorinated organic contaminants such as PCE to substituent carbon dioxide, water, and chloride. Reported rate constants for reaction of hydroxyl free radicals with PCE range from 2.3 to 2.8 x 10^9 $M^{-1}s^{-1}$ (Buxton et al., 1988), indicating an extremely rapid reaction. Leung et al. (1992) and Sato et al. (1993) have analyzed PCE destruction by Fenton's reagent, and have reported that mineralization is rapid and complete. The only significant intermediate product of Fenton's oxidation of PCE ($Cl_2C=CCl_2$) is dichloroacetic acid ($CHCl_2COOH$), which is further oxidized to water (H_2O), carbon dioxide (CO_2), hydrogen ions (H^+) and chloride ions (Cl^-) (Figure 2):

$$Cl_2C=CCl_2 + OH\cdot + H_2O \rightarrow CHCl_2COOH + H^+ + Cl^- + Cl\cdot$$

$$CHCl_2COOH + 4OH\cdot \rightarrow 2H^+ + 2Cl^- + 2H_2O + 2CO_2$$

(Leung et al., 1992; Sato et al., 1992). Residual hydrogen peroxide not consumed by oxidation of organic compounds naturally decomposes to oxygen and water. Soluble ferrous iron catalyst amendments will naturally precipitate as ferric iron compounds.

1.3 Goals of the Phase II Geo-Cleanse® Treatment Program at the NSB Kings Bay Site

Data provided by Bechtel indicated that CACs (primarily PCE, TCE, cis-1,2-DCE and VC) were concentrated in the groundwater in Site 11 at NSB Kings Bay in areas outside of the Phase I primary treatment area. The goals of the Geo-Cleanse® Treatment at the site were to treat groundwater within the contaminated plume source area at Site 11, to achieve reduction CACs.

Natural attenuation modeling results indicated that source area reduction of CACs to 100 µg/L for each compound would be sufficient for natural attenuation to achieve compliance levels in the groundwater plume prior to leaving the base boundaries and reaching offsite monitoring points (Chapelle and Bradley, 1998). Thus a more conservative target of 100 µg/L of total CACs (taken as the sum of PCE, TCE, cis-1,2-DCE and VC concentrations) was established as the remedial goal.

2. TREATMENT PROGRAM OPERATIONS AND OBSERVATIONS

2.1 Cone Penetrometer Testing

Phase I post-treatment sampling identified an upgradient, previously undetected CAC source near I-14 with dissolved PCE concentrations exceeding 1% of the solubility of PCE and, therefore, indicative of the presence of residual DNAPL (see Section 1.1). To further characterize this source area and to provide additional downgradient delineation, Bechtel advanced a cone penetrometer at 24 locations to collect water samples for CAC analysis. The analytical results (Table 2 and Figure 3) identified a concentrated source area near I-14 with a maximum total CAC concentration of 7,430 µg/L. The plume source appears to extend no further upgradient than I-14, and extends downgradient towards CPT-07. Sample locations upgradient or side-gradient of I-14 (CPT-01 through CPT-06 and CPT-14) did not contain any CACs. The vertical distribution of CACs at location CPT-15 indicated that CACs were concentrated deeper than 25 feet. Additionally, results from one location within the Phase I primary treatment area (CPT-08) indicated the presence of 190 µg/L of total CACs, and results from one location outside and downgradient of the treatment area (CPT-13) indicated the presence of 286 µg/L of total CACs.

2.2. Injector Installation

Prior to the Phase I treatment, the State of Georgia Department of Natural Resources issued Injection Well Operating Permit #089 (dated October 26, 1998 [Appendix A]) to the Department of the Navy on behalf of Bechtel for installation and operation of injectors for the Geo-Cleanse® Treatment Program. Under this permit and in preparation for the Phase II treatment, an additional 21 injectors distributed in two vertical levels were installed from May 20-27 at the locations indicated in Figure 1. Boreholes were drilled by hollow stem auger. Sixteen of the injectors were installed to a

depth of approximately 35 ft below grade (referred to as shallow injectors). The remaining 5 injectors were installed to a depth of approximately 42 ft below grade (deep injectors). Injector construction depths and screened intervals are summarized in Table 3. Soil boring logs are included as Appendix B and injector construction logs included as Appendix C of this report.

The riser, screen, and completion materials were selected and designed for resistance to the chemical reagents used, and the heat and pressure generated by the Geo-Cleanse® Process. The injectors were constructed with 3 ft of 1¼-inch diameter, 0.010-slot stainless steel screens. The riser pipe is composed of 1¼-inch diameter Schedule 80 black steel riser pipe and couplings and extends approximately 1 ft above grade The screens were packed with filter sand and a layer of bentonite pellets was installed to seal the screened interval. The annulus was then sealed to grade with a Portland cement and bentonite grout. The injector risers have threaded caps. The injectors are designed to accommodate the patented Geo-Cleanse® Mixing Head, which was attached directly to the riser (Figure 4). This mixing head is designed to deliver a stabilized mixture of reagents to the subsurface.

2.3. Pre-Injection Sampling Results

After Phase II injector installation was completed in May 1999, Bechtel personnel collected a round of groundwater samples from every injector, recovery well and monitoring well within or adjacent to the treatment area prior to the Phase II injection. The analytical results for the May sampling event (Table 1) indicated that the CAC concentrations within the central part of the plume (e.g., monitoring well KBA-11-34) generally remained below 100 µg/L as a result of the Phase I treatment program. The primary exception was near I-14, at which total CAC concentrations of 5,885 µg/L in I-14 and 1,622 µg/L in new Phase II injector I-27 were detected (both previously unknown source areas until after the Phase I treatment). The CACs at both locations (and in general within the upgradient plume area) were primarily PCE (5,000 µg/L and 1,400 µg/L, respectively). Within the downgradient plume area, the two sampling locations with the highest CAC levels were USGS-1 (1,130 µg/L) and I-40 (1,080 µg/L). The CACs in the downgradient locations are predominantly PCE breakdown products, primarily cis-1,2-DCE (820 µg/L and 810 µg/L, respectively).

2.4. Injection Operations and Observations

Field injection operations were conducted in two mobilizations, from June 3-11, 1999 and from July 12-15, 1999. A round of groundwater samples was collected between the mobilizations in order to monitor progress and to refine the injection plan for the July mobilization. For each mobilization, the first day was devoted primarily to site preparation activities, including positioning the GCI mobile treatment unit, hydrogen peroxide tanker, and generator, establishing an exclusion zone, preparing the safety shower and eyewash, and conducting a health and safety meeting for all personnel. Pre-treatment injection activities included pneumatic and hydraulic tests of the injectors and aquifer to determine permeability.

Injection was initiated on the first field day during each mobilization. Approximately 82,200 lbs (8,286 gallons) of 50% hydrogen peroxide solution and an equivalent volume of ferrous iron catalyst solution were injected during the June mobilization. An additional 29,400 lbs (2,964 gallons) of 50% hydrogen peroxide solution and an equivalent volume of ferrous iron catalyst solution were injected during the July mobilization, for a total Phase II injection volume of approximately 11,250 gallons of 50% hydrogen peroxide. Injection rates ranged from 0.2 to 2.0 gallons per minute per injector for both catalyst and hydrogen peroxide. A maximum of 3 cubic feet per minute of air per injector was used to enhance reagent distribution.

Hydrogen peroxide injection volumes by location and day are summarized in Table 4 and Figure 6 (catalyst injection volumes were very similar). Total injection volumes for the Phase I treatment (concluded in February 1999) and Phase II are summarized in Table 5. Injection volumes ranged from 55 gallons to 1,570 gallons (although not all locations were treated during Phase II), with daily totals ranging from 6 gallons to 1,359 gallons. Hydrogen peroxide was not injected to every location during Phase II. The variable injection volumes reflect primarily the contaminant concentrations at individual injectors, coupled with field indications of contaminant mass destruction (primarily carbon dioxide levels; see below). For example, injector I-14 and I-27, which received the highest hydrogen peroxide volumes (1,226 and 1,570 gallons, respectively), had the highest CAC concentrations prior to injection.

2.4.1. Groundwater Quality Measurements

Groundwater samples were collected each day from monitoring wells in order to determine if appropriate chemical conditions were established in the aquifer, reagents were dispersed effectively

and inert oxidation byproducts were generated. Parameters monitored to ensure that appropriate conditions were established and reagents were dispersed include pH, alkalinity, total iron and hydrogen peroxide. Fenton's reagent is most effective at mildly acidic pH ranges, and the optimal groundwater pH range for the Geo-Cleanse® Process is less than 6. High levels of dissolved carbonate and bicarbonate inhibits reduction of groundwater pH to less than 6, and carbonate is also a hydroxyl free radical trap. Accordingly, relatively low alkalinity (less than 200 mg/L) is optimal for the Geo-Cleanse® Process. Iron is a catalyst that promotes hydroxyl free radical formation (see Section 1.2), and dissolved total iron levels greater than 5 mg/L are optimal for the Geo-Cleanse® Process.

All field monitoring data are compiled in Appendix D. Routine sampling indicated that appropriate chemical conditions were established within the treatment zone of the aquifer. Groundwater pH generally ranged from 3.5 to 6 (Figure 7) and alkalinity was less than 200 mg/L (Figure 8). Iron concentrations were typically greater than 10 mg/L. Hydrogen peroxide was not widely detected or persistent in the monitoring wells, indicating the dissolved iron was sufficient to consume the hydrogen peroxide.

Chloride is produced as a byproduct of chlorinated solvent oxidation (see Section 1.2). Chloride could not be readily measured because the relatively low groundwater pH (<5.5) interfered with the test. The available data indicated relatively unchanged chloride concentrations over the course of treatment. This is consistent with the CAC levels observed at the site. For example, PCE is approximately 85.5% chloride by mass. Thus if the maximum observed PCE concentration is 5,000 µg/L (the pre-injection result for I-14; Table 1), then the corresponding maximum chloride increase is approximately 4.3 mg/L. The resolution of the field test kit is ±5 mg/L and, therefore, not sufficient to detect the chloride signals.

Photoionization detector (PID) measurements of groundwater headspace samples were utilized as a semiquantitative measure of dissolved CAC concentrations. The PID measures volatile organic compounds (including CACs) in the gas headspace trapped above a water sample in a sealed jar. The concentration of volatile organic compounds in the gas headspace, in turn, is proportional to the concentration dissolved in groundwater, as dictated by Henry's Law. Thus the PID readings provide rapid field measures of CAC concentration in groundwater. The headspace measurements yielded relatively low readings, with a maximum of 15 ppm but predominantly less than 3 ppm. Only KBA-11-31 consistently yielded readings. The groundwater headspace readings in KBA-11-31 peaked on the second day of injection and then decreased, indicative of decreasing CAC

concentration (Figure 9). The remainder of the monitoring wells yielded relatively low headspace PID readings.

2.4.2. Offgas Composition Measurements

Off gases liberated via the monitoring wells and injectors were monitored for carbon dioxide and oxygen concentration. The gases were liberated only during the measurement process, and capping the riser pipes controlled venting from the monitoring wells and injectors. The concentrations of carbon dioxide and oxygen in these gases provide measures of CAC oxidation and treatment progress. Carbon dioxide is produced as a product of CAC oxidation (see Section 1.2). In the absence of organic compounds (reflecting progressive destruction of the CACs), reaction of hydroxyl free radicals with hydrogen peroxide or other radicals generates oxygen. Thus in general, over the course of a Geo-Cleanse® injection, carbon dioxide levels reach maxima in the first few days of injection and decrease over the course of treatment, while oxygen levels increase.

The expected patterns for offgas concentrations were observed at NSB Kings Bay. However, due to the large number of injectors at the site, the timing of the maxima varied reflecting different focus areas at different times during the injection. For example, carbon dioxide reached a maximum in the upgradient area near injector I-14 after 2 days of injection and then decreased (Figure 10), corresponding with an initial hydrogen peroxide injection focus in that area during the first week. Subsequently, a carbon dioxide maximum in the downgradient area (near the recovery wells RW-7 and RW-8) occurred after approximately 6 days of injection, reflecting a downgradient shift in the injection focus. Oxygen levels were initially near ambient (20.9%) but rose to >30% within the first few days. This is consistent with observations from Geo-Cleanse® Treatment at other sites impacted by CACs.

2.5. Post-Injection Sampling Results

Bechtel personnel collected groundwater samples from selected locations for CAC analysis after each treatment phase. The first round of post-injection samples was collected June 21-23, 1999, 10 days after concluding the first treatment mobilization. The analytical results (Table 1 and Figure 11) indicate reductions ranging from 4 to 100% at 37 locations, no change at 3 locations, and increases at 16 locations. The observed decreases were greatest in the upgradient area. Total CACs in injector I-14 were reduced by 99%, to 70 µg/L (average of two duplicates) from 5,613 µg/L (average

of two duplicates). Total CACs in injector I-27 were reduced by 98%, to 29 µg/L from 1,622 µg/L. The observed increases were generally small changes at locations with low total CAC concentrations. For example, injector I-11 increased to 9 µg/L from 4 µg/L, for a 125% increase. Injector I-16 was the only location that increased above the 100 µg/L cleanup objective, to 212 µg/L of total CACs from 17 µg/L. Overall, at the conclusion of the June treatment, eight locations yielded total CAC concentrations that exceeded the 100 µg/L cleanup objective, of which five locations were at the downgradient margin of the treatment area.

Additional post-injection rounds of groundwater samples were collected by Bechtel personnel from selected locations on July 26-27 and on August 16-17, 1999 (Table 1), after the conclusion of the second treatment mobilization on July 15, 1999. Results from the July 26-27 round (Figure 12) indicate continued reductions in total CAC concentrations. Of the 37 locations sampled, 35 yielded reductions from 16-100% relative to the May 1999 pre-injection levels. The two locations that yielded increases (I-11 and KBA-11-35) were insignificant, from 4 µg/L to 8 µg/L and from 0 to 1 µg/L, respectively. Only one location (I-14) remained above the 100 µg/L total CAC cleanup objective, and that yielded an overall 98% reduction to 136 µg/L from 5,614 µg/L (mean of two duplicates).

The results from the August 16-17 round (Figure 13) indicate further reductions across most of the site, particularly in the downgradient portion of the site. All four USGS peizometers yielded approximately 50% reductions from the July results. Within the upgradient portion of the site, most of the sampling locations remain well below the cleanup objective of 100 µg/L. Only one location at the site (I-14) exceeds the cleanup objective. Total CACs at injector location I-14 rebounded to 2,180 µg/L in August from 136 µg/L in July, although overall the total CACs are reduced by 61% relative to the May pre-injection sampling round.

3. TREATMENT PROGRAM RESULTS

The Phase I Geo-Cleanse® Treatment Program at the Kings Bay site was intended to address contamination known in the area of monitoring well KBA-11-34 (Figure 1). On the basis of successful Phase I results, the Phase II Geo-Cleanse® Treatment at the Kings Bay site was intended to address additional contaminant mass primarily in two areas: downgradient of the Phase I treatment area near the two recovery wells, and upgradient of the Phase I treatment area near I-14. The area near I-14 was identified after the Phase I treatment as a likely source area (see below). The goal of the Geo-Cleanse® Treatment was to reduce total CAC levels to 100 µg/L or less and maintain that level

for at least 30 days. After injection of 11,247 gallons of 50% hydrogen peroxide solution during two mobilizations in June and July 1999, the total CAC level in 55 out of 56 sampling points was below 100 µg/L and maintained for at least 30 days after the injection was concluded (Figures 12 and 13). Within the downgradient plume area, total CACs prior to treatment ranged from 0 to 1,130 µg/L and were composed primarily of natural PCE degradation products (TCE, cis-1,2-DCE and VC). The concentrations detected were not generally indicative of the presence of a dense non-aqueous phase liquid (DNAPL) within the downgradient area, and consistent with the hypothesis that the CAC source area was upgradient from the recovery wells. After conclusion of the injection, the maximum observed total CAC level was 66 µg/L in I-40, which was reduced from 1,080 µg/L.

Within the upgradient plume area (near I-14), pre-injection total CAC concentrations exceeded 5,000 µg/L, of which PCE comprised 85% of the total CACs. The concentration of PCE exceeded 1% of the pure phase water solubility (2,200 µg/L), indicating the likely presence of a residual DNAPL phase near I-14. Also, the predominance of PCE (rather than its natural degradation products) indicates that the CACs were not significantly degraded relative to the downgradient material and thus likely more proximal to the source area. Pre-injection cone penetrometer and groundwater sample results (Figures 3 and 5) indicate that the CAC contamination was apparently restricted to a narrow plume extending from I-14 towards CPT-07 and I-27. Additionally, the results for CPT-15 indicate that the contamination extends to a shallower depth (25-28 ft) than previously suspected.

Following the Phase II treatment, total CACs were reduced to less than 100 µg/L and maintained for 30 days in all but one of the upgradient sampling locations (Figure 13). The remaining sample point was injector I-14, which yielded 70 µg/L of total CACs after the first treatment mobilization in June 1999, but rebounded to 137 µg/L immediately after the second mobilization and to 2,180 µg/L by 30 days after the July injection. The surrounding sampling points were maintained below 100 µg/L of total CACs. Injector I-14 is, therefore, very likely located directly within the source area. The relatively high CAC levels indicate the presence of a persistent source remaining after the Geo-Cleanse® Treatment Program. However, the source is possibly not within the targeted depth intervals.

Eight injectors and two monitoring wells are located within 20 ft of I-14. In addition, Bechtel advanced 10 cone penetrometer points within 20 ft of I-14, for a total of 21 groundwater sample locations. All of the injectors and monitoring wells, and most of the cone penetrometer points, were sampled for groundwater from depths ranging from 28 to 42 ft below grade. Cone penetrometer

location CPT-15 was sampled at 3-ft intervals from 10 to 28 ft, and detected significant contamination at the 25-28 ft interval.. At the conclusion of the Phase II treatment in July, total CAC levels in the eight injectors and two monitoring wells remained below the cleanup objective of 100 µg/L for 30 days, thus achieving the cleanup goal. Only the results from I-14 indicated rebound. The low total CAC results from 10 points surrounding I-14, coupled with the cone penetrometer test indicating significant contamination at the 25-28 ft depth interval and the observation that the CACs present are predominantly PCE, indicates that a likely source for the residual plume is in very close proximity of I-14 but located stratigraphically higher. This is consistent with the site history, because the site was formerly a landfill excavated to a depth of approximately 10 ft into which the PCE source was apparently dumped.

4. CONCLUSIONS

A Geo-Cleanse® Treatment was completed at the Naval Submarine Base Kings Bay Site 11 on July 15, 1999. The Geo-Cleanse® Process is an in-situ chemical oxidation technology to destroy organic contaminants in soil and groundwater. Site 11 was a former landfill, and the underlying aquifer was impacted with chlorinated aliphatic compounds (primarily tetrachloroethene). A Phase I Geo-Cleanse® Treatment at the site, concluded in February 1999, resulted in significant CAC reductions within the primary targeted area. This Phase II treatment targeted additional contamination located in two areas, downgradient near the recovery wells and upgradient near I-14. For Phase II, the maximum observed concentrations were 7,000 µg/L of tetrachloroethene and 7,430 µg/L of total chlorinated aliphatics. The dissolved tetrachloroethene concentration exceeds 1% of the compound water solubility, indicating the likely presence of a dense nonaqueous phase liquid within the treatment area. The cleanup objective was to reduce the concentration of total chlorinated aliphatic compounds to less than 100 µg/L. Based upon bioremediation modeling (Chapelle and Bradley, 1998), if the source area concentrations were reduced to 100 µg/L, natural biological degradation processes in the aquifer at Site 11 would destroy the remaining contaminants before the groundwater migrated beyond the base boundary.

An additional 21 specially designed injectors were installed in an array encompassing the targeted plume areas. During the Phase II treatment 11,247 gallons of 50% hydrogen peroxide and a similar volume of ferrous iron catalyst solution were injected over the course of 12 days between two mobilizations (June 3-11 and July 12-15, 1999). Post-injection sampling results indicate that the

cleanup objective was achieved in 55 out of 56 sampling points within and adjacent to the targeted treatment areas, and maintained for at least 30 days after injection. Only one location (I-14), located in the upgradient treatment area, yielded a total CAC level in excess of the 100 µg/L cleanup objective. Based upon the observation that ten monitoring points located within 20 ft of I-14 are below 100 mg/L and that cone penetrometer testing indicates that contamination extends shallower than 28 ft (shallower than previously suspected), a previously unknown source is likely present at shallower depths above the primary treatment zone.

The Geo-Cleanse® Process provided an effective and rapid solution to chlorinated aliphatic compound contamination in the aquifer underlying the Site 11 landfill. Further characterization and treatment of the remaining area near I-14 is warranted. Based upon these results, Geo-Cleanse® Treatment achieved dissolved chlorinated aliphatic compound concentrations below 100 µg/L at this site, indicating that the application was successful and protective of groundwater migrating offsite.

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Table 1. NSB Kings Bay Groundwater Chlorinated Aliphatic Compound (CAC) Results

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
KBA-11-31	09/17/98	<1	9	6	2	17
	10/30/98	<1	1	7	<1	8
	11/06/98	1	<1	<1	<1	1
	11/24/98	8	7	2	<1	17
	12/22/98	12	12	6	<1	30
	01/27/99	14	15	4	<1	33
	02/18/99	23	17	5	<1	45
	03/15/99	15	12	7	<1	34
	05/20/99	69	57	73	5	204
	06/21/99	6	<1	<1	<1	6
	07/26/99	4	<1	<1	<1	4
	08/16/99	7	<1	<1	<1	7
KBA-11-32	09/17/98	3	91	30	9	133
	10/30/98	<1	110	54	4	168
	11/13/98	<1	<1	<1	<1	0
	11/24/98	4	9	3	<1	16
	12/22/98	7	13	5	<1	25
	01/27/99	9	17	5	<1	31
	02/18/99	6	8	3	<1	17
	03/15/99	11	11	4	<1	26
	05/20/99	18	13	<1	<5	31
	06/21/99	12	6	1	<1	19
	07/26/99	9	4	<1	<1	13
	08/16/99	10	2	<1	<1	12
KBA-11-33	09/17/98	<1	<1	<1	<1	0
	10/30/98	<1	<1	<1	<1	0
	11/24/98	<1	<1	<1	<1	0
	12/22/98	<1	<1	<1	<1	0
	01/27/99	<3	<1	<1	<1	0
	02/18/99	<1	<1	<1	<1	0
	03/15/99	<1	<1	<1	<1	0
	05/20/99	<3	<1	<1	<5	0
	06/22/99	<3	<1	<1	<1	0
	07/26/99	<3	<1	<1	<1	0
	08/16/99	<1	<1	<1	<1	0
KBA-11-34	09/17/98	3,200	350	8	<1	3,558
	9/17/98 (dup)	2,500	320	8	<1	2,828
	10/30/98	8,500	550	24	<1	9,074
	11/13/98	180	30	<5	<5	210
	11/24/98	200	19	<1	<1	219
	11/24/98 (dup)	130	15	<1	<1	145
	12/22/98	87	6	<1	<1	93
	01/27/99	83	7	<1	<1	90
	02/18/99	9	<1	<1	<1	9
	03/15/99	62	3	<1	<1	65
	3/15/99 (dup)	57	2	<1	<1	59
	05/20/99	83	3	<1	<5	86
	06/22/99	10	<1	<1	<1	10
	07/26/99	24	<1	<1	<1	24
	08/16/99	16	<	<1	<1	16

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
KBA-11-35	09/17/98	<1	<1	<1	<1	0
	10/30/98	<1	<1	<1	<1	0
	11/06/98	<1	<1	<1	<1	0
	11/24/98	<1	<1	<1	<1	0
	12/22/98	<1	<1	<1	<1	0
	01/27/99	<3	<1	<1	<1	0
	02/18/99	<1	<1	<1	<1	0
	03/15/99	<1	<1	<1	<1	0
	05/20/99	<3	<1	<1	<5	0
	06/21/99	18	1	<1	<1	19
	07/26/99	<3	<1	1	<1	1
	08/16/99	2	<1	<1	<1	2
KBA-11-36	09/17/98	7	440	60	5	512
	10/30/98	5	360	60	<1	424
	10/30/98 (dup)	4	330	59	1	394
	11/24/98	17	55	3	<1	75
	12/22/98	370	44	2	<1	416
	01/27/99	380	44	2	<1	426
	02/18/99	3	<1	3	<1	6
	03/15/99	51	3	<1	<1	54
	05/20/99	90	10	<1	<5	100
	06/22/99	<3	<1	<1	<1	0
	07/26/99	14	3	<1	<1	17
	08/16/99	28	2	<1	<1	30
KBA-11-13A	09/17/98	<1	24	160	78	262
	10/30/98	<10	16	130	10	156
	11/04/98	<3	15	5	28	48
	11/24/98	<1	16	100	22	138
	11/25/98	<5	16	79	26	121
	12/22/98	<1	14	230	22	266
	01/07/99	<5	<5	34	60	94
	01/27/99	<3	20	110	22	152
	02/18/99	<1	15	150	22	187
	03/15/99	<10	13	150	15	178
	04/07/99	<1	7	49	93	149
	05/20/99	<3	29	350	61	440
	06/23/99	<3	25	280	45	350
	07/26/99	<15	26	240	57	323
	08/17/99	<1	24	240	26	290
RW7	10/30/98	720	160	66	<1	946
	11/24/98	220	62	110	<1	392
	1/27/99[1]	<3	2	2	<1	4
	02/18/99	120	10	5	<1	135
	2/18/99 (dup)	120	10	6	<1	136
	03/15/99	69	10	7	<1	86
	05/20/99	77	6	<1	<5	83
	5/20/99 (dup)	76	6	<1	<5	82
	06/23/99	9	2	2	<1	13
	6/23/99 (dup)	10	2	2	<1	14
	07/27/99	11	2	<1	<1	13
	08/17/99	18	<1	<1	<1	18
	8/17/99 (dup)	18	2	<1	<1	20

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
RW8	10/30/98	<1	83	57	10	150
	11/24/98	<1	57	110	10	177
	1/27/99[1]	<3	2	2	<1	4
	02/18/99	5	17	110	7	139
	05/20/99	11	14	22	22	69
	06/23/99	4	4	23	<1	31
	07/27/99	<3	5	7	<1	12
	08/17/99	1	2	3	<1	6
USGS-1	08/06/98	<5	1,140	919	314	2,373
	11/04/98	<3	28	340	33	401
	11/25/98	<5	120	580	61	761
	01/07/99	<5	78	213	<5	291
	04/07/99	<1	198	731	64	993
	5/20/99[4]	500	240	25	<5	765
	05/26/99	<3	190	820	120	1,130
	06/23/99	<30	150	400	21	571
	6/23/99 (dup)	<30	170	420	21	611
	07/27/99	<3	13	77	<1	90
	08/17/99	<1	8	34	<1	42
USGS-2	08/06/98	<5	160	290	219	669
	11/04/98	<3	560	660	45	1,265
	11/25/98	<5	180	300	22	502
	01/07/99	<5	34	293	39	366
	04/07/99	<1	49	500	56	605
	5/20/99[4]	15	96	190	16	317
	06/03/99	<3	130	440	11	581
	06/23/99	4	57	170	<1	231
	07/27/99	<3	2	34	<1	36
	08/17/99	<1	3	13	<1	16
USGS-3	08/06/98	<5	45	328	327	700
	11/04/98	<3	350	1,300	74	1,724
	11/25/98	<5	260	860	26	1,146
	01/07/99	<5	290	1,070	64	1,424
	04/07/99	5	97	492	54	648
	5/20/99[4]	6	71	430	24	531
	06/03/99	20	130	130	9	289
	06/23/99	70	67	60	<1	197
	07/27/99	<3	1	15	<1	16
	08/17/99	<1	2	10	<1	12
USGS-15	11/04/98	<1	9	3	7	19
	11/25/98	<5	7	34	6	47
	01/07/99	<5	25	29	<5	54
	04/07/99	29	42	8	<1	79
	5/20/99[4]	<3	160	840	110	1,110
	06/03/99	330	170	13	<1	513
	06/23/99	310	160	25	<5	495
	07/27/99	6	7	2	<1	15
	08/17/99	26	28	7	<1	61
I-1	10/30/98	<1	<1	9	<1	9
	12/22/98	<1	<1	<1	<1	0
	03/16/99	<1	<1	<1	<1	0
	05/20/99	<3	<1	<1	<5	0
	06/22/99	4	<1	<1	<1	4

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-2	12/22/98	290	9	<1	<1	299
	01/27/99	4	<1	4	<1	8
	02/18/99	52	1	<1	<1	53
	03/16/99	230	3	<1	<1	233
	3/16/99 (dup)	250	4	<1	<1	254
	05/20/99	27	3	5	<5	35
	06/22/99	10	<1	7	<1	17
	07/27/99	<3	<1	2	<1	2
	08/16/99	15	<1	<1	<1	15
I-3	12/22/98	<1	<1	1	<1	1
	03/16/99	56	2	<1	<1	58
	05/20/99	8	<1	<1	<5	8
	06/22/99	22	<1	<3	<1	22
I-4	11/24/98	290	43	<1	<1	333
	12/22/98	900	30	1	<1	931
	01/27/99	230	18	17	<1	265
	02/18/99	97	2	<1	<1	99
	03/16/99	88	2	<1	<1	90
	3/16/99 (dup)	87	2	<1	<1	89
	05/20/99	13	3	3	<5	19
	06/22/99	32	1	<1	<1	33
	6/22/99 (dup)	21	<1	<1	<1	21
	07/27/99	<3	1	15	<1	16
	08/17/99	30	<1	<1	<1	30
	8/17/99 (dup)	6	<1	<1	<1	6
I-5	02/18/99	<1	<1	1	<1	1
	03/16/99	<1	<1	<1	<1	0
	05/20/99	77	4	1	<5	82
	06/22/99	<3	<1	3	<1	3
I-6	02/18/99	2	<1	<1	<1	2
	03/16/99	2	<1	<1	<1	2
	05/20/99	<3	<1	<1	<5	0
	06/22/99	<3	<1	<1	<1	0
I-7	02/18/99	<1	<1	210	3	213
	03/16/99	<1	<1	85	2	87
	05/21/99	4	1	240	<1	245
	06/22/99	<3	<1	13	<1	13
	07/27/99	<3	<1	16	<1	16
	08/16/99	6	1	10	<1	17
I-8	12/22/98	13	15	1	<1	29
	03/16/99	7	<1	<1	<1	7
	05/20/99	3	2	5	<5	10
	06/22/99	5	<1	<1	<1	5
I-9	12/22/98	9	1	37	1	48
	01/27/99	<3	1	13	<1	14
	03/16/99	8	3	12	<1	23
	05/20/99	<3	<1	20	<5	20
	06/22/99	70	3	2	<1	75
I-10	12/22/98	27	8	<1	<1	35
	01/27/99	25	4	<1	<1	29
	03/16/99	22	1	<1	<1	23
	05/20/99	22	3	<1	<5	25
	06/22/99	<3	<1	<1	<1	0

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-11	11/13/98	<1	<1	200	<1	200
	12/22/98	5	<1	66	<1	71
	12/22/98 (dup)	3	<1	57	<1	60
	02/18/99	1	<1	27	1	29
	03/16/99	<1	<1	10	<1	10
	05/21/99	<3	<1	4	<1	4
	06/21/99	5	<1	4	<1	9
	07/26/99	4	<1	4	<1	8
	08/16/99	3	<1	2	<1	5
I-12	11/13/98	170	44	<5	<5	214
	11/24/98	29	8	<1	<1	37
	12/22/98	76	2	<1	<1	78
	12/22/98 (dup)	65	1	<1	<1	66
	01/27/99	43	2	<1	<1	45
	02/18/99	25	<1	<1	<1	25
	03/16/99	44	<1	<1	<1	44
	05/20/99	27	<1	<1	<5	27
	06/21/99	22	<1	<1	<1	22
	07/26/99	8	<1	<1	<1	8
	08/16/99	13	<1	<1	<1	13
I-13	12/22/98	<1	<1	33	2	35
	01/27/99	<3	<1	14	<1	14
	02/18/99	<1	<1	79	<1	79
	2/18/99 (dup)	<1	<1	61	2	63
	03/16/99	6	<1	12	<1	18
	05/21/99	<3	<1	8	<1	8
	06/21/99	4	<1	4	<1	8
I-14	03/16/99	3,500	300	<10	<10	3,800
	03/31/99	3,200	200	<50	<50	3,400
	04/12/99	2,420	220	11	5	2,656
	05/20/99	5,000	870	15	<5	5,885
	5/20/99 (dup)	4,600	730	12	<5	5,342
	06/21/99	48	14	<1	<1	62
	6/21/99 (dup)	59	18	<1	<1	77
	07/26/99	110	26	<1	<1	136
	7/26/99 (dup)	110	27	<1	<1	137
	08/16/99	1,600	100	<50	<50	1,700
	8/16/99 (dup)	2,500	160	<50	<50	2,660
I-15	03/16/99	<1	<1	<1	<1	0
	05/20/99	<3	<1	<1	<5	0
	06/21/99	<3	<1	<1	<1	0
I-16	10/30/98	<1	<1	<1	<1	0
	12/22/98	71	<1	<1	<1	71
	01/27/99	33	<1	<1	<1	33
	03/16/99	140	<10	<10	<10	140
	03/31/99	68	<1	<1	<1	68
	05/20/99	17	<1	<1	<5	17
	06/21/99	210	2	<1	<1	212
	07/26/99	<3	<1	<1	<1	0
	08/16/99	56	<1	<1	<1	56
I-17	12/22/98	<1	<1	<1	<1	0
	03/16/99	4	<1	<1	<1	4
	05/20/99	22	<1	1	<5	23
	06/21/99	51	<1	<1	<1	51

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-18	12/22/98	16	<1	<1	<1	16
	03/16/99	96	3	<1	<1	99
	05/20/99	180	7	<1	<5	187
	06/21/99	<3	<1	<1	<1	0
	07/26/99	15	<1	<1	<1	15
	08/16/99	31	<1	<1	<1	31
I-19	12/22/98	<1	<1	100	<1	100
	02/18/99	<1	<1	110	2	112
	03/16/99	1	<1	8	2	11
	05/21/99	7	<1	34	<1	41
	06/22/99	<3	<1	18	<1	18
	07/26/99	<3	<1	3	<1	3
	08/16/99	4	<1	6	<1	10
I-20	03/16/99	<1	<1	<1	<1	0
	05/20/99	<3	3	1	<5	4
	06/21/99	<3	<1	6	<1	6
I-21	03/16/99	<1	<1	210	13	223
	05/21/99	4	<1	110	7	121
	06/21/99	<3	1	110	5	116
	07/26/99	<3	<1	100	<1	100
	08/16/99	<1	<1	14	<1	14
I-22	03/16/99	14	30	28	<1	72
	05/20/99	33	24	12	5	74
	06/21/99	4	1	<1	<1	5
I-23	03/16/99	6	8	4	<1	18
	05/21/99	19	13	5	<1	37
	06/22/99	24	21	5	<1	50
I-24	05/21/99	30	15	4	<1	49
	06/21/99	8	5	<1	<1	13
I-25	05/25/99	390	42	2	<1	434
	06/21/99	<3	<1	9	<1	9
	07/26/99	<3	<1	<1	<1	0
	08/16/99	<1	<1	1	<1	1
I-26	05/25/99	550	11	1	<1	562
	06/21/99	73	<1	<1	<1	73
	07/26/99	12	<1	<1	<1	12
	08/16/99	18	<1	<1	<1	18
I-27	05/21/99	1,400	220	2	<1	1,622
	06/21/99	26	3	<1	<1	29
	07/26/99	4	<1	<1	<1	4
	08/16/99	34	<1	<1	<1	34
I-28	05/24/99	84	4	<1	<1	88
	06/22/99	5	<1	<1	<1	5
	07/26/99	14	<1	<1	<1	14
	08/16/99	26	<1	<1	<1	26
I-29	05/25/99	150	8	<1	<1	158
	06/22/99	7	<1	5	<1	12
	07/27/99	30	3	<1	<1	33
	08/16/99	40	1	<1	<1	41
I-30	05/25/99	250	18	<1	<1	268
	06/22/99	16	1	<1	<1	17
	07/27/99	6	<1	<1	<1	6
	08/16/99	17	<1	<1	<1	17

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-31	05/26/99	14	1	1	<1	16
	06/22/99	24	3	1	<1	28
I-32	05/26/99	<3	<1	<1	<1	0
	06/22/99	11	<1	<1	<1	11
I-33	05/26/99	<3	<1	<1	<1	0
	06/22/99	17	3	1	<1	21
I-34	05/26/99	9	<1	<1	<1	9
	06/23/99	9	3	1	<1	13
I-35	05/27/99	11	49	150	23	233
	06/23/99	<3	<1	<1	<1	0
	07/27/99	6	1	<1	<1	7
	08/17/99	11	2	<1	<1	13
I-36	05/26/99	26	15	10	<1	51
	06/23/99	20	5	2	<1	27
I-37	05/27/99	13	5	170	<1	188
	06/22/99	<3	3	43	<1	46
	07/27/99	3	3	11	<1	17
	08/17/99	10	3	5	<1	18
I-38	05/27/99	9	34	31	<1	74
	06/23/99	9	15	8	<1	32
	07/27/99	<3	6	7	<1	13
	08/16/99	2	7	9	<1	18
I-39	05/27/99	<3	17	73	23	113
	06/23/99	<3	26	220	<1	246
	07/27/99	<3	3	2	<1	5
	08/17/99	<1	3	3	<1	6
I-40	05/27/99	<3	130	810	140	1,080
	06/23/99	3	22	12	<1	37
	07/27/99	<3	7	16	<1	23
	08/17/99	2	14	50	<1	66
I-41	05/27/99	<3	23	560	53	636
	06/23/99	<30	27	330	<10	357
	07/27/99	<3	6	32	<1	38
	08/17/99	<1	10	40	<1	50
I-42	05/27/99	<3	4	31	<1	35
	06/23/99	<3	3	33	<1	36
I-43	05/27/99	120	210	79	<1	409
	06/23/99	15	11	4	<1	30
	07/27/99	3	2	3	<1	8
	08/17/99	2	2	1	<1	5
I-44	05/27/99	120	16	1	<1	137
	06/23/99	23	8	2	<1	33
	07/27/99	20	7	<1	<1	27
	08/17/99	15	4	<1	<1	19

Notes:

1. Results for RW7 and RW8 on 1/27/99 are not considered valid due to inadequate purging prior to sample collection.
2. Total Chlorinated Aliphatics (CACs) = sum of tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride concentrations.
3. For computation of Total Chlorinated Aliphatics (CACs), all non-detect values were assumed to be zero.
4. Data are considered suspect, and the wells were re-sampled on 5/26/99 or 6/3/99.

Table 2. NSB Kings Bay Cone Penetrometer Groundwater Analytical Results

Location	Date	Sample Depth (ft)	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[1]
CPT-01	04/12/99	32 - 35	<5	<5	<5	<5	0
CPT-02	04/12/99	32 - 35	<5	<5	<5	<5	0
CPT-03	04/12/99	32 - 35	<5	<5	<5	<5	0
CPT-04	04/12/99	32 - 35	<5	<5	<5	<5	0
CPT-05	04/12/99	32 - 35	<5	<5	<5	<5	0
CPT-06	04/12/99	32 - 35	31	<5	<5	<5	31
CPT-07	04/12/99	32 - 35	7,000	430	<5	<5	7,430
CPT-08	04/13/99	32 - 35	190	<5	<5	<5	190
CPT-09	04/13/99	32 - 35	10	<5	<5	<5	10
CPT-10	04/13/99	32 - 35	42	<5	<5	<5	42
CPT-11	04/13/99	32 - 35	21	<5	<5	<5	21
CPT-12	04/13/99	32 - 35	19	<5	<5	<5	19
CPT-13	04/13/99	32 - 35	280	6	<5	<5	286
CPT-14	04/13/99	32 - 35	<5	<5	<5	<5	0
CPT-15	04/13/99	25 - 28	1,600	130	<5	<5	1,730
CPT-15	04/13/99	20 - 23	48	<5	<5	<5	48
CPT-15	04/13/99	15 - 18	24	<5	<5	<5	24
CPT-15	04/13/99	10 - 13	29	<5	<5	<5	29
CPT-16	04/14/99	32 - 35	6	<5	<5	<5	6
CPT-17	04/14/99	32 - 35	77	<5	<5	<5	77
CPT-18	04/14/99	32 - 35	140	120	10	<5	270
CPT-19	04/14/99	32 - 35	<5	185	595	150	930
CPT-20	04/14/99	32 - 35	<5	9	95	23	127
CPT-21	04/14/99	32 - 35	<5	<5	<5	<5	0
CPT-22	04/14/99	32 - 35	<5	<5	<5	<5	0
CPT-23	04/14/99	32 - 35	<5	13	30	10	53
CPT-24	04/14/99	32 - 35	<5	<5	<5	<5	0

Table 3. NSB Kings Bay Phase II Injector Construction Summary.

Injector	Depth Designation	Borehole Depth (ft)	Screened Interval (ft)
I-24	Shallow	35	32 - 35
I-25	Deep	40	37 - 40
I-26	Shallow	35	32 - 35
I-27	Shallow	35	32 - 35
I-28	Shallow	35	32 - 35
I-29	Deep	40	37 - 40
I-30	Shallow	35	32 - 35
I-31	Deep	40	37 - 40
I-32	Shallow	35	32 - 35
I-33	Shallow	35	32 - 35
I-34	Shallow	35	32 - 35
I-35	Deep	40	37 - 40
I-36	Shallow	35	32 - 35
I-37	Deep	40	37 - 40
I-38	Shallow	35	32 - 35
I-39	Shallow	35	32 - 35
I-40	Shallow	35	32 - 35
I-41	Shallow	35	32 - 35
I-42	Deep	40	37 - 40
I-43	Shallow	35	32 - 35
I-44	Shallow	35	32-35

Table 4. Hydrogen Peroxide Injection Totals by Location and Date

	June Mobilization								July Mobilization				
Station / Date	06/03/99	06/04/99	06/05/99	06/07/99	06/08/99	06/09/99	06/10/99	06/11/99	07/12/99	07/13/99	07/14/99	07/15/99	Total (gal)
I-1													0
I-2													0
I-3													0
I-4													0
I-5							362						362
I-6													0
I-7						420							420
I-8													0
I-9												56	56
I-10													0
I-11													0
I-12													0
I-13													0
I-14	3	288	295	279			305					56	1,226
I-15													0
I-16									18		326		344
I-17									24			53	77
I-18				249	103			425					777
I-19					292								292
I-20													0
I-21				116	0						184		300
I-22					209								209
I-23												55	55
I-24													0
I-25		237	229									53	519
I-26	3	253	229							100			585
I-27		338	298	285				310		339			1,570
I-28					264								264
I-29					387								387
I-30					105	241							345
I-31													0
I-32													0
I-33													0
I-34													0
I-35							362						362
I-36													0
I-37							294						294
I-38													0
I-39										283			283
I-40						334							334
I-41										293			293
I-42								149					149
I-43						334							334
I-44								287					287
11-32													0
11-34													0
11-35												55	55
11-36													0
USGS-1										3	341		344
USGS-2									28			163	191
USGS-3										3	341		344
USGS-15									25			163	189
Daily Total (gal)	**6**	**1,117**	**1,051**	**928**	**1,359**	**1,328**	**1,322**	**1,170**	**95**	**1,021**	**1,193**	**655**	**11,247**
Total to Date (gal)	**6**	**1,123**	**2,174**	**3,103**	**4,462**	**5,791**	**7,113**	**8,283**	**8,378**	**9,399**	**10,592**	**11,247**	

Table 5. NSB Kings Bay Total Hydrogen Peroxide Volumes (Phase I + Phase II)

Station / Date	Phase I	Phase II	Total (gal)
I-1	321	0	321
I-2	446	0	446
I-3	322	0	322
I-4	296	0	296
I-5	205	338	543
I-6	220	0	220
I-7	243	393	636
I-8	233	0	233
I-9	621	53	674
I-10	289	0	289
I-11	555	0	555
I-12	396	0	396
I-13	316	0	316
I-14	224	1,147	1,371
I-15	266	0	266
I-16	95	325	420
I-17	170	73	243
I-18	1,312	726	2,038
I-19	538	273	811
I-20	115	0	115
I-21	162	285	447
I-22	260	195	455
I-23	346	52	398
I-24	Did Not Exist	0	0
I-25		486	486
I-26		548	548
I-27		1,471	1,471
I-28		247	247
I-29		362	362
I-30		323	323
I-31		0	0
I-32		0	0
I-33		0	0
I-34		0	0
I-35		338	338
I-36		0	0
I-37		275	275
I-38		0	0
I-39		267	267
I-40		312	312
I-41		277	277
I-42		139	139
I-43		312	312
I-44		268	268
11-32	24	0	24
11-34	176	0	176
11-35	0	52	52
11-36	106	0	106
USGS-1	0	325	325
USGS-2	0	180	180
USGS-3	0	325	325
USGS-15	0	178	178
Total (gal)	**8,257**	**10,545**	**18,802**

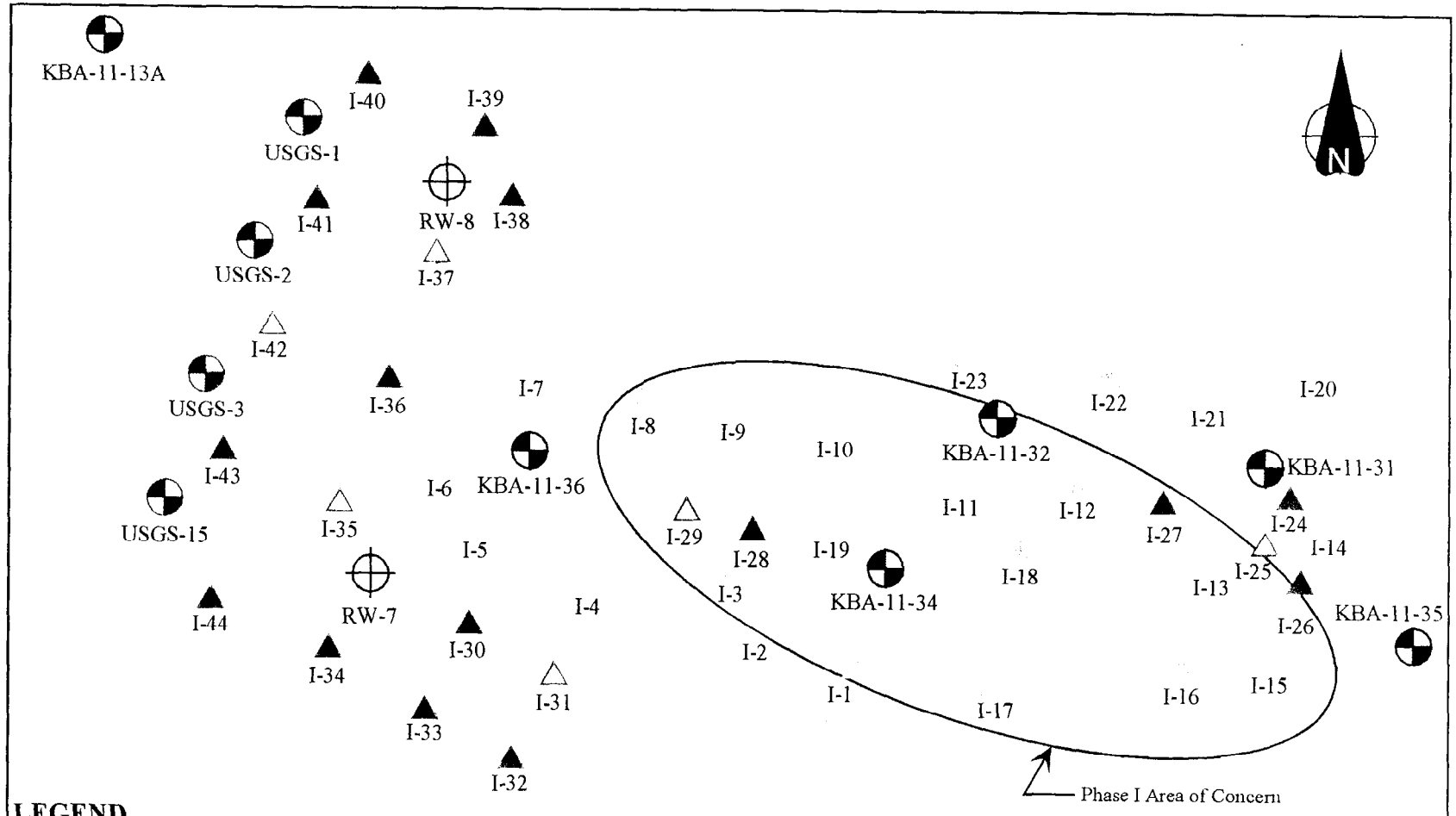

FIGURE 1. NSB Kings Bay Injector and Monitoring Well Location Map

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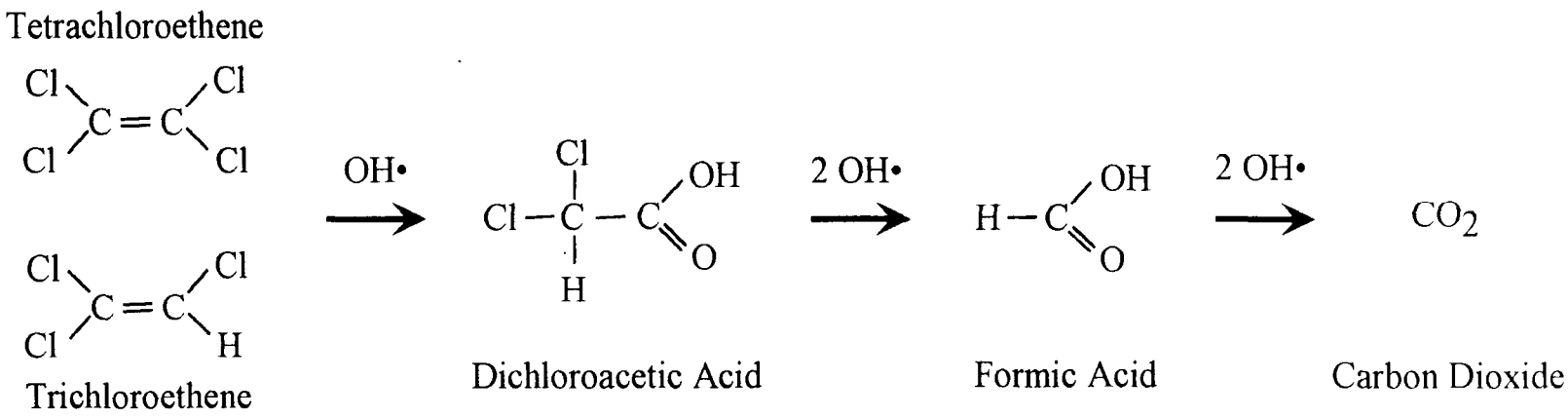
Tetrachloroethene & Trichloroethene Oxidation Pathway



References: Leung et al. 1992; Sato et al. 1993

FIGURE 2. TETRACHLOROETHENE AND TRICHLOROETHENE FENTON'S REAGENT OXIDATION PATHWAY

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4 Mark Road, Suite C
Kenilworth, NJ 07033

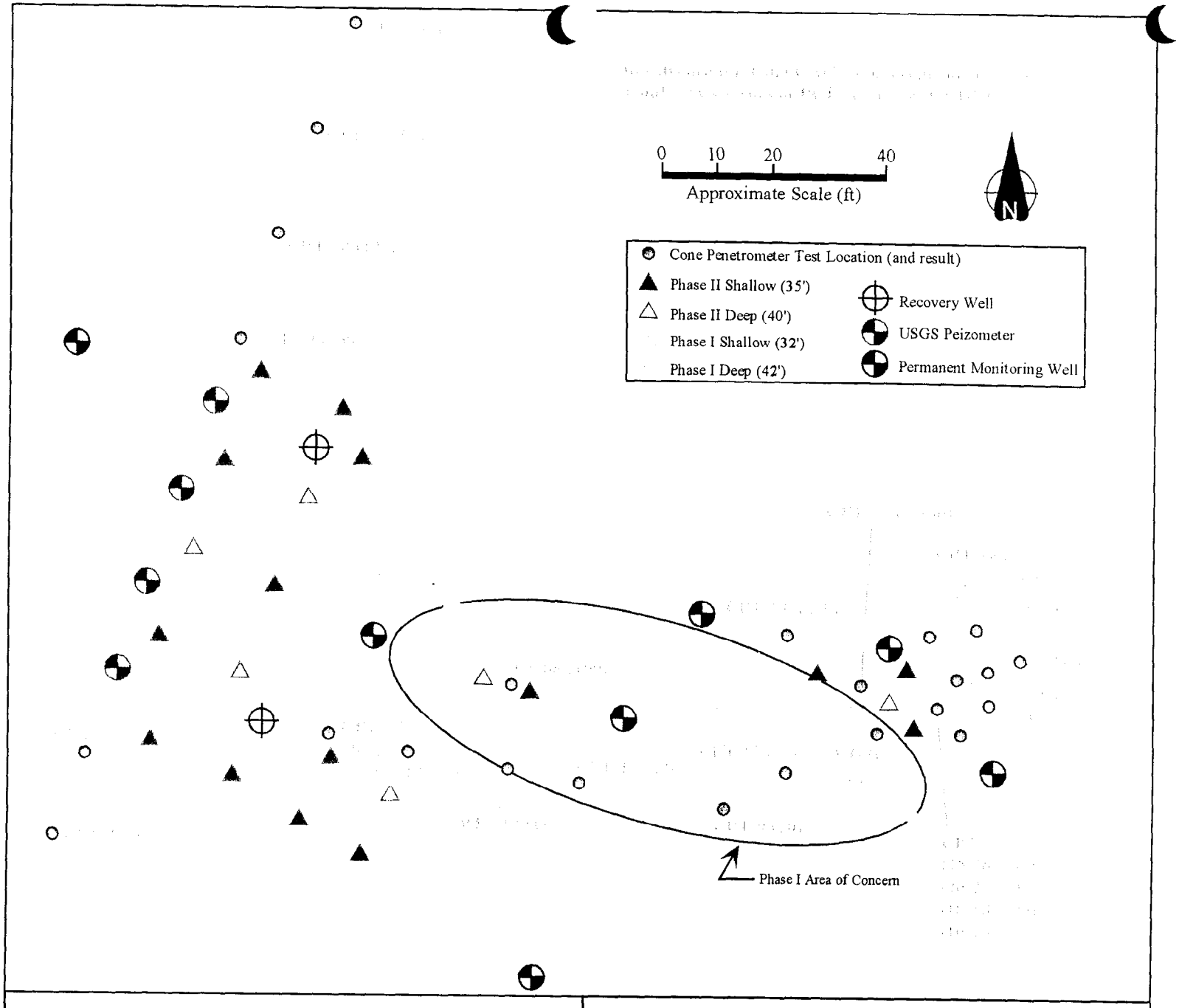

FIGURE 3. CONE PENETROMETER TEST LOCATIONS AND RESULTS

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Kenilworth, NJ 07033

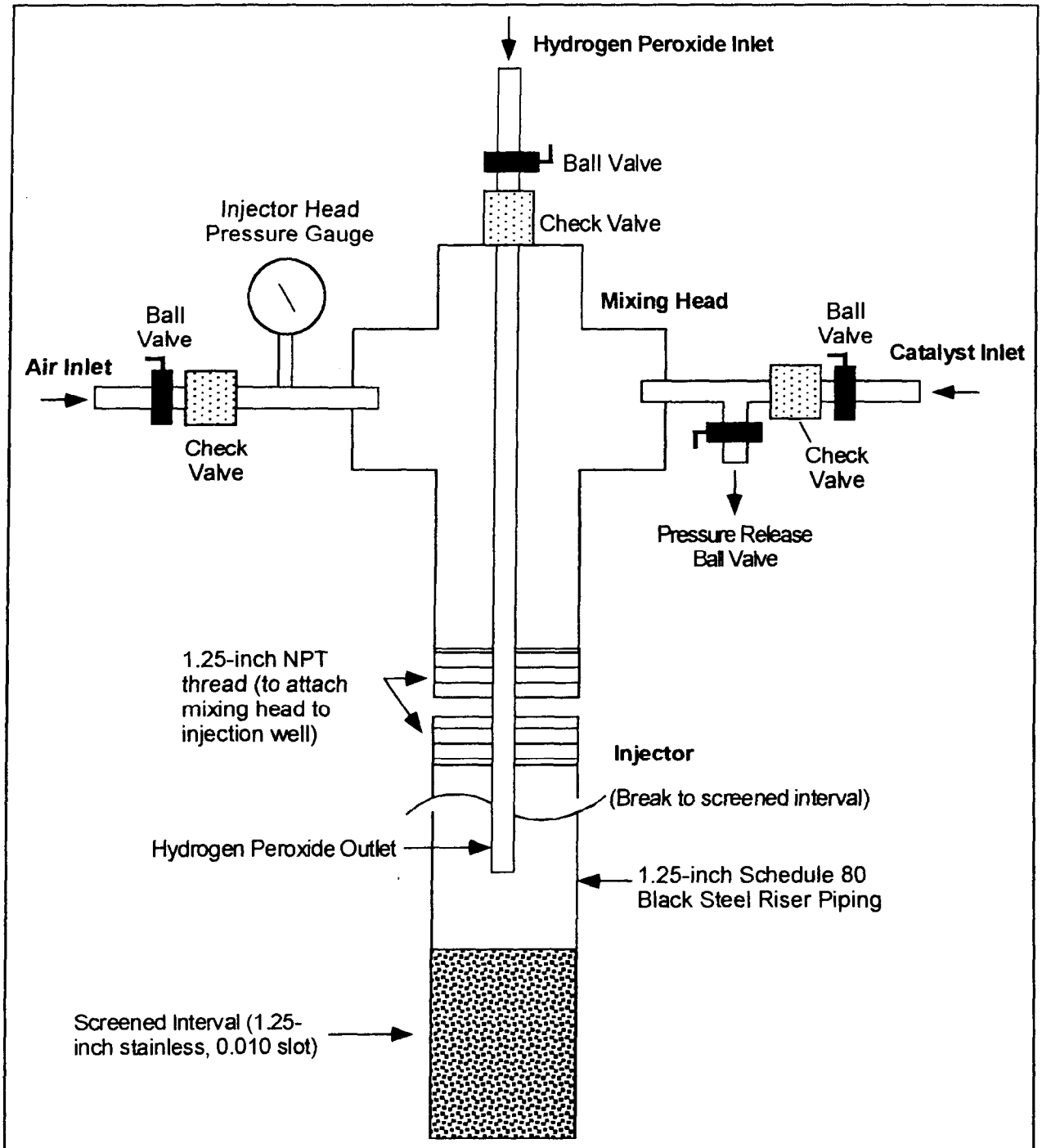

FIGURE 4. Geo-Cleanse® Patented Injector and Mixing Head Design Schematic (U.S. Patents 5,525,008 and 5,611,642)

Geo-Cleanse International, Inc.
4 Mark Road, Suite C
Kenilworth, NJ 07033

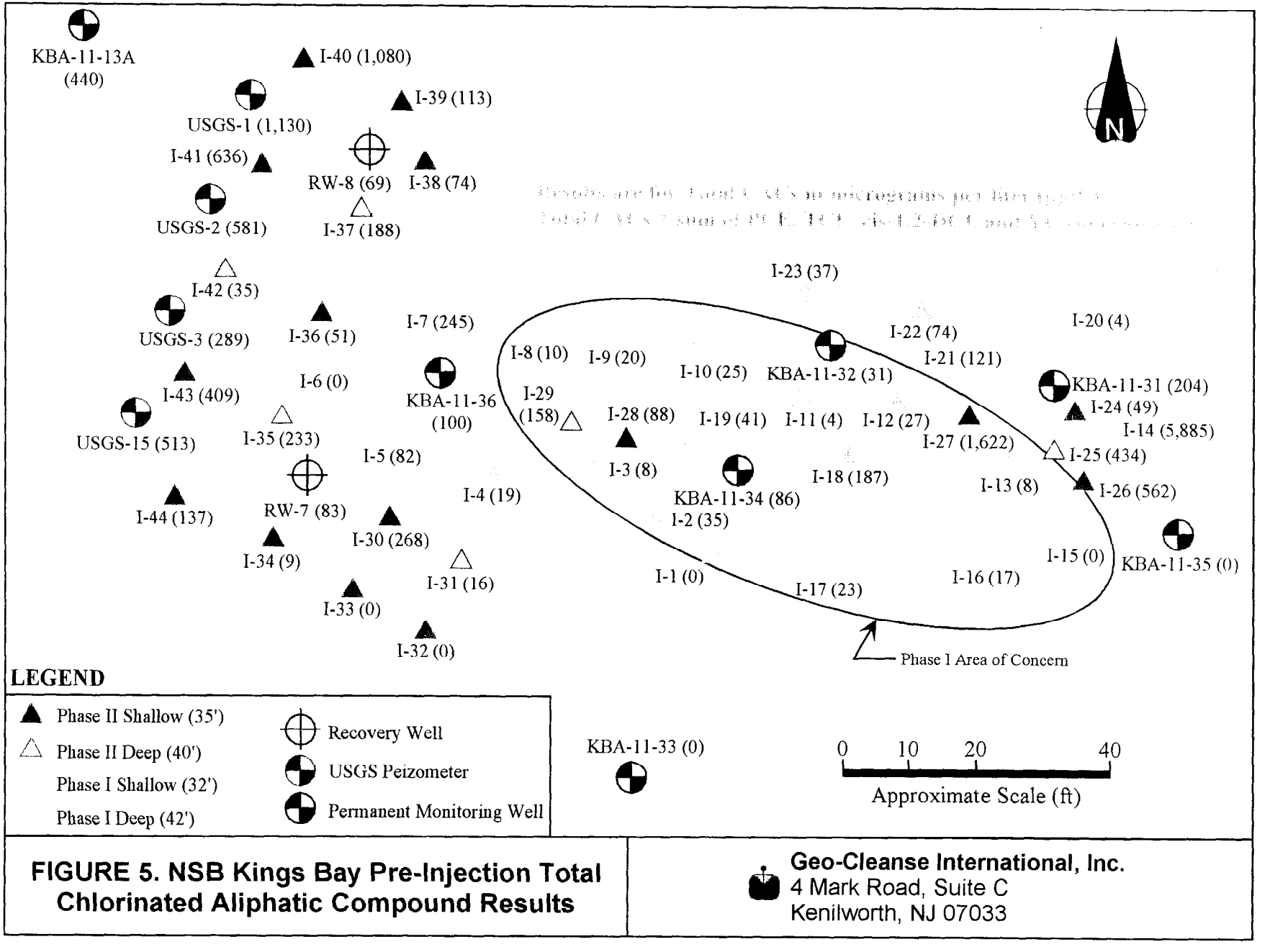

FIGURE 5. NSB Kings Bay Pre-Injection Total Chlorinated Aliphatic Compound Results

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Kenilworth, NJ 07033

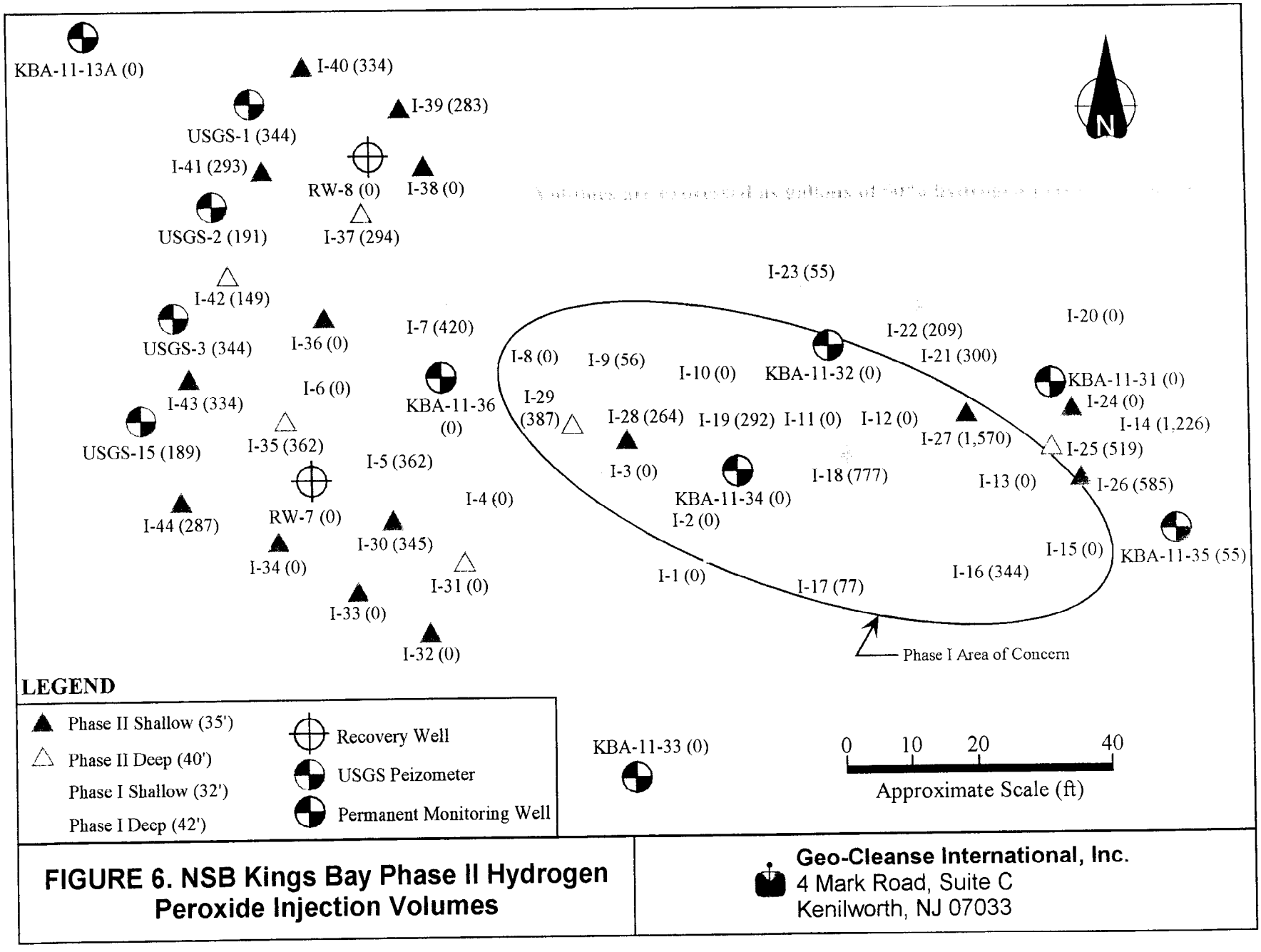

FIGURE 6. NSB Kings Bay Phase II Hydrogen Peroxide Injection Volumes

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4 Mark Road, Suite C
Kenilworth, NJ 07033

Figure 7. NSB Kings Bay Phase II Groundwater pH Data

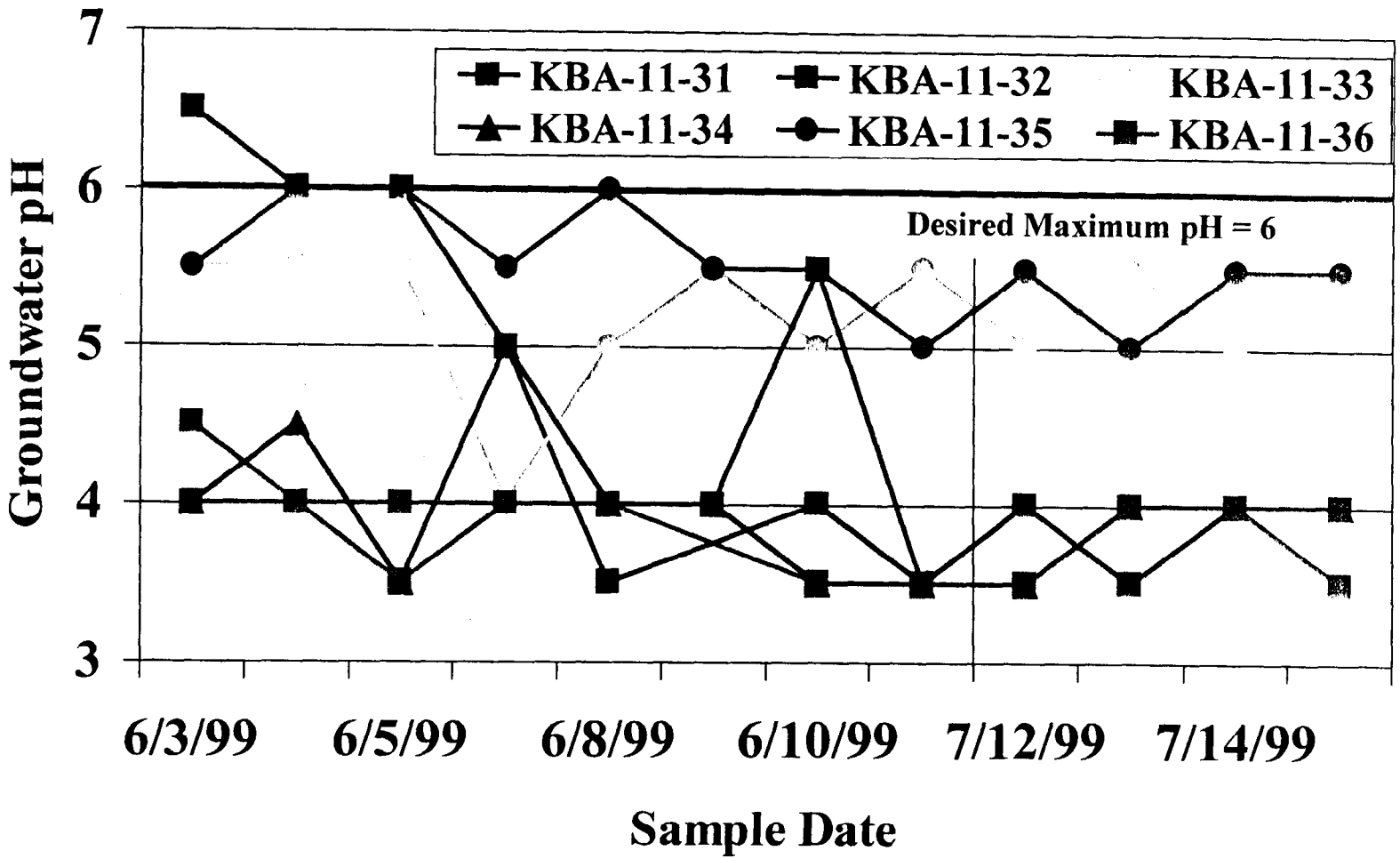


Figure 8. NSB Kings Bay Phase II Groundwater Alkalinity Data

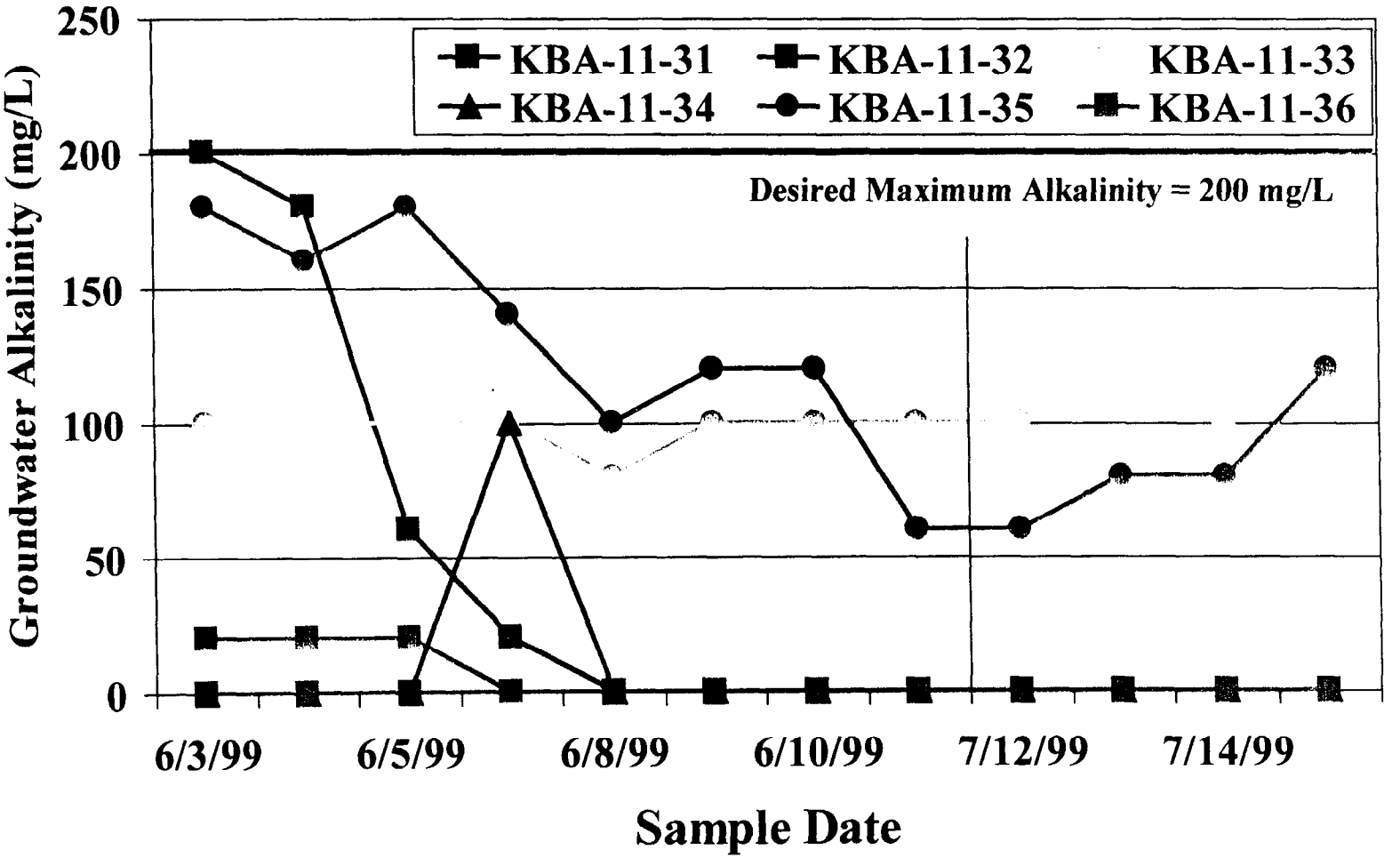


Figure 9. NSB Kings Bay Phase II Groundwater Headspace PID Data

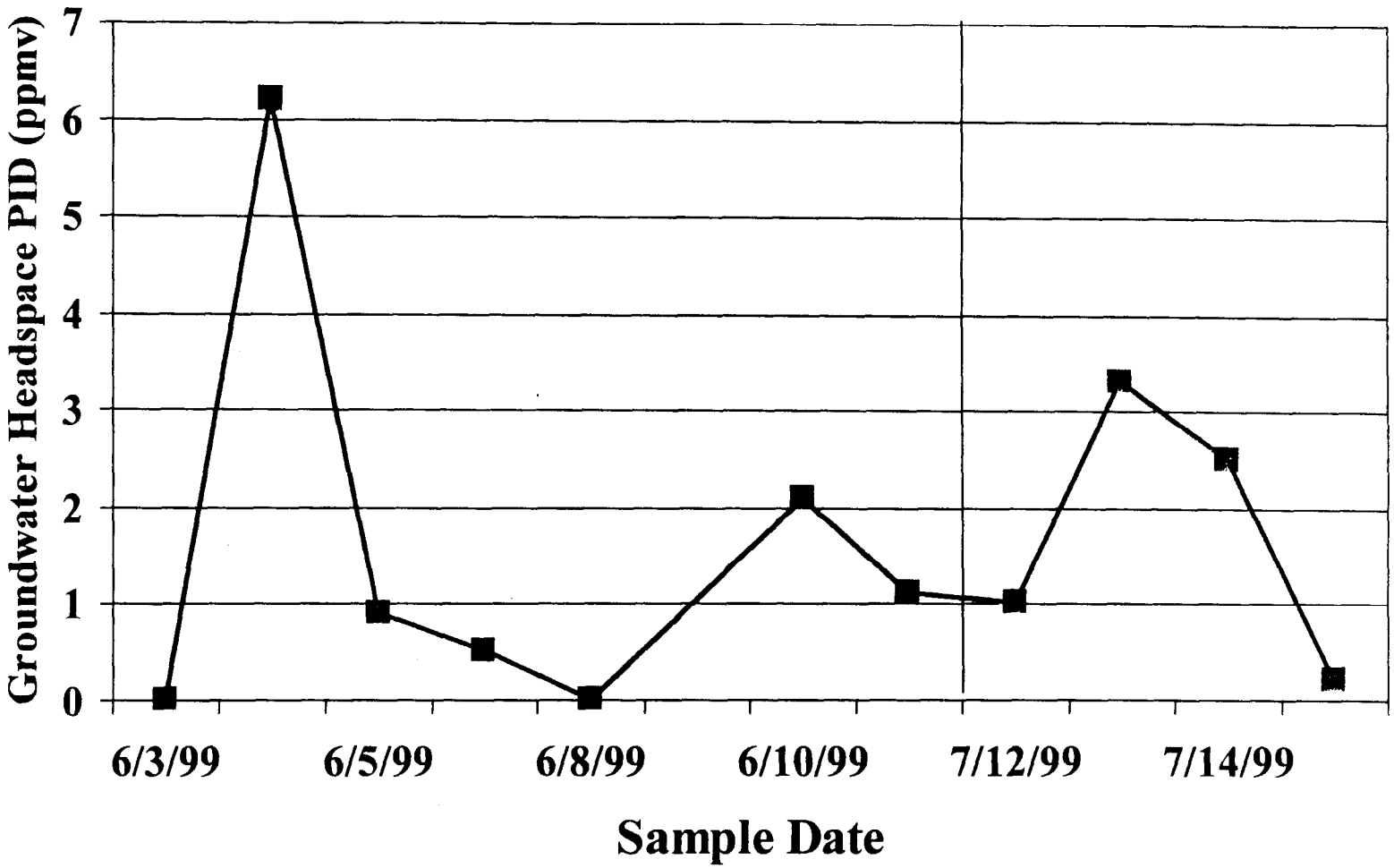
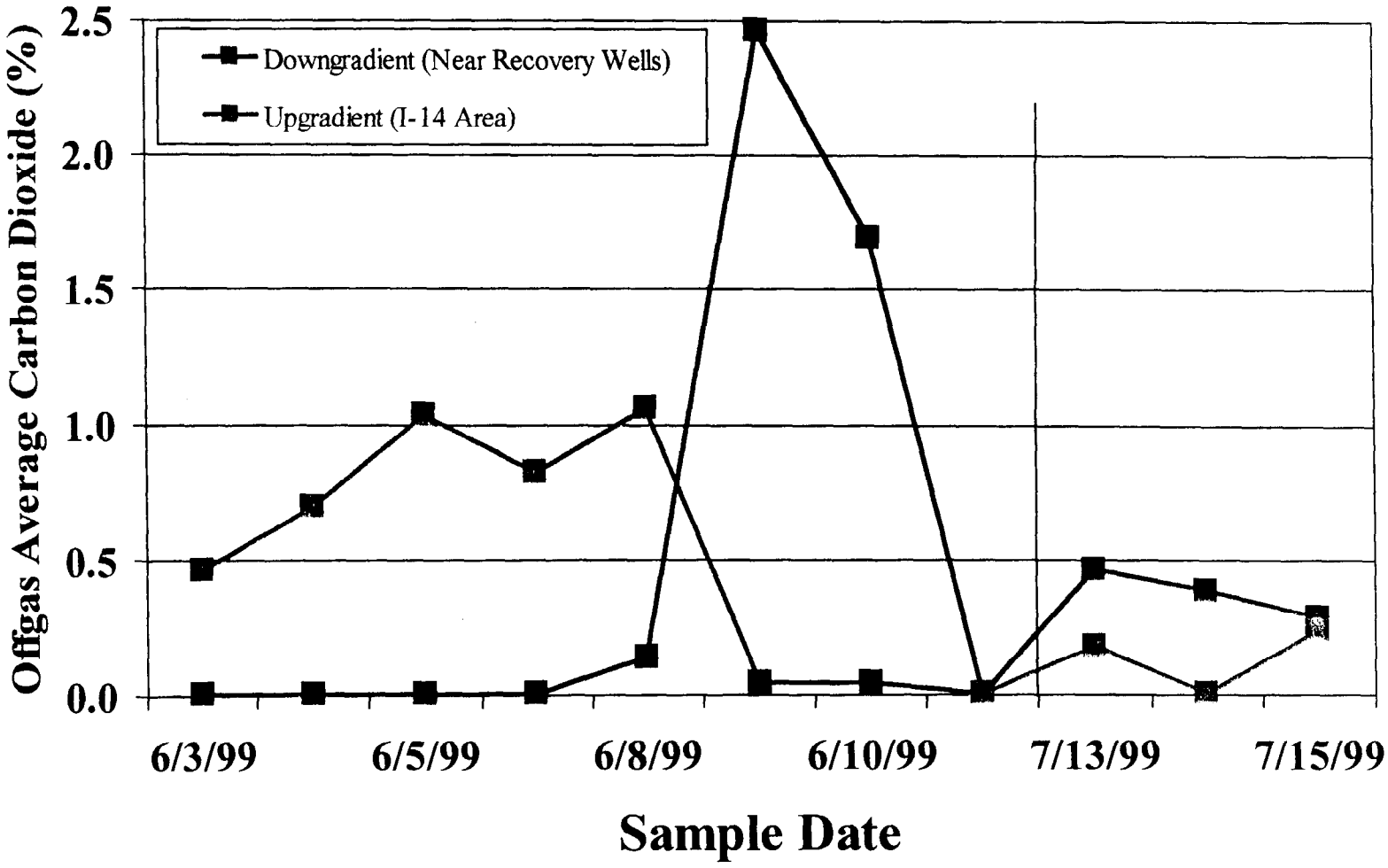


Figure 10. NSB Kings Bay Phase II Offgas Carbon Dioxide Data



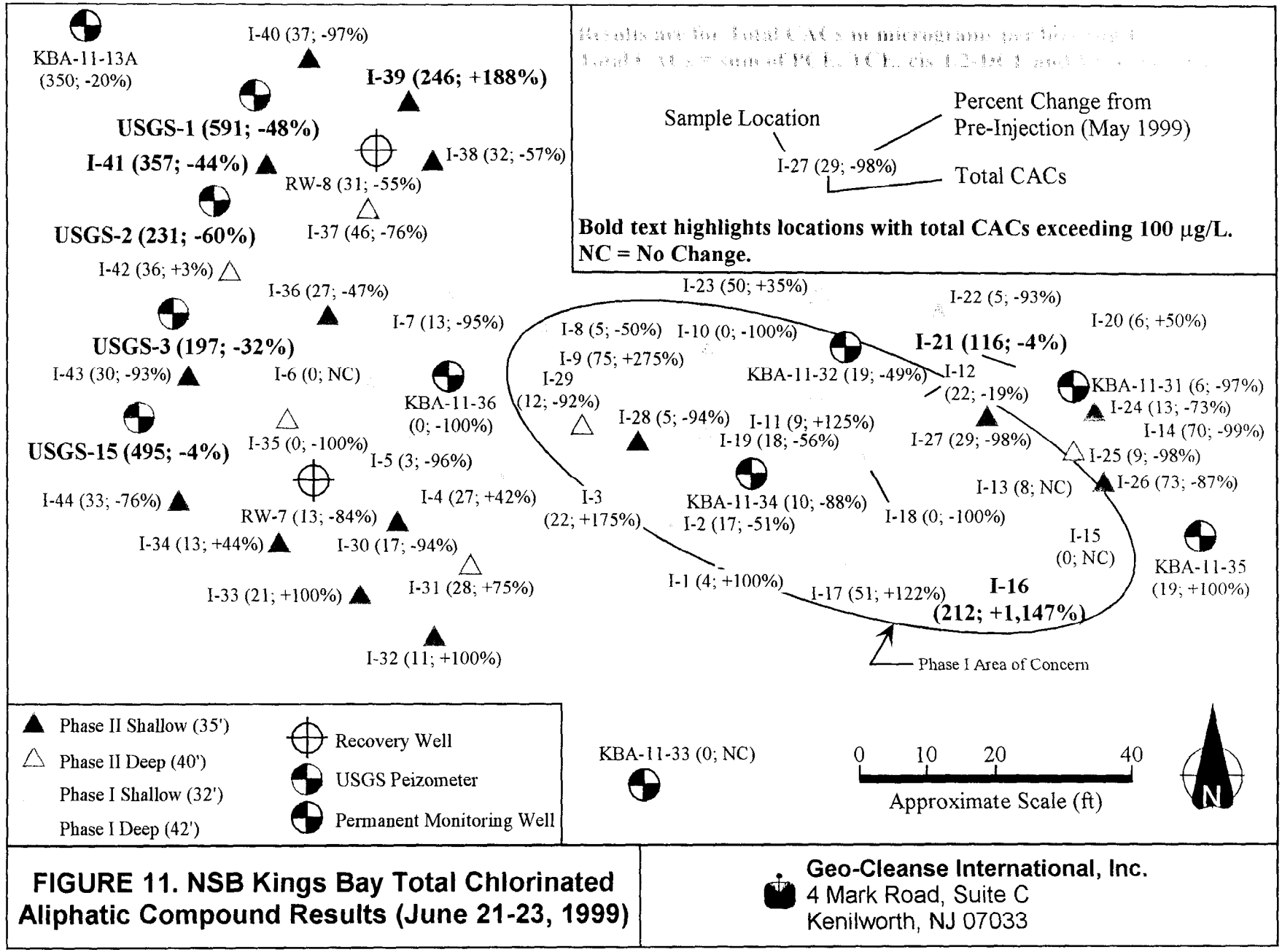


FIGURE 11. NSB Kings Bay Total Chlorinated Aliphatic Compound Results (June 21-23, 1999)

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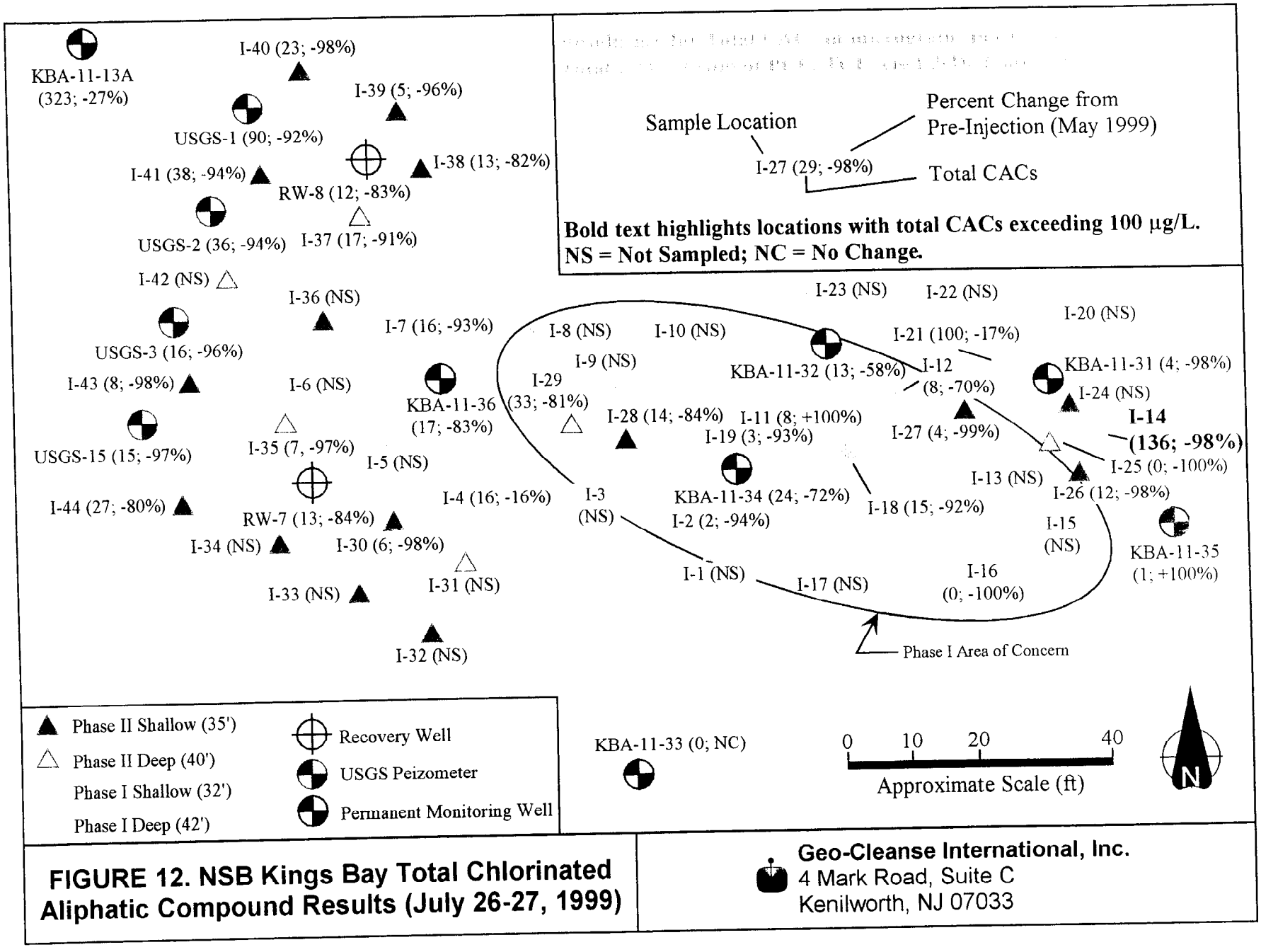

FIGURE 12. NSB Kings Bay Total Chlorinated Aliphatic Compound Results (July 26-27, 1999)

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Kenilworth, NJ 07033

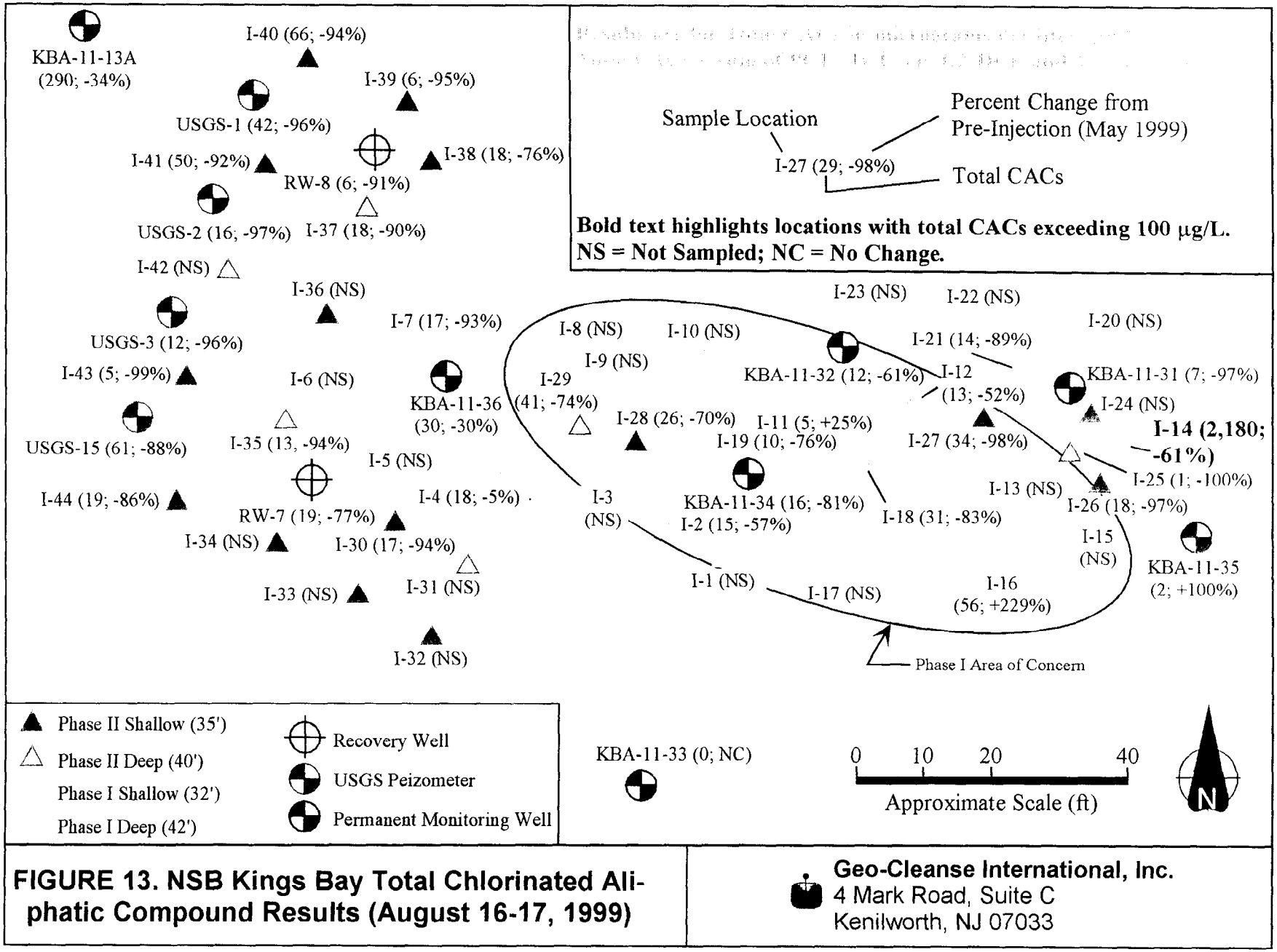

FIGURE 13. NSB Kings Bay Total Chlorinated Aliphatic Compound Results (August 16-17, 1999)

Geo-Cleanse International, Inc.
4 Mark Road, Suite C
Kenilworth, NJ 07033

STATE OF GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

INJECTION WELL OPERATING PERMIT

PERMIT NUMBER: #089 **DATE ISSUED: October 26, 1998**

FACILITY DATA: **INJECTION WELL TYPE: CLASS V (type 5X26)**

FACILITY: Naval Submarine Base
Site 11
Old Camden Co. Landfill
Kings Bay, GA
Camden County

OPERATOR: Dept. Of Navy*
Naval Submarine Base
1063 USS Tennessee Ave.
Kings Bay, GA 31547-2606

LOCATION: Lat: 30° 42' 15" N
Long: 81° 36' 52" W

EPD ID # GA17009001
HWMB Permit# HW-014(S)(2)

In accordance with the provisions of the Georgia Rules for Underground Injection Control, Chapter 391-3-6-.13, this permit is issued for the operation of the herein described injection system. Unless appealed, this permit is effective thirty (30) days after its issuance and is conditioned upon the following:

1) The Permittee's continued compliance with the Georgia Rules for Underground Injection Control, Chapter 391-3-6-.13, the Georgia Rules for Water Quality Control (Revised) and the Georgia Rules for Safe Drinking Water (Revised); and

2) The Permittee's continued compliance with the Permittee's approved injection operation plan which is part of the approved Corrective Action Plan for this site, along with provisions of officially approved plan amendments, if any.

Additional conditions 1 through 7 are attached hereto.

This permit is issued in accordance with the initial application received July 24, 1998, and the revised application received October 1, 1998. The injection operation plan was approved on October 26, 1998, and is based on the statements and supporting data entered herein or attached thereto, all of which are filed with the Environmental Protection Division of the Georgia Department of Natural Resources and hereby made a part of this permit.

This permit is subject to revocation for noncompliance with aforementioned conditions.

This permit expires on **October 26, 2003**, unless previously terminated.

Harold F. Reheis, Director, Environmental Protection Division
Georgia Department of Natural Resources

* Bechtel Environmental Inc., as consultant to Kings Bay Submarine Base, may be contacted regarding technical questions at (423) 431-1922.

Georgia Department of Natural Resources
205 Butler Street, S.E., East Floyd Tower, Atlanta, Georgia 30334
Lonice C. Barrett, Commissioner
Harold F. Reheis, Director
Environmental Protection Divis
(404) 656-47

PostIt® Fax Note 7671		Date 10/28	# of pages ▶ 5
To John Garner		From Madelyne Kellam	
Co./Dept. Env. Div. Subase		Co. GA EPD	
Phone #		Phone # 404 656 2833	
Fax # 912 673 3639		Fax #	

October 26 , 1998

Mr. John R. Garner
Environmental Division
Dept. Of Navy
Naval Submarine Base
1063 USS Tennessee Ave.
Kings Bay, GA 31547-2606

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▶ 5

To Jay Ross	From JOHN GARNER
Dept./Agency Bechtel	Phone # 912 673 4048
Fax # 904 779 8999	Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

RE: Underground Injection Control Permit #089 for injection of hydrogen peroxide, ferrous sulfate and sulfuric acid, Kings Bay Submarine Base Site 11, Old Camden Co. Landfill, Kings Bay, Georgia.

Dear Mr. Garner:

Enclosed is an Underground Injection Control (UIC) Permit #089 for the Kings Bay Submarine Base Site 11, Old Camden Co. Landfill, located at Kings Bay, Georgia. This UIC permit allows The U.S. Navy to utilize injection of hydrogen peroxide, ferrous sulfate, calcium phosphate, dilute phosphoric acid and dilute sulfuric acid through twenty three (23) wells to assist with the remediation of soil and ground-water contaminated with chlorinated solvents at this site for up to five (5) years. The UIC permit includes seven (7) special conditions in addition to the standard conditions.

If you or your staff have any questions about the permit please contact Bruce O'Connor, UIC Coordinator, at (404) 656-3214.

Sincerely,

Harold F. Reheis
Director

Enclosure

cc: File UIC Permit #089
H. Bauer, Bechtel
L. Rogers, EPD-CR
M. Kellam, EPD-HWMB

INJECTION WELL OPERATING PERMIT
ADDITIONAL CONDITIONS

1. Permit Conditions.

   a. This permit is not transferable until any new operator shall agree in writing to these additional permit conditions. Any new operator also shall provide the Environmental Protection Division (Division) with appropriate documentation that they have adequate financial assurances to plug all existing Class V wells.

   b. If The U.S. Navy (Operator) wishes to continue an activity regulated by this permit after the expiration of the permit, the Operator must apply for and obtain a new permit.

   c. The Operator shall report any instances of noncompliance with permit conditions to the Division in writing within five (5) working days of such noncompliance and shall take all reasonable steps to minimize the impact on the environment resulting from noncompliance with this permit and the Georgia Rules for Underground Injection Control.

   d. The Operator shall notify the Division of any proposed changes to the performance of the water injection system in writing at least thirty (30) days prior to the change.

   e. All reports submitted to the Division shall be signed and stamped by a Georgia Registered Professional Engineer or Professional Geologist.

2. System Parameters.

   a. This permit is issued to the Operator for the purpose of operating an injection system consisting of a hydrogen peroxide, ferrous sulfate, calcium phosphate, dilute phosphoric acid and dilute sulfuric acid, at the above referenced site to aid in remediation of soil and ground-water contaminated with chlorinated solvents.

   b. Number of Class V injection wells: twenty three (23).

   c. Injected fluid: Hydrogen peroxide and ferrous sulfate solution buffered with phosphoric acid, sulfuric acid and calcium phosphate, as needed.

   d. Maximum injection rate per well: 1.0 gallons of liquid/min.(gpm)/well
   Maximum total injection rate: 23.0 gpm

   e. Maximum total injection volume per well: 575 gallons of liquid/day/well
   Maximum total injection volume: 13,225 g/day

   f. Maximum daily average injection pressure (at well head): 40 psig.

3. Monitoring and Reporting Requirements.

a. The Operator shall report to the Underground Injection Control Program of the Division the number and exact location of all Class V injection wells it installs or plugs on a quarterly basis. The reports are to be submitted to the UIC Program in accordance with the reporting schedule stipulated by the Hazardous Waste Management Branch.

b. The Operator shall submit to the Division for its approval, a detailed schematic diagram and location map on any Class V injection well that is different in construction from the specifications contained in the UIC permit application, no later than 45 days prior to installation of the injection well. The Operator cannot install such a well until it receives approval from the Division.

c. The Operator shall submit to the UIC Program one (1) copy of any report regarding this site which the Operator is required to submit to the Hazardous Waste Management Branch, or any other program within the Division.

d. The Operator shall submit to the UIC Program an annual report which will contain the following information.

1. Status of the injection system operation;

2. Results of any ground-water sampling and analyses;

3. Results of any soil sampling and analyses;

4. An evaluation of the plume movement through the ground-water, if any;

5. Comparisons of analyses to determine any changes in pollutant concentrations.

The annual reports will be provided to the UIC Program in accordance with the schedule stipulated by the Hazardous Waste Management Branch.

4. Emergency Situations.

a. The Operator is to immediately notify the Division of any emergency situation that affects the injection system and describe the remedial activity that the Operator is utilizing to correct the situation.

b. The Operator is to immediately notify the Division when the emergency situation ceases to exist.

5. The Operator shall grant the Division permission to enter the facility property to conduct inspections of the injection system.

6. The Operator shall maintain a copy of this permit at the facility site.

7. The Operator shall, upon termination of the injection of water, bacteria and nutrients through a Class V injection well at this site, properly plug and abandon all Class V wells constructed on this site and notify the division within thirty (30) days of such termination and abandonment.

Geo-Cleanse International, Inc.
4 Mark Road, Suite C • Kenilworth, NJ 07033 • Tel. (908) 206-1250 • FAX (908) 206-1251

SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia

DATE: 5/20/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-24
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Municipal waste.	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6										
8										
10								Tan to light brown-grey, fine-med quartz SAND		
12										
14						W				
16										
18										
20										
22										
24										
26										
28								Dark brown silty fine quartz SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/24/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-25
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Municipal waste.		
6										
8										
								Light tan fine SAND		
10										
								Light grey fine SAND		
12										
14						W				
16						↓				
18										
20										
22										
24								Dark brown silty fine quartz SAND		
26										
28										
30										
32										
34								Light brown-orange silty quartz SAND		
36										
38								Greenish grey silty quartz SAND		
40								Total depth = 40 ft		

Geo-Cleanse International, Inc.
4 Mark Road, Suite C • Kenilworth, NJ 07033 • Tel. (908) 206-1250 • FAX (908) 206-1251

SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/21/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-26
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Municipal waste.	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6										
8										
10								Tan to light brown-grey, fine-med quartz SAND		
12										
14						W ↓				
16										
18										
20										
22										
24										
26										
28								Dark brown silty fine quartz SAND		
30										
32										
34								Light org-brwn silty fine quartz SAND		
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
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Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-27
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Municipal waste.		
6										
8										
10										
12								Light grey fine-med quartz SAND		
14						W				
16										
18										
20										
22										
24								Dark brown silty fine quartz SAND		
26										
28										
30										
32										
34								Light org-brwn silty fine quartz SAND		
36								Total depth = 35 ft		
38										
40										

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PROJECT: NSB Kings Bay
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Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant / Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-28
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Municipal waste.		
6							6			
8										
10								Tan fine SAND		
12										
14						W	14			
16						↓				
18										
20										
22								Dark brown silty fine quartz SAND		
24										
26										
28										
30							30			
32								Light org-brwn silty fine quartz SAND		
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

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Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant / Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-29
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Municipal waste.	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4							4			
6								Lt brown silty fine quartz SAND		
8							8			
10								Light tan silty fine quartz SAND		
12										
14						W	14			
						↓		Light grey silty fine quartz SAND		
16							16			
18										
20								Dark brown silty fine quartz SAND		
22										
24										
26							26			
28										
30								Light org-brwn silty fine quartz SAND		
32										
34							34			
36										
38								Greenish-grey silty quartz SAND		
40								Total depth = 40 ft		

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PROJECT: NSB Kings Bay
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Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant / Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-30
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Light tan fine quartz SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4							4			
								Dark brown silty fine SAND		
6							6			
8										
10								Light tan fine quartz SAND		
12										
14						W	14			
						↓		Light grey fine quartz SAND		
16							16			
18										
20										
22								Dark brown silty fine quartz SAND		
24										
26										
28										
30							30			
32								Light org-brwn silty fine quartz SAND		
34										
36								Total depth = 35 ft		
38										
40										

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PROJECT: NSB Kings Bay
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-31
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Dark tan silty fine quartz SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6										
8								Dark brown silty fine quartz SAND		
10										
12								Light grey silty fine quartz SAND		
14						W ↓				
16										
18										
20								Dark brown silty fine quartz SAND		
22										
24										
26										
28										
30								Light org-brwn silty fine quartz SAND		
32										
34										
36										
38								Greenish-grey silty fine quartz SAND		
40								Total depth = 40 ft		

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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-32
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Municipal waste	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Dark brown silty fine quartz SAND		
6										
8								Tan silty fine quartz SAND		
10										
12								Light grey silty fine quartz SAND		
14						W				
16						↓				
18								Dark brown silty fine quartz SAND		
20										
22										
24										
26										
28								Light org-brwn silty fine quartz SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-33
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Light tan fine SAND		
6										
8								Tan fine silty SAND		
10										
12								Light grey fine SAND		
14						W				
16						↓				
18										
20								Dark brown silty fine SAND		
22										
24										
26										
28								Light org-brwn silty fine quartz SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-34
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Light tan-grey fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4							4			
6								Light brown fine quartz SAND		
8							8			
10								Tan fine quartz SAND		
12							12			
14						W		Light grey fine SAND		
16							16			
18										
20										
22								Dark brown silty fine quartz SAND		
24										
26										
28							28			
30								Light org-brwn silty fine quartz SAND		
32										
34										
36								Total depth = 35 ft		
38										
40										

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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Jeff / John
Drill Rig/Method: Failing Mini-Star HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-35
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Brown fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4							4			
6										
8								Tan fine SAND		
10										
12							12	Light grey fine SAND		
14						W	14			
16						↓				
18										
20								Dark brown silty fine SAND		
22										
24										
26							26			
28								Light org-brwn silty fine SAND		
30										
32										
34										
36										
38										
40								Total depth = 40 ft		

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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Jeff / John
Drill Rig/Method: Failing Mini-Star HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-36
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Light tan fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6										
8								Tan fine SAND		
10										
12										
14						W		Light grey fine SAND		
16										
18										
20								Dark brown silty fine quartz SAND		
22										
24										
26										
28								Light org-brwn fine quartz SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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PROJECT: NSB Kings Bay
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly / JT
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-37
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Brown fine silty SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6										
8								Tan fine SAND		
10										
12								Light grey silty fine quartz SAND		
14						W				
16										
18										
20										
22										
24								Dark brown silty fine quartz SAND		
26										
28										
30										
32										
34								Light org-brwn silty fine SAND		
36										
38								Greenish-gray silty fine quartz SAND		
40								Total depth = 40 ft		

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PROJECT: NSB Kings Bay
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly / JT
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-38
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Brown fine SAND		
6							6			
8								Tan fine SAND		
10										
12							12			
14						W		Dark tan silty fine SAND		
16										
18								Dark brown silty fine SAND		
20										
22							22			
24										
26										
28								Light org-brwn fine SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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PROJECT: NSB Kings Bay
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly / JT
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-39
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Tan fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6								Light brown fine SAND		
8								Light tan fine SAND		
10										
12								Light grey fine SAND		
14						W				
16										
18										
20								Dark brown silty fine SAND		
22										
24										
26										
28								Light org-brwn silty fine SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-24
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Municipal waste.	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6										
8										
10								Tan to light brown-grey, fine-med quartz SAND		
12										
14						W				
16										
18										
20										
22										
24										
26										
28								Dark brown silty fine quartz SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-25
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Municipal waste.		
6										
8										
10								Light tan fine SAND		
12								Light grey fine SAND		
14						W				
16										
18										
20										
22										
24								Dark brown silty fine quartz SAND		
26										
28										
30										
32										
34								Light brown-orange silty quartz SAND		
36										
38								Greenish grey silty quartz SAND		
40								Total depth = 40 ft		

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Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-26
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Municipal waste.	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6										
8										
10								Tan to light brown-grey, fine-med quartz SAND		
12										
14						W ↓				
16										
18										
20										
22										
24										
26								Dark brown silty fine quartz SAND		
28										
30										
32										
34								Light org-brwn silty fine quartz SAND		
36								Total depth = 35 ft		
38										
40										

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Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-27
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Municipal waste.		
6										
8										
10										
12								Light grey fine-med quartz SAND		
14						W				
16										
18										
20										
22										
24								Dark brown silty fine quartz SAND		
26										
28										
30										
32										
34								Light org-brwn silty fine quartz SAND		
36								Total depth = 35 ft		
38										
40										

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Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant / Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-28
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Municipal waste.		
6							6			
8										
10								Tan fine SAND		
12										
14						W	14			
16						↓				
18										
20										
22								Dark brown silty fine quartz SAND		
24										
26										
28										
30							30			
32										
34								Light org-brwn silty fine quartz SAND		
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/21/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant / Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-29
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Municipal waste.	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6								Lt brown silty fine quartz SAND		
8										
10								Light tan silty fine quartz SAND		
12										
14						W ↓		Light grey silty fine quartz SAND		
16										
18										
20								Dark brown silty fine quartz SAND		
22										
24										
26										
28										
30								Light org-brwn silty fine quartz SAND		
32										
34										
36								Greenish-grey silty quartz SAND		
38										
40								Total depth = 40 ft		

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
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PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Sam Ross
GCI Rep(s).: Dan Bryant / Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-30
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Light tan fine quartz SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4							4			
6								Dark brown silty fine SAND		
8							8			
10								Light tan fine quartz SAND		
12										
14						W	14	Light grey fine quartz SAND		
16						↓	16			
18										
20										
22								Dark brown silty fine quartz SAND		
24										
26										
28										
30							30			
32								Light org-brwn silty fine quartz SAND		
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia

DATE: 5/25/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-31
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Dark tan silty fine quartz SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6							6			
8								Dark brown silty fine quartz SAND		
10										
12							12	Light grey silty fine quartz SAND		
14						W	14			
16										
18										
20								Dark brown silty fine quartz SAND		
22										
24										
26							26			
28										
30								Light org-brwn silty fine quartz SAND		
32										
34							34			
36								Greenish-grey silty fine quartz SAND		
38										
40								Total depth = 40 ft		

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/25/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-32
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Municipal waste	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Dark brown silty fine quartz SAND		
6										
8								Tan silty fine quartz SAND		
10										
12								Light grey silty fine quartz SAND		
14						W ↓				
16										
18								Dark brown silty fine quartz SAND		
20										
22										
24										
26										
28								Light org-brwn silty fine quartz SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/25/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-33
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Light tan fine SAND		
6										
8								Tan fine silty SAND		
10										
12								Light grey fine SAND		
14						W ↓				
16										
18										
20								Dark brown silty fine SAND		
22										
24										
26										
28								Light org-brwn silty fine quartz SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
DATE: 5/25/99
LOCATION: Kings Bay, Georgia
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-34
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Light tan-grey fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6								Light brown fine quartz SAND		
8										
10								Tan fine quartz SAND		
12										
14						W ↓		Light grey fine SAND		
16										
18										
20										
22								Dark brown silty fine quartz SAND		
24										
26										
28										
30								Light org-brwn silty fine quartz SAND		
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/26/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Jeff / John
Drill Rig/Method: Failing Mini-Star HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-35
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Brown fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4							4			
6										
8								Tan fine SAND		
10										
12							12	Light grey fine SAND		
14						W	14			
16										
18										
20								Dark brown silty fine SAND		
22										
24										
26							26			
28								Light org-brwn silty fine SAND		
30										
32										
34										
36										
38										
40								Total depth = 40 ft		

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/26/99
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Jeff / John
Drill Rig/Method: Failing Mini-Star HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-36
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Light tan fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6										
8								Tan fine SAND		
10										
12										
								Light grey fine SAND		
14						W ↓				
16										
18										
20								Dark brown silty fine quartz SAND		
22										
24										
26										
28								Light org-brwn fine quartz SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia

DATE: 5/26/99
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly / JT
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-37
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Brown fine silty SAND		
6							6			
8								Tan fine SAND		
10							12			
12								Light grey silty fine quartz SAND		
14						W	14			
16						↓				
18										
20										
22										
24								Dark brown silty fine quartz SAND		
26										
28										
30										
32							34			
34								Light org-brwn silty fine SAND		
36							38			
38								Greenish-gray silty fine quartz SAND		
40								Total depth = 40 ft		

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/26/99
PAGE 1 OF 1

Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly / JT
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-38
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Brown fine SAND		
6							6			
8								Tan fine SAND		
10										
12							12			
14						W		Dark tan silty fine SAND		
16						↓				
18								Dark brown silty fine SAND		
20										
22							22			
24										
26										
28								Light org-brwn fine SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/26/99

Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly / JT
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-39
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Tan fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4										
6								Light brown fine SAND		
8								Light tan fine SAND		
10										
12								Light grey fine SAND		
14						W ↓				
16										
18										
20								Dark brown silty fine SAND		
22										
24										
26										
28								Light org-brwn silty fine SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/26/99
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-40
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Light tan fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4							4			
6								Brown fine SAND		
8										
10							10	Yellow fine SAND		
12							12	Light grey fine SAND		
14						W ↓	14			
16										
18										
20								Dark brown silty fine SAND		
22										
24										
26							26			
28								Brown-orange silty fine SAND		
30										
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/27/99
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-41
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Brown fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Dark brown fine SAND		
6										
8								Tan fine SAND		
10								Yellow fine SAND		
12								Light grey fine SAND		
14						W ↓				
16										
18										
20								Dark brown silty fine SAND		
22										
24										
26										
28										
30								Brown-orange silty fine SAND		
32										
34										
36								Total depth = 35 ft		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
DATE: 5/26/99
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Alan Kelly / JT
Drill Rig/Method: DR10K HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-42
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Tan fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Light brown fine SAND		
6										
8								Tan fine SAND		
10										
12								Yellow-tan fine silty quartz SAND		
14						W		Light grey fine silty quartz SAND		
16						↓				
18										
20										
22										
24								Dark brown silty fine quartz SAND		
26										
28										
30										
32										
34										
36								Light org-brwn silty fine quartz SAND		
38								Greenish-gray silty fine quartz SAND		
40								Total depth = 40 ft		

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SOIL BORING LOG

PROJECT: NSB Kings Bay
LOCATION: Kings Bay, Georgia
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Jeff / John
Drill Rig/Method: Failing Mini Star HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-43
PID Type: _____
PID Lamp: _____

Approx. Location
See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2									Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Brown fine SAND		
6							6			
8								Tan fine SAND		
10							10			
12								Light grey fine silty SAND		
14						W	14			
16						↓				
18										
20								Dark brown silty fine SAND		
22										
24										
26							26			
28										
30								*Orange-brown fine silty SAND*		
32										
34										
36								*Total depth = 35 ft*		
38										
40										

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SOIL BORING LOG

PROJECT: NSB Kings Bay
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Consultant/Rep(s).: Bechtel / Mark Gage
GCI Rep(s).: Peter Yanczak
Drilling Contractor: Partridge Well Company
Driller/Helper: Jeff / John
Drill Rig/Method: Failing Mini Star HSA 4.25" ID

Well No.: _____
Boring No.: _____
Injector No.: I-44
PID Type: _____
PID Lamp: _____

Approx. Location

See site map.

Depth (feet)	Sample Interval	Recovery (Inches)	Sample ID #	Blows per 6"	PID	Moisture Content	Depth of Change	Soil Description/Classification	Remarks	Well/Injector Construction
2								Tan fine SAND	Auger plugged (HDPE) and drilled to depth. Soil descriptions are from cuttings.	See construction detail
4								Brown fine SAND		
6										
8								Light brown fine SAND		
10								Yellow-tan fine SAND		
12								Light grey fine SAND		
14						W ↓				
16										
18										
20								Dark brown silty fine SAND		
22										
24										
26										
28										
30										
32								Orange-brown fine silty SAND		
34										
36								Total depth = 35 ft		
38										
40										

GEO-CLEANSE® INJECTOR CONSTRUCTION DETAIL

NSB Kings Bay
Kings Bay, Georgia

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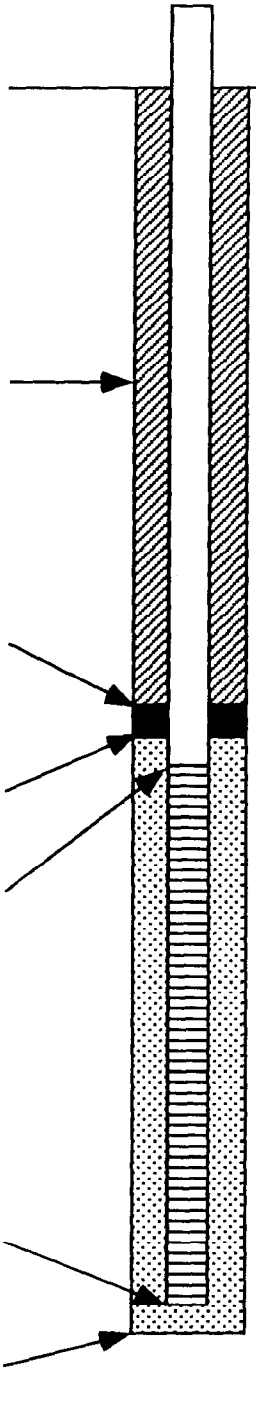

Site Name: Kings Bay

Injector Identification: I-24

Installation Date: 5/20/99

GCI Installation Oversight: Dan Bryant

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Sam Ross

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

GEO-CLEANSE® INJECTOR CONSTRUCTION DETAIL

NSB Kings Bay
Kings Bay, Georgia

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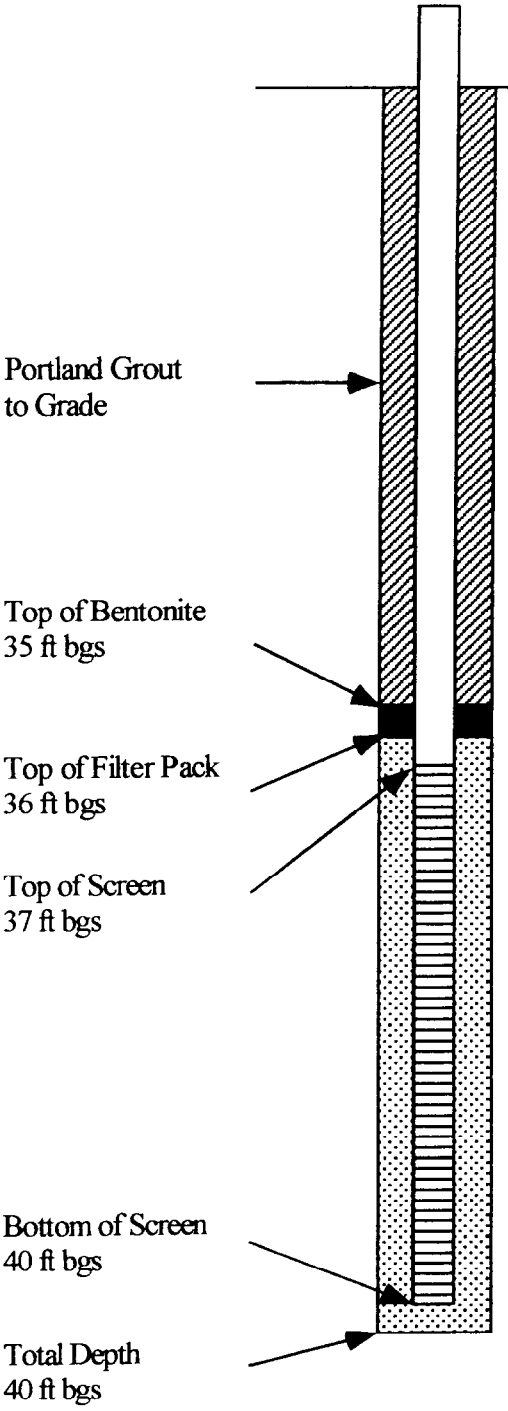

Site Name: Kings Bay

Injector Identification: I-25

Installation Date: 5/24/99

GCI Installation Oversight: Peter Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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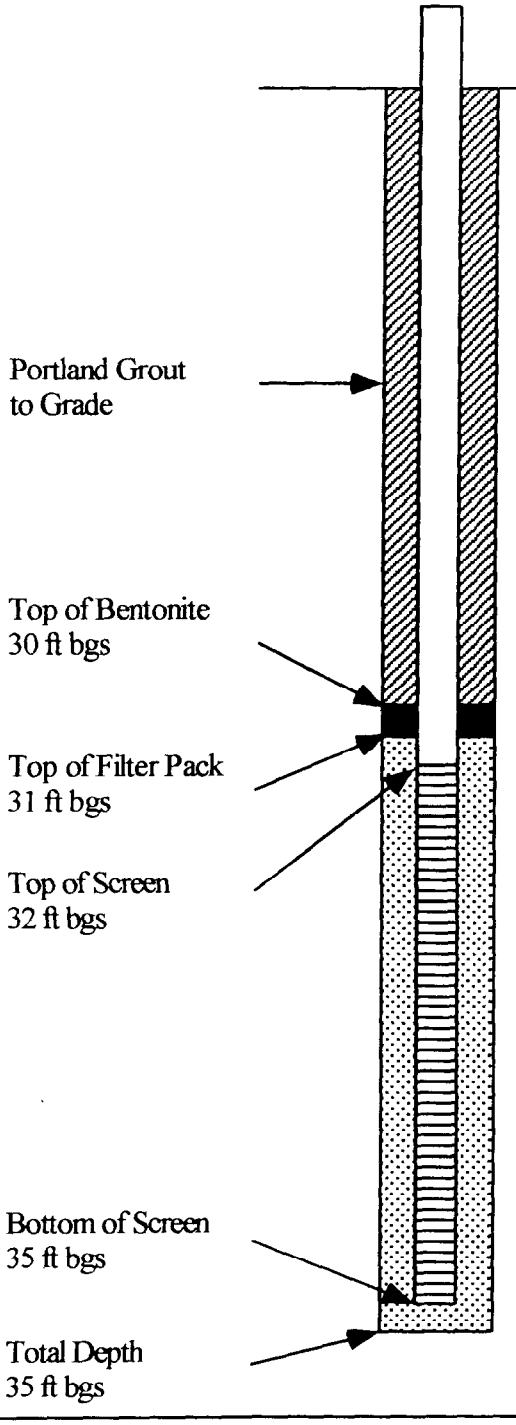

Site Name: Kings Bay

Injector Identification: I-26

Installation Date: 5/21/99

GCI Installation Oversight: Dan Bryant

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Sam Ross

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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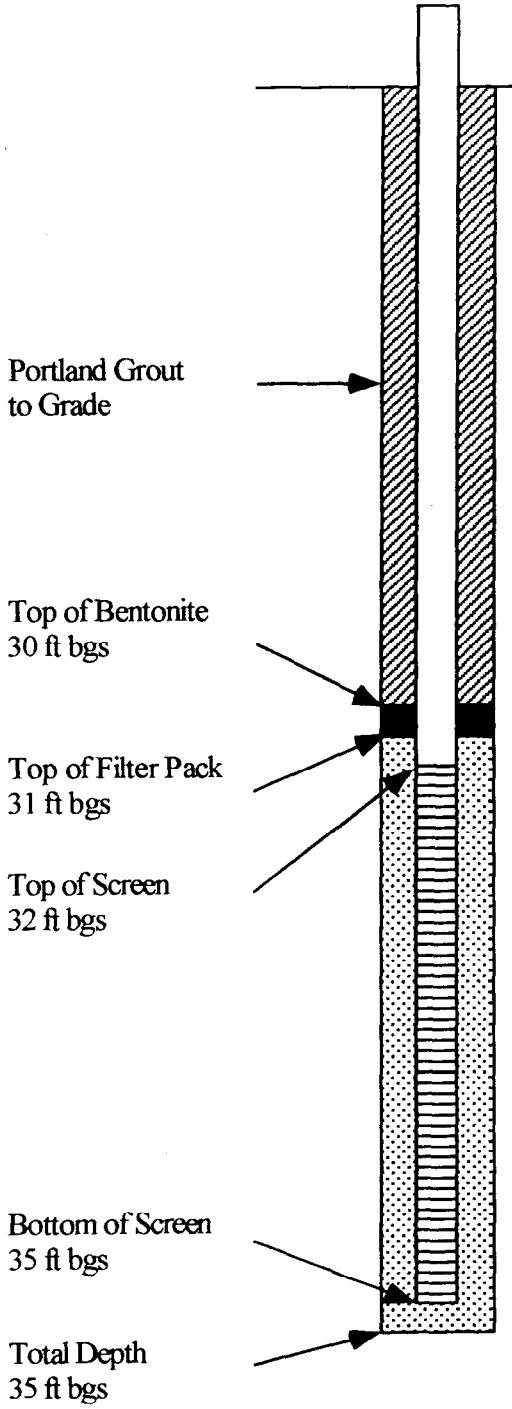

Site Name: Kings Bay

Injector Identification: I-27

Installation Date: 5/20/99

GCI Installation Oversight: Dan Bryant

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Sam Ross

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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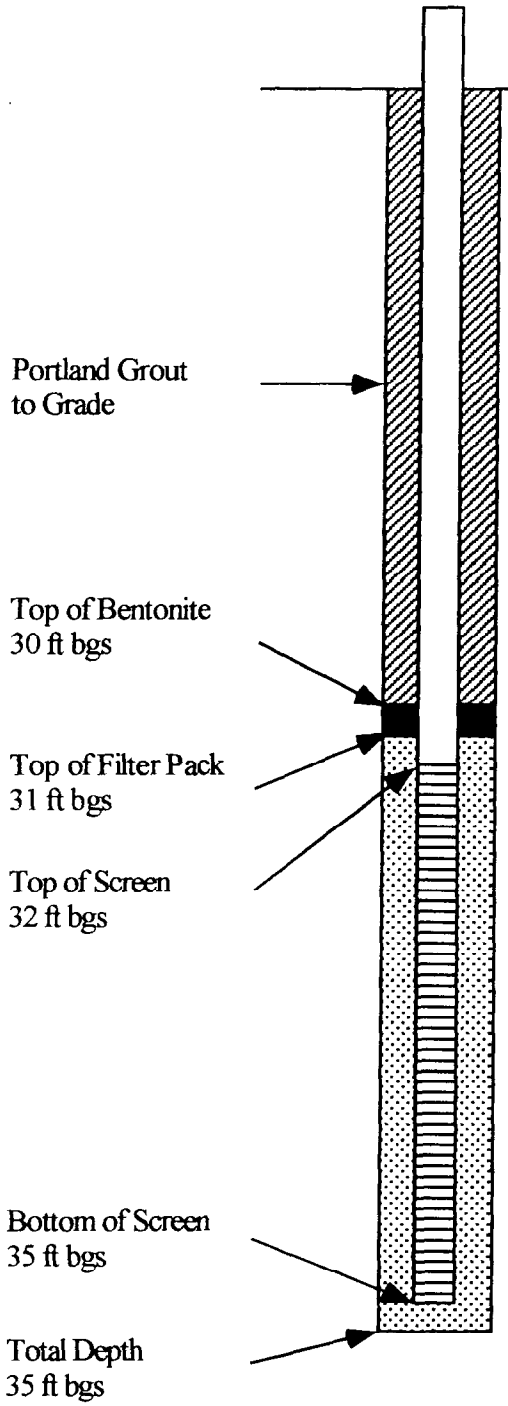

Site Name: Kings Bay

Injector Identification: I-28

Installation Date: 5/21/99

GCI Installation Oversight: D. Bryant, P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Sam Ross

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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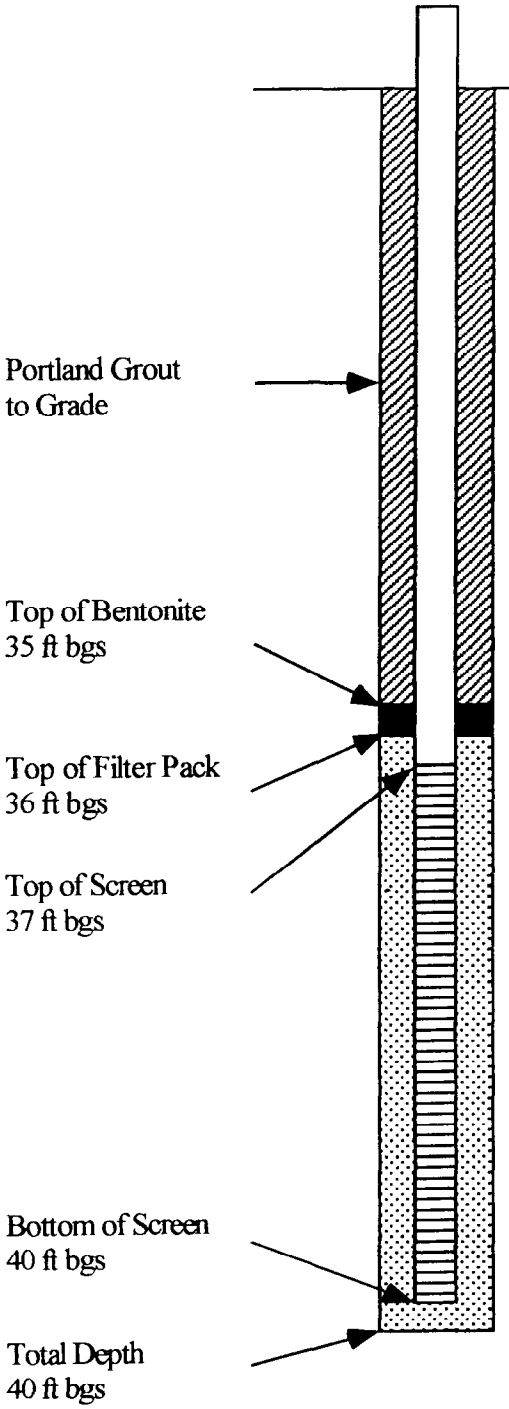

Site Name: Kings Bay

Injector Identification: I-29

Installation Date: 5/24/99

GCI Installation Oversight: Peter Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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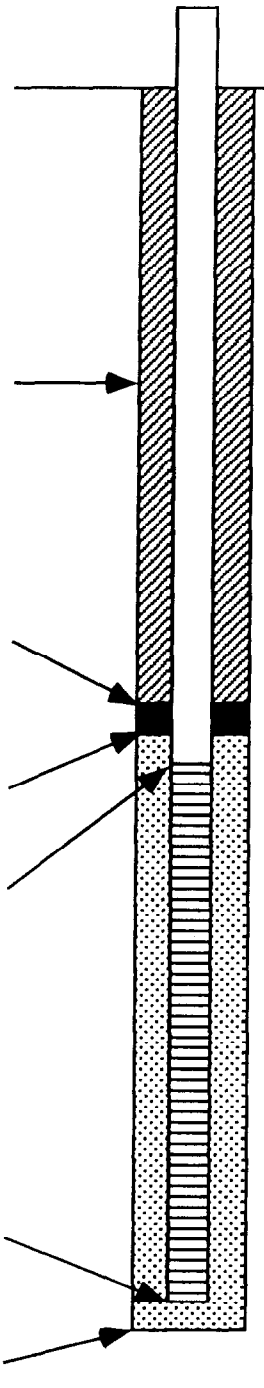

Site Name: Kings Bay

Injector Identification: I-30

Installation Date: 5/21/99

GCI Installation Oversight: D. Bryant, P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Sam Ross

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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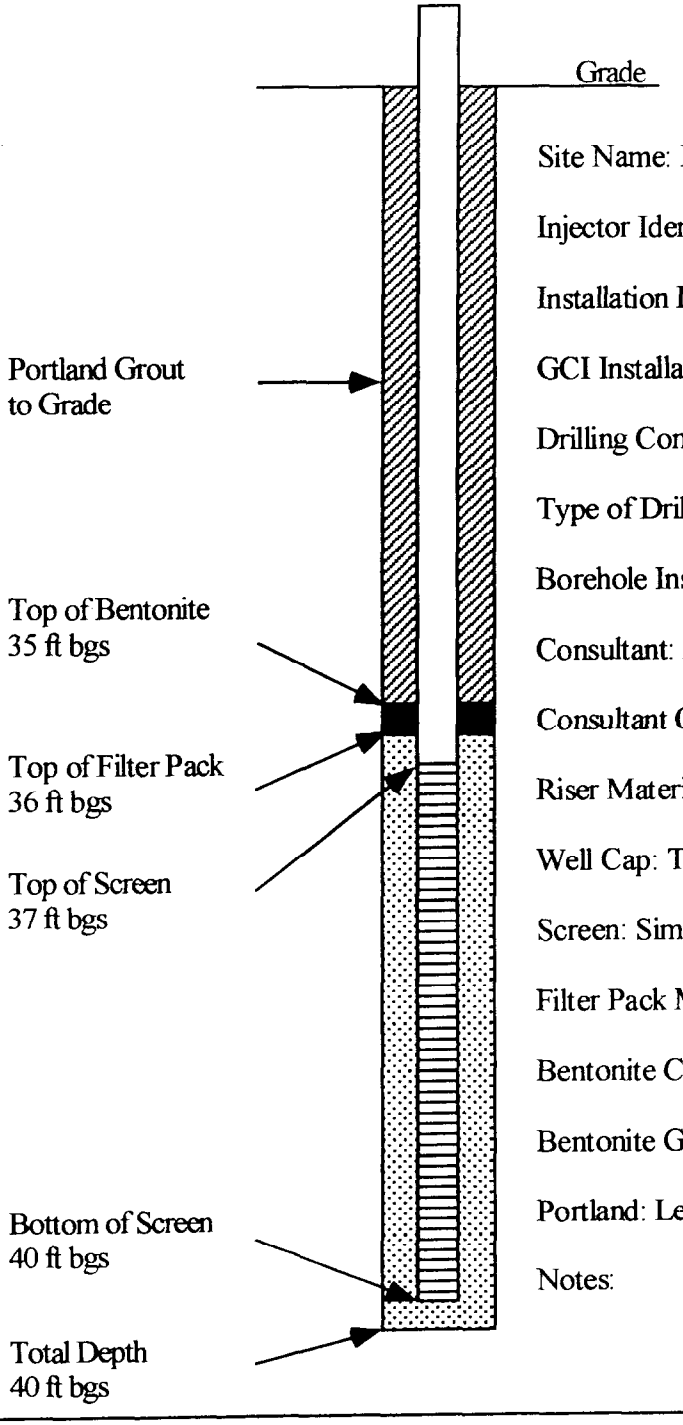

Site Name: Kings Bay

Injector Identification: I-31

Installation Date: 5/25/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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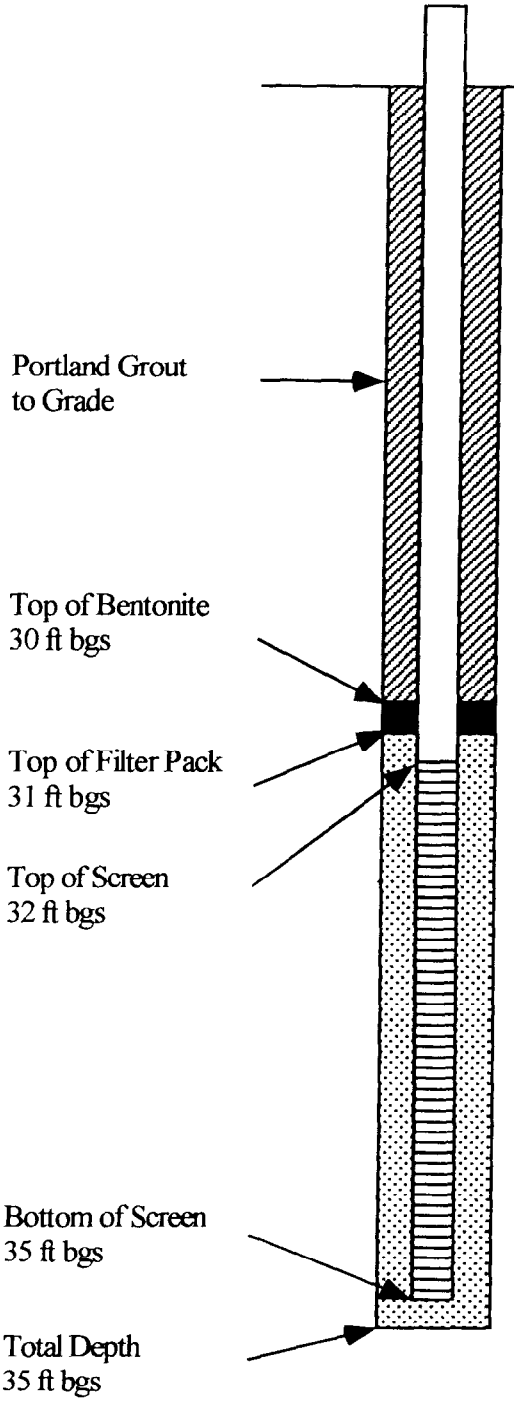

Site Name: Kings Bay

Injector Identification: I-32

Installation Date: 5/25/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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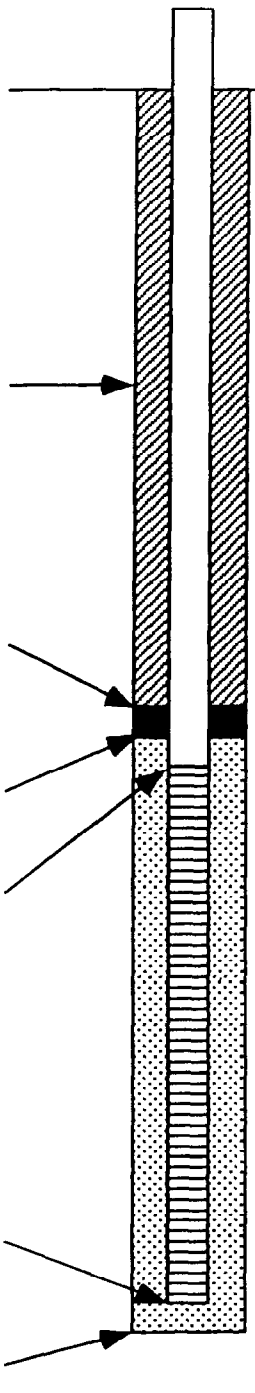

Site Name: Kings Bay

Injector Identification: I-33

Installation Date: 5/25/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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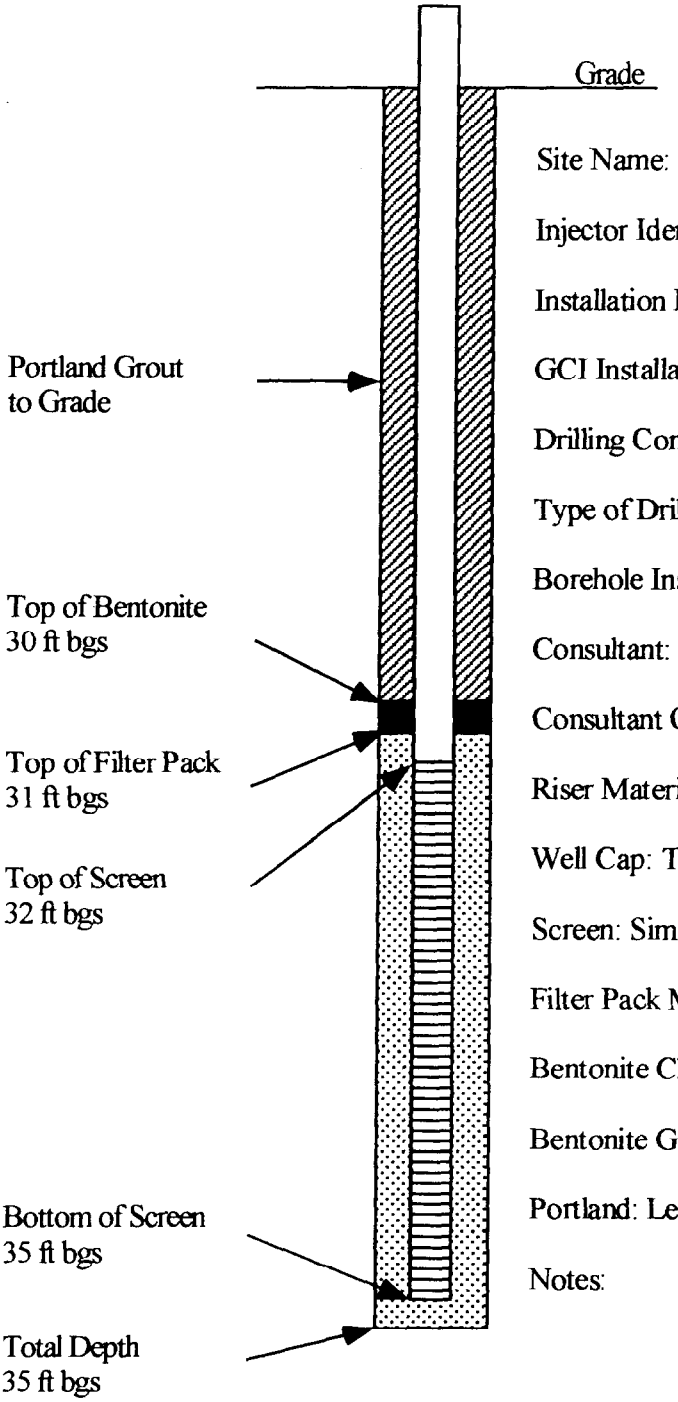

Site Name: Kings Bay

Injector Identification: I-34

Installation Date: 5/25/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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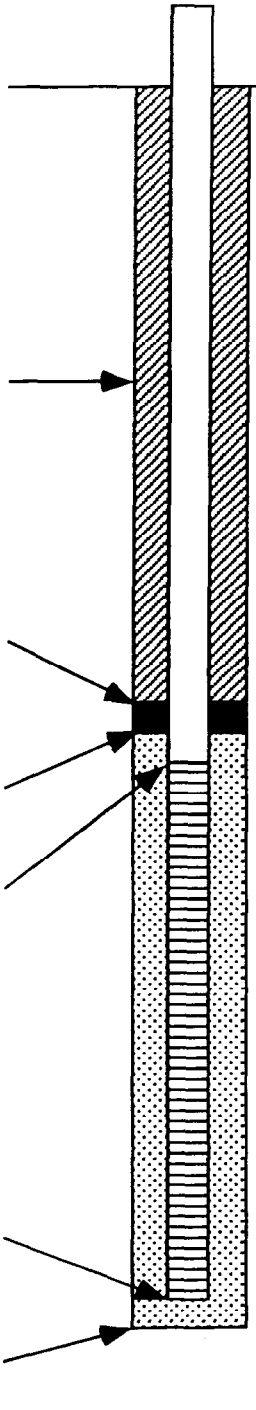

Site Name: Kings Bay

Injector Identification: I-35

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: Failing Mini-Star HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap:. Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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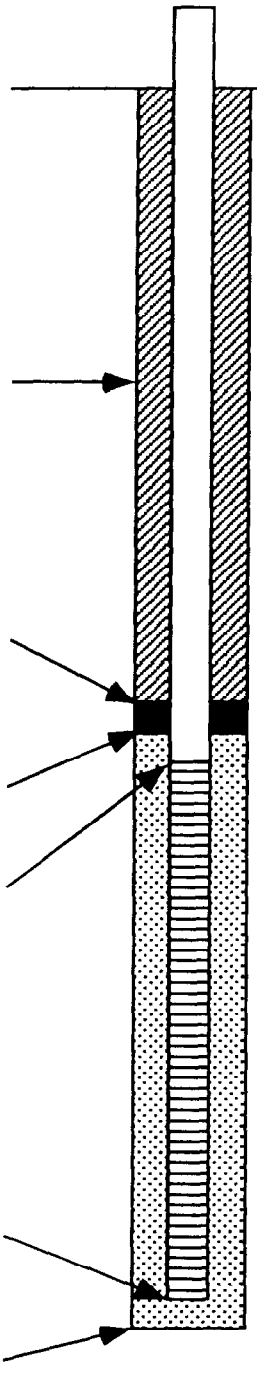

Site Name: Kings Bay

Injector Identification: I-36

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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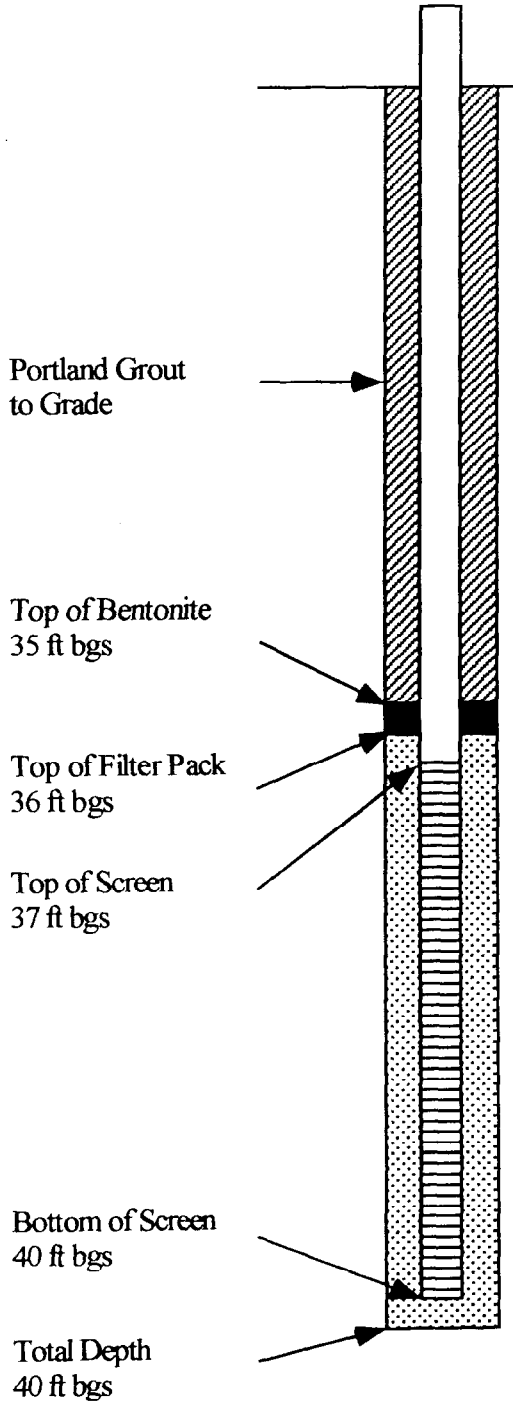

Site Name: Kings Bay

Injector Identification: I-37

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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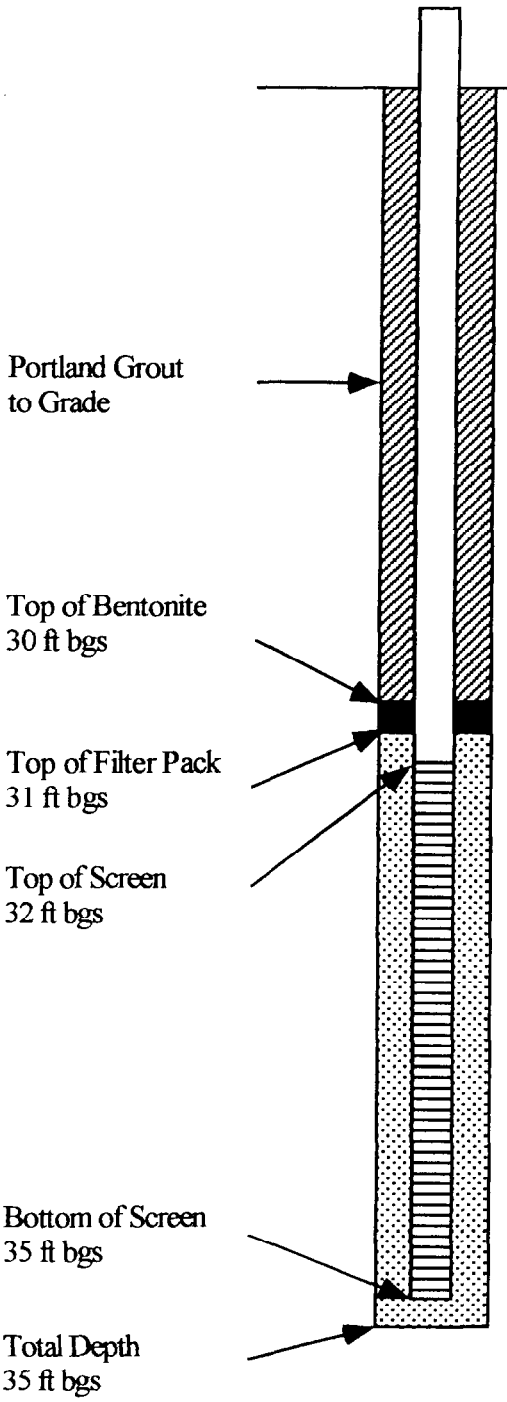

Site Name: Kings Bay

Injector Identification: I-38

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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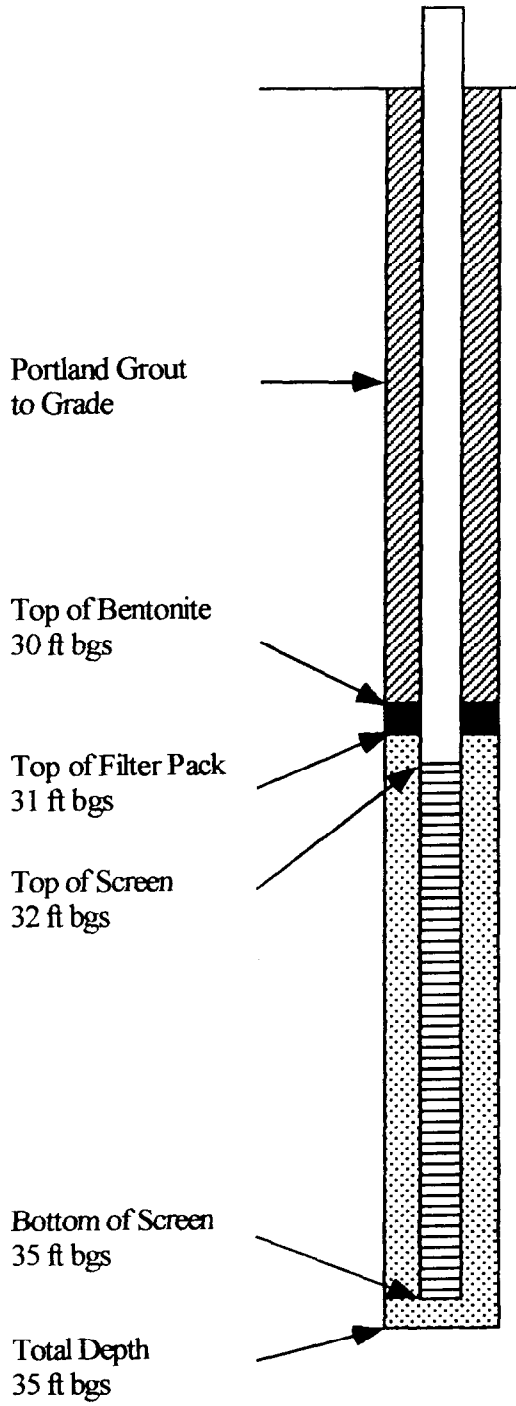

Site Name: Kings Bay

Injector Identification: I-39

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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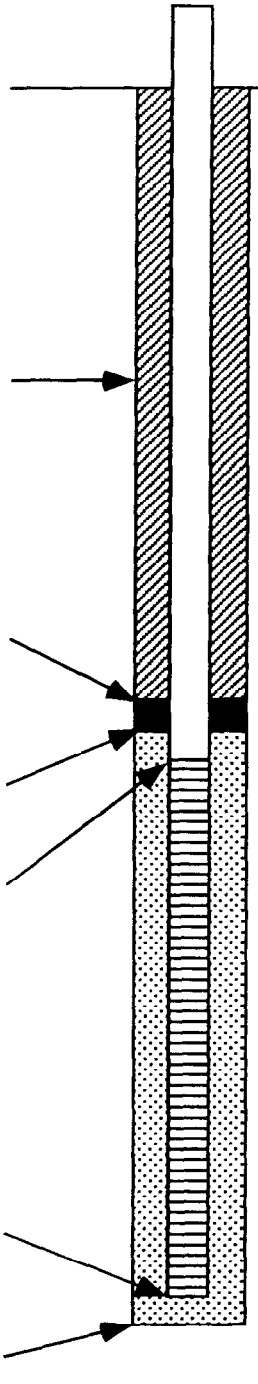

Site Name: Kings Bay

Injector Identification: I-40

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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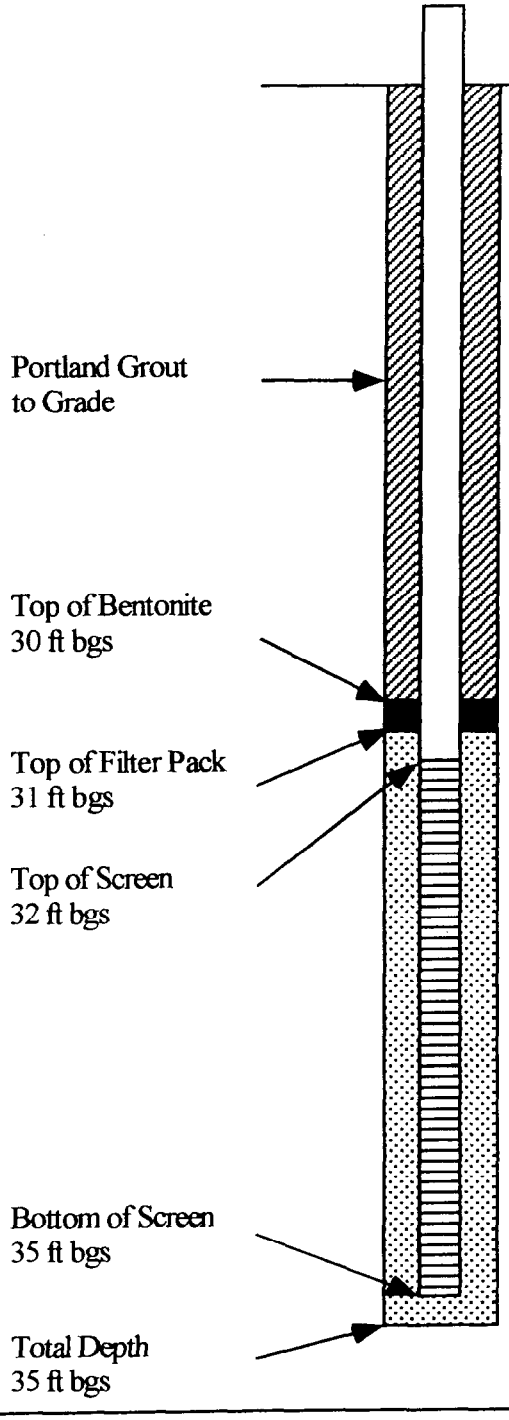

Site Name: Kings Bay

Injector Identification: I-41

Installation Date: 5/27/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: DR10K HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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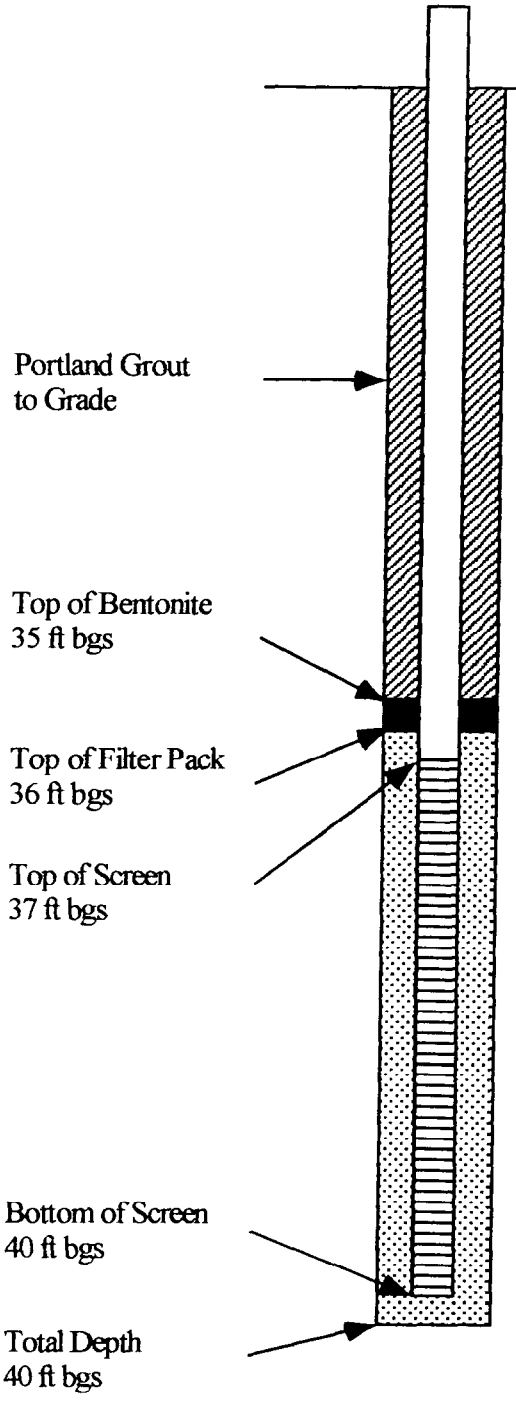

Site Name: Kings Bay

Injector Identification: I-42

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: Failing Mini-Star HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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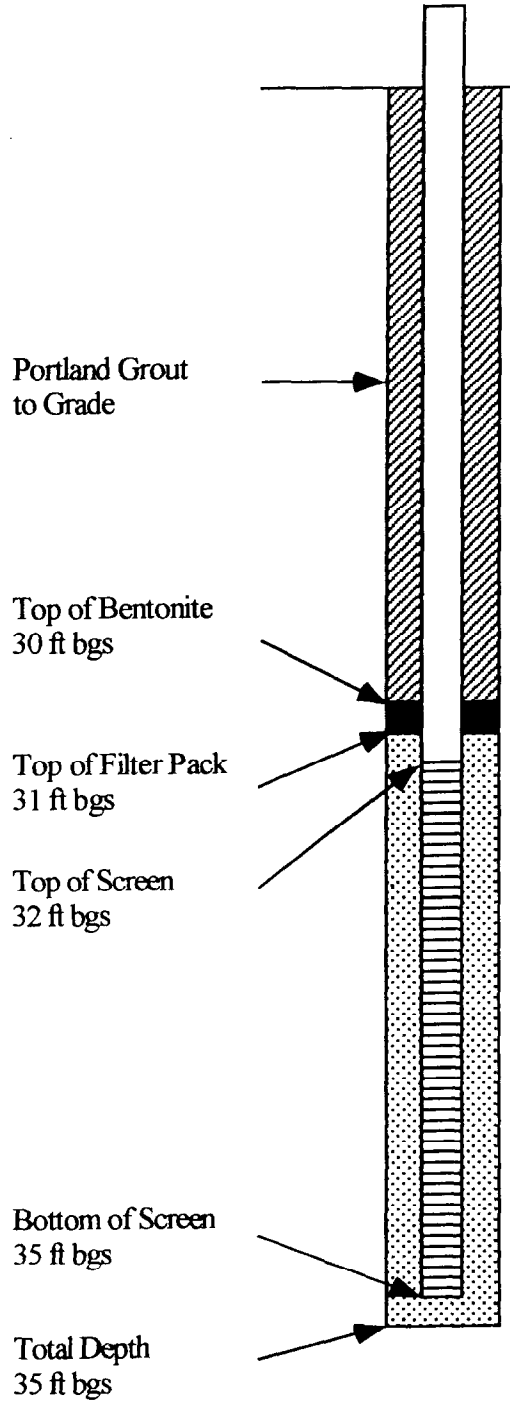

Site Name: Kings Bay

Injector Identification: I-43

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: Failing Mini-Star HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

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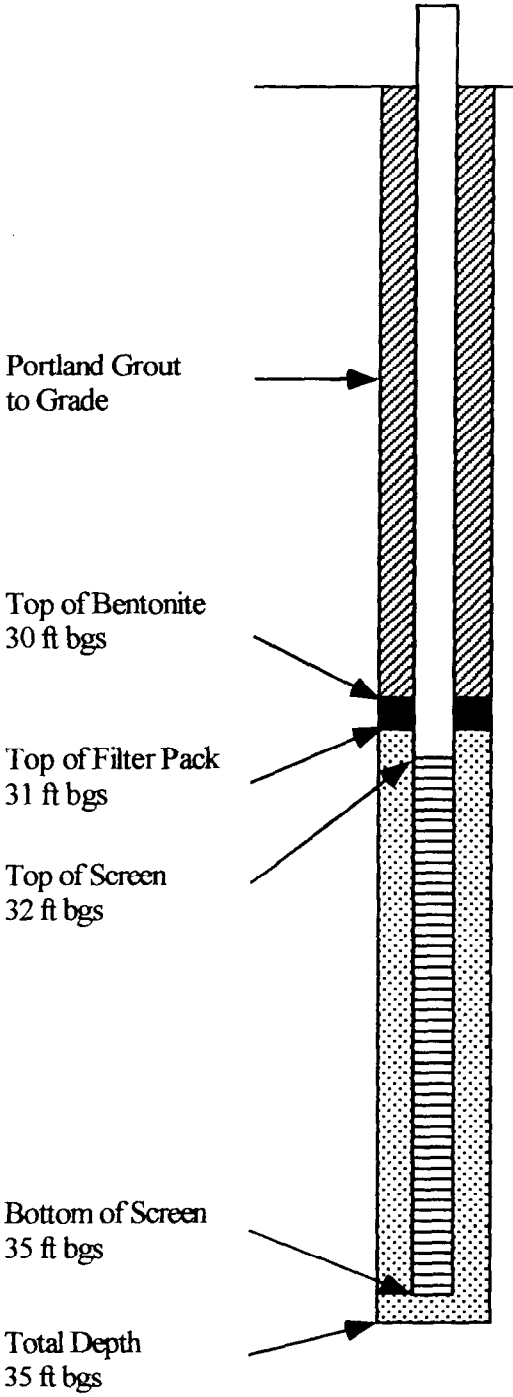


Site Name: Kings Bay

Injector Identification: I-44

Installation Date: 5/26/99

GCI Installation Oversight: P. Yanczak

Drilling Contractor: Partridge Well Company

Type of Drill Rig: Failing Mini-Star HSA

Borehole Inside/Outside Diameter: 4.25" ID

Consultant: Bechtel

Consultant Oversight: Mark Gage

Riser Material & Diameter: Sched 80 Black Iron 1.25"

Well Cap: Threaded

Screen: Simmons stainless .010-slot 1.25" diameter

Filter Pack Material: Standard Sand & Silica 20/30

Bentonite Chips/Pellets: Enviroplug Coarse

Bentonite Gel: Baroid Quik-Gel

Portland: Lehigh Type I-II

Notes:

Appendix D - Table 1. Groundwater pH Measurements.

Date	Time	KBA-11-31	KBA-11-32	KBA-11-33	KBA-11-34	KBA-11-35	KBA-11-36
06/03/99	16:10	6.5	4.5	5.5	4.0	5.5	4.0
06/04/99	8:15	6.0	4.0	5.5	4.5	6.0	4.0
06/05/99	7:25	6.0	3.5	5.5	3.5	6.0	4.0
06/07/99	9:30	5.0	4.0	4.0	5.0	5.5	4.0
06/08/99	8:10	3.5	4.0	5.0	4.0	6.0	4.0
06/09/99	8:10	-	-	5.5	4.0	5.5	4.0
06/10/99	8:35	4.0	3.5	5.0	3.5	5.5	5.5
06/11/99	8:00	3.5	3.5	5.5	3.5	5.0	3.5
07/12/99	12:15	4.0	3.5	5.0	3.5	5.5	3.5
07/13/99	9:48	3.5	4.0	5.5	4.0	5.0	4.0
07/14/99	7:45	4.0	4.0	5.0	4.0	5.5	4.0
07/15/99	8:00	3.5	3.5	5.5	4.0	5.5	4.0

Appendix D - Table 2. Groundwater Alkalinity Measurements.

Date	Time	KBA-11-31	KBA-11-32	KBA-11-33	KBA-11-34	KBA-11-35	KBA-11-36
06/03/99	16:10	200	20	100	0	180	0
06/04/99	8:15	180	20	100	0	160	0
06/05/99	7:25	60	20	100	0	180	0
06/07/99	9:30	20	0	100	100	140	0
06/08/99	8:10	0	0	80	0	100	0
06/09/99	8:10	-	-	100	0	120	0
06/10/99	8:35	0	0	100	0	120	0
06/11/99	8:00	0	0	100	0	60	0
07/12/99	12:15	0	0	100	0	60	0
07/13/99	9:48	0	0	60	0	80	0
07/14/99	7:45	0	0	100	0	80	0
07/15/99	8:00	0	0	80	0	120	0

Note: Concentrations in mg/l

Appendix D - Table 3. Groundwater Iron Measurements.

Date	Time	KBA-11-31	KBA-11-32	KBA-11-33	KBA-11-34	KBA-11-35	KBA-11-36
06/03/99	16:10	10.0	>10	3.4	>10	8.2	10.0
06/04/99	8:15	>10	>10	3.8	>10	8.8	>10
06/05/99	7:25	>10	>10	3.4	>10	4.8	>10
06/07/99	9:30	>10	>10	>10	7.6	1.6	>10
06/08/99	8:10	>10	>10	>10	>10	1.0	9.5
06/09/99	8:10	-	-	>10	>10	7.2	>10
06/10/99	8:35	9.5	>10	>10	>10	4.7	9.4
06/11/99	8:00	>10	>10	>10	>10	1.8	>10
07/12/99	12:15	>10	>10	>10	>10	1.0	>10
07/13/99	9:48	>10	>10	>10	9.0	8.0	>10
07/14/99	7:45	>10	>10	>10	>10	9.5	>10
07/15/99	8:00	>10	>10	>10	>10	>10	>10

Note: Concentrations in mg/l

Appendix D - Table 4. Groundwater Hydrogen Peroxide Measurements.

Date	Time	KBA-11-31	KBA-11-32	KBA-11-33	KBA-11-34	KBA-11-35	KBA-11-36
06/03/99	16:10	0	0	0	0	0	0
06/04/99	8:15	0	0	0	0	0	0
06/05/99	7:25	0	0	0	0	0	0
06/07/99	9:30	0	0	0	0	0	0
06/08/99	8:10	50	0	0	0	0	0
06/09/99	8:10	-	-	0	0	0	0
06/10/99	8:35	0	0	0	30	0	0
06/11/99	8:00	0	0	0	0	0	0
07/12/99	12:15	0	0	0	0	0	0
07/13/99	9:48	0	0	0	0	0	0
07/14/99	7:45	0	0	0	0	0	0
07/15/99	8:00	0	0	0	0	0	0

Note: Concentrations in mg/l

Appendix D - Table 5. Groundwater Chloride Measurements.

Date	Time	KBA-11-31	KBA-11-32	KBA-11-33	KBA-11-34	KBA-11-35	KBA-11-36
06/03/99	16:10	*10*	*10*	10	*5*	5	*5*
06/04/99	8:15	*10*	*10*	10	*5*	5	*5*
06/05/99	7:25	*10*	*5*	10	*10*	10	*5*
06/07/99	9:30	*10*	*10*	5	*10*	10	*10*
06/08/99	8:10	*15*	*10*	10	*5*	10	*10*
06/09/99	8:10	-	-	5	*5*	5	*5*
06/10/99	8:35	*5*	*10*	10	*15*	10	*15*
06/11/99	8:00	*10*	*10*	10	*15*	10	*15*
07/12/99	12:15	*10*	*20*	10	*10*	10	*10*
07/13/99	9:48	*20*	*20*	20	*20*	40	*20*
07/14/99	7:45	*20*	*20*	20	*20*	20	*20*
07/15/99	8:00	*20*	*20*	20	*20*	20	*20*

Notes: Concentrations in mg/l

Italics indicate that the result is questionable due to low pH

Appendix D - Table 6. Groundwater Headspace Photoionization Detector Measurements.

Date	Time	KBA-11-31	KBA-11-32	KBA-11-33	KBA-11-34	KBA-11-35	KBA-11-36
06/03/99	16:10	0.0	0.0	0.0	0.0	0.0	0.0
06/04/99	8:15	6.2	1.2	0.0	15.0	0.0	1.5
06/05/99	7:25	0.9	0.0	0.0	0.0	0.0	0.0
06/07/99	9:30	0.5	0.0	1.0	0.0	0.0	0.4
06/08/99	8:10	0.0	0.0	0.0	0.2	0.0	0.0
06/09/99	8:10	-	-	0.0	0.3	0.0	0.0
06/10/99	8:35	2.1	0.5	0.0	0.0	0.0	0.0
06/11/99	8:00	1.1	0.0	0.0	0.0	0.0	0.0
07/12/99	12:15	1.0	0.0	0.0	0.0	0.0	0.9
07/13/99	9:48	3.3	0.0	0.0	0.0	0.0	0.0
07/14/99	7:45	2.5	0.0	0.0	0.0	1.7	0.0
07/15/99	8:00	0.2	0.0	0.0	0.0	0.0	0.0

Note: Concentrations in parts per million by volume

Appendix D - Table7. Offgas Carbon Dioxide Measurements.

Date	Time	I-4	I-5	I-9	I-12	I-13	I-14	I-15	I-16	I-17	I-18	I-19	I-20	I-21	I-24	I-25	I-27	I-30	I-35	I-36	I-37	I-40	I-41	I-42	I-43	I-44	USGS-1	USGS-2	USGS-3	USGS-15	KBA-11-35
06/03/99	17:30	-	-	-	-	0.0	-	-	-	-	-	-	0.0	-	1.1	3.9	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/04/99	10:10	-	-	-	-	1.5	-	0.8	0.4	-	-	-	-	0.3	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12:45	-	-	-	-	16.1	-	0.7	0.2	-	-	-	-	10.1	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/05/99	8:00	-	-	-	-	4.5	-	0.0	2.5	-	-	-	-	3.8	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10:30	-	-	-	-	17.0	-	0.0	1.0	-	-	-	-	2.1	14.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/07/99	14:05	-	-	-	3.4	0.9	-	-	-	0.0	-	-	-	3.5	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15:55	-	-	-	2.4	0.8	-	-	-	3.2	-	-	-	14.8	8.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/08/99	9:25	0.0	-	0.0	2.2	-	-	-	-	8.8	-	17.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/09/99	10:04	0.2	2.7	-	-	-	-	-	-	-	-	1.4	-	-	-	-	-	-	1.0	-	0.1	-	-	-	-	18.0	-	-	-	-	-
	13:15	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6	8.2	18.7	-	-	14.2	-	-	8.4	-	-	-	-	-
	14:45	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	9.5	13.9	-	-	16.8	-	-	8.0	-	-	-	-	-
06/10/99	10:30	0.0	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	0.5	2.5	-	10.4	-	-	4.4	-	-	6.8	-	-	-	-	-
	13:15	0.0	-	-	-	-	-	-	-	-	1.1	-	-	-	-	-	0.0	8.8	-	11.8	-	-	2.8	-	-	8.8	-	-	-	-	-
	15:15	0.3	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-	0.0	7.0	-	18.1	-	-	0.3	-	-	4.1	-	-	-	-	-
07/12/99	13:46	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	0.0	-	-	-	-	-
07/13/99	12:50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	0.0	-	5.9	0.0	0.0	-	2.6		4.5	-
	16:10	-	-	-	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	1.4	-	0.0	2.8	-	0.8	0.2	-
	19:39	-	-	-	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	5.2	-	-	-	-
07/14/99	11:35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	3.4	7.4	-	-	-	-	-	-	-
	16:12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-	-
07/15/99	10:35	-	-	-	-	-	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.0	5.5	-	-	-	-	2.7	-	-
	12:54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.4	4.8	0.0	-	-	-	1.2	-	4.4

Note: Concentration in percent by volume.

Appendix D - Table 8. Offgas Oxygen Measurements.

Date	Time	I-4	I-5	I-9	I-12	I-13	I-14	I-15	I-16	I-17	I-18	I-19	I-20	I-21	I-24	I-25	I-27	I-30	I-35	I-36	I-37	I-40	I-41	I-42	I-43	I-44	USGS-1	USGS-2	USGS-3	USGS-15	KBA-11-35
06/03/99	17:30	-	-	-	-	20.9	-	-	-	-	-	-	19.0	-	19.5	18.4	19.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/04/99	10:10	-	-	-	-	19.7	-	19.8	20.2	-	-	-	-	19.7	26.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12:45	-	-	-	-	>30	-	19.6	19.8	-	-	-	-	>30	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/05/99	8:00	-	-	-	-	>30	-	14.3	>30	-	-	-	-	>30	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10:30	-	-	-	-	>30	-	19.1	>30	-	-	-	-	>30	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/07/99	14:05	-	-	-	>30	20.1	-	-	-	15.4	-	-	-	>30	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15:55	-	-	-	>30	20.4	-	-	-	>30	-	-	-	>30	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/08/99	9:25	17.2	-	5.7	>30	-	-	-	-	>30	-	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/09/99	10:04	18.9	18.7	-	-	-	-	-	-	-	-	>30	-	-	-	-	-	-	21.5	-	20.3	-	-	-	-	>30	-	-	-	-	-
	13:15	18.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	>30	>30	>30	-	-	>30	-	-	>30	-	-	-	-	-
	14:45	19.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	>30	>30	>30	-	-	>30	-	-	>30	-	-	-	-	-
06/10/99	10:30	17.9	-	-	-	-	-	-	-	-	22.3	-	-	-	-	-	16.1	>30	-	>30	-	-	>30	-	-	>30	-	-	-	-	-
	13:15	20.3	-	-	-	-	-	-	-	-	>30	-	-	-	-	-	13.1	>30	-	>30	-	-	>30	-	-	>30	-	-	-	-	-
	15:15	22.5	-	-	-	-	-	-	-	-	22.5	-	-	-	-	-	16.1	>30	-	>30	-	-	20.1	-	-	>30	-	-	-	-	-
07/12/99	13:46	15.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.4	-	-	-	-	-	-	19.1	-	-	-	-	-
07/13/99	12:50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.1	-	-	16.3	-	>30	19.5	17.3	-	>30	-	>30	-
	16:10	-	-	-	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	-	-	-	-	28.9	-	15.3	>30	-	28.5	22.9	-
	19:39	-	-	-	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23.8	-	-	-	-	>30	-	-	-	-
07/14/99	11:35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	>30	>30	>30	-	-	-	-	-	-	-
	16:12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	>30	-	-	-	-	-	-	-	-
07/15/99	10:35	-	-	-	-	-	>30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	>30	>30	-	-	-	-	>30	-	-
	12:54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	>30	>30	-	-	-	-	>30	-	>30

Note: Concentration in percent by volume.

ATTACHMENT 2

GEOPROBE INVESTIGATION REPORT

GEOPROBE INVESTIGATION REPORT
SEPTEMBER 1999

SITE 11, OLD CAMDEN COUNTY LANDFILL
NAVAL SUBMARINE BASE KINGS BAY, GEORGIA

Prepared for

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

Under Contract No. N62467-93-D-0936

Prepared by

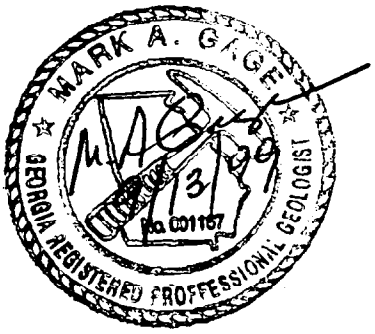
BECHTEL ENVIRONMENTAL, INC.
JACKSONVILLE, FLORIDA

SEPTEMBER 1999

REVISION 0

Bechtel Job No. 22567

The work described and professional opinions rendered in this document, *Geoprobe Investigation Report, Site 11, Old Camden County Landfill, Naval Submarine Base, Kings Bay, Georgia, September 1999, Revision 0,* were conducted and developed using commonly accepted procedures consistent with applicable standards of practice. The scope of services and activities described in this document were developed under the supervision of a professional geologist registered in the State of Georgia.



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1.0 INTRODUCTION

Bechtel Environmental, Inc. (Bechtel) has been contracted by the Department of the Navy, Naval Facilities Command, Southern Division, to provide remedial services as the Navy's Environmental Response Action Contractor (RAC). Under Delivery Order (DO) 109, Task 1, of the Prime Contract N62467-93-D-0936, Bechtel has been contracted to conduct Interim Measures for remediation of source area contaminated groundwater at Site 11, Old Camden County Landfill at the Naval Submarine Base (NSB) Kings Bay.

This report documents the geoprobe™ investigation and groundwater sampling and analyses activities at site 11 during August 31, 1999 through September 2, 1999. Figure 1 shows the area of geoprobe investigation. The purpose for this work was to investigate the source of the perchlorethylene/tetrachloroethlyene (PCE) rebounding in injector I-14. Analytical results from the August 1999 sampling event showed PCE concentrations of 1600 and 2500 µg/L at I-14, significantly higher than the previous month concentration of 110 µg/L. A summary of the analytical results for the site is provided in Table 1.

1.1 SUMMARY OF ACTIVITIES

Activities included procuring subcontract services, establishing a grid system at I-14, collecting groundwater samples using geoprobe equipment, and analyzing the samples for volatile organic constituents using a mobile laboratory.

Subcontracts - Bechtel subcontracted with Probe Domain of Jacksonville, FL to provide the equipment and labor to collect groundwater samples in the area at I-14. Probe Domain subcontracted with Analytical Laboratories of Florida, Inc., of Cocoa, FL to provide a mobile laboratory for onsite sample analyses.

Grid System – Bechtel arrived at site 11 on August 30, 1999 to layout a grid system for sample locations. Grid points were established at 5-ft intervals and in a north-south and east-west direction. Sample locations were marked with survey flags. Sample locations were identified as GP, for geoprobe, followed by a sequential number. For example, GP-10 identifies geoprobe sample location number 10.

Sample Collection – Groundwater samples were collected at 16 locations (Figures 2 through 6). Probe Domain provided a truck mounted, Geoprobe Model 5400, direct push machine for collecting samples. The equipment advanced an enclosed screen by pushing 1 ¼-inch outside diameter, 4-ft sections of steel rod to a depth of 30 to 33 ft below grade (bg). Once the depth of investigation was reached, the rods were pulled back, exposing a 3-ft, stainless steel, 0.004-inch wire wrapped screen. A ¼-inch inside diameter, polyethylene tube was positioned near the center of the screen and connected at the surface to a peristaltic pump. Approximately 2 gallons of groundwater were purged through the screen prior to collecting the sample. After purging, the

lower end of the tube was removed from the screen and upper end disconnected from the peristaltic pump. The sample was then collected by allowing the groundwater to flow out the lower end of the tube and into the sample container. After collecting the initial sample from the lowest interval, the screen was pulled up the hole to the next sampling interval. A new piece of polyethylene tubing was positioned near the center of the screen and the purge and sample process was repeated. Groundwater samples were collected at depths of 21 - 24 ft, 24 - 27 ft, and 27 - 30 ft bg at each location. Additional samples from depths of 11 - 14 ft, 15 –18 ft, 18 –21 ft, and 30 – 33 ft were collected at selected locations as directed by Bechtel. After all samples were collected at a location, the screen was removed from the hole and the hole was backfilled with a cement grout. The sample screen was then decontaminated with potable water, alconox and potable water, and potable water rinses.

Chemical Analyses – Collected samples were immediately provided to the onsite mobile laboratory under chain of custody protocol. Chain of custody records are attached. The samples were submitted for volatile organic analyses using EPA method 8021. Specific compounds analyzed included perchloroethylene/tetrachloroethylene, trichloroethylene, cis-1,2-dichloroethene, trans 1-2-dichloroethene, 1,1-dichloroethene, vinyl chloride, benzene, and chlorobenzene. Two of the samples analyzed onsite were duplicated and sent to ENCO Labs of Jacksonville, FL for confirmation analyses.

2.0 DATA PRESENTATION

Mobile Lab Results

PCE concentration results using the mobile lab ranged from 2 to 99,000 ppb. The highest concentrations of PCE were detected in the samples collected at location GP-10. Coincidentally, the highest concentrations for all intervals sampled were also associated with GP-10. Analytical results from samples 5 to 10 ft north, south, east, and west of GP-10 show a significant reduction in PCE concentration. Figures 2 through 6 have the PCE concentration for the particular interval sampled plotted on the figure. Figures 3 through 5 display an isoconcentration map depicting a "hot area" around GP-10. Complete analytical results are attached.

Confirmation Results

Duplicate samples GP-01 (24-27 ft) and GP-09 (24-27 ft) were submitted to ENCO Labs for volatile organic analyses. The results were then compared to those measured with the mobile lab (table below). ENCO results for GP-01 represent approximately 50% and results for GP-09 represent approximately 75% of the concentration measured by the mobile lab. Considering the samples were not preserved, subject to dilution, and ENCO samples analyzed 4 and 5 days after sample collection, the results are within reason.

Sample ID	Analytical Laboratories of Florida – Mobile Lab PCE Concentration (ppb)	ENCO Labs PCE Concentration (ppb)
GP-01 (24-27 ft)	19,000 (Analyzed 8/31/99)	9,200 (Analyzed 9/5/99)
GP-09 (24-27 ft)	48,000 (Analyzed 9/1/99)	35,000 (Analyzed 9/5/99)

3.0 OBSERVATIONS AND RECOMMENDATIONS

Observations - The highest concentration of PCE in groundwater at site 11 to date was detected at location GP-10. PCE concentrations at GP-10 ranged from 6,000 ppb near the top of the groundwater (11-14 ft) to 99,000 ppb at a depth of 27 – 30 ft. Location GP-10 is approximately 12 ft southeast of injector I-14. The rebound in PCE observed at I-14 most likely reflects its proximity to high concentration of PCE encountered at GP-10. The PCE concentrations encountered at GP-10 suggest closed proximity to a waste source within the landfill refuse.

Recommendations – To complete source area remediation and mitigate groundwater contamination at site 11, the area within a 10 ft radius of GP-10 should be excavated to an approximate depth of 10 ft bg. The purpose for this excavation is to search and remove any source continuing to leach PCE into the subsurface. Excavating and removing the source of PCE contamination in this area should speed up the remediation of affected groundwater.

FIGURES

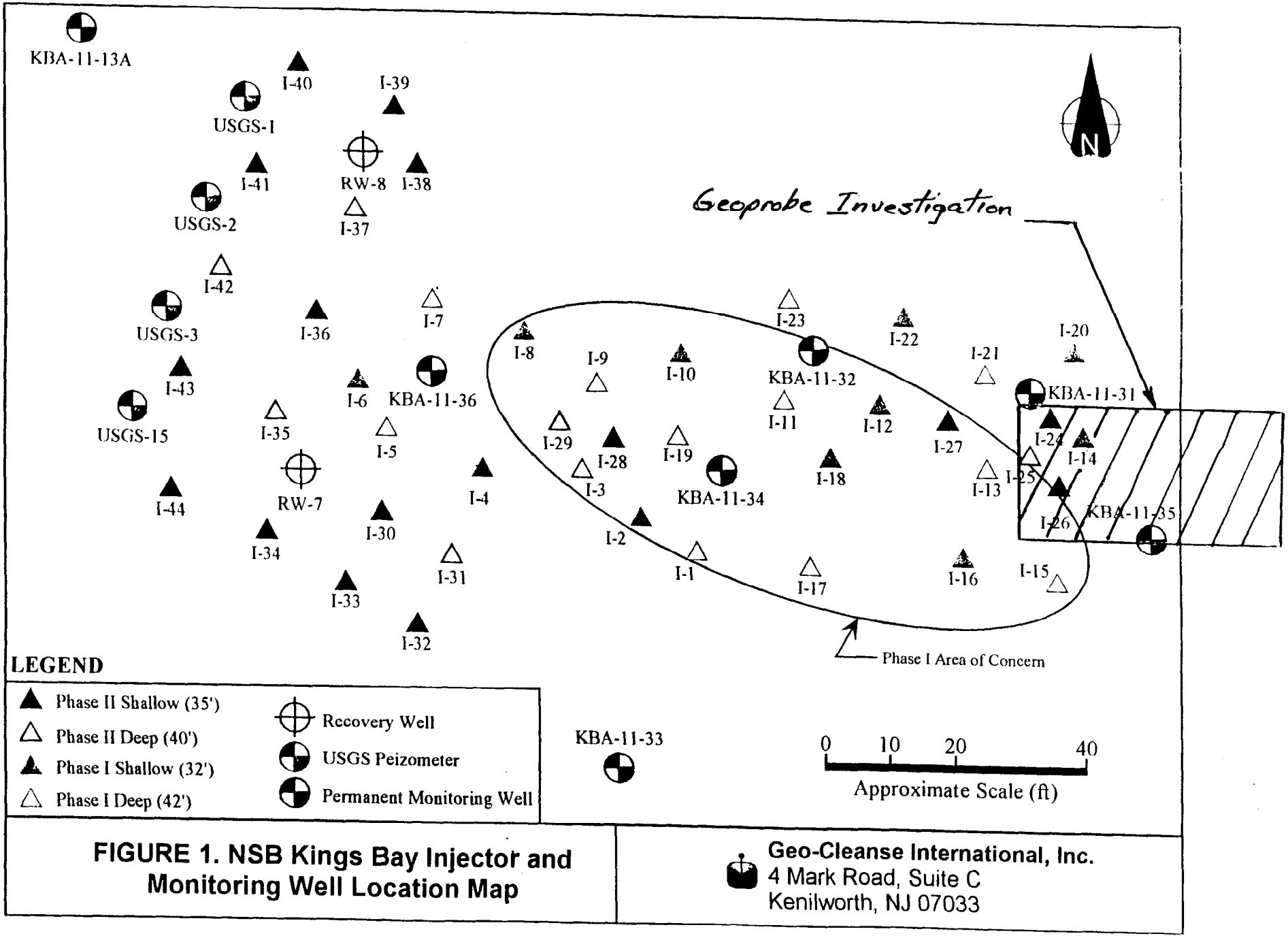


FIGURE 1. NSB Kings Bay Injector and Monitoring Well Location Map

Geo-Cleanse International, Inc.
4 Mark Road, Suite C
Kenilworth, NJ 07033

Figure 2

PCE Concentrations (ppb)
11-14 Ft Depth

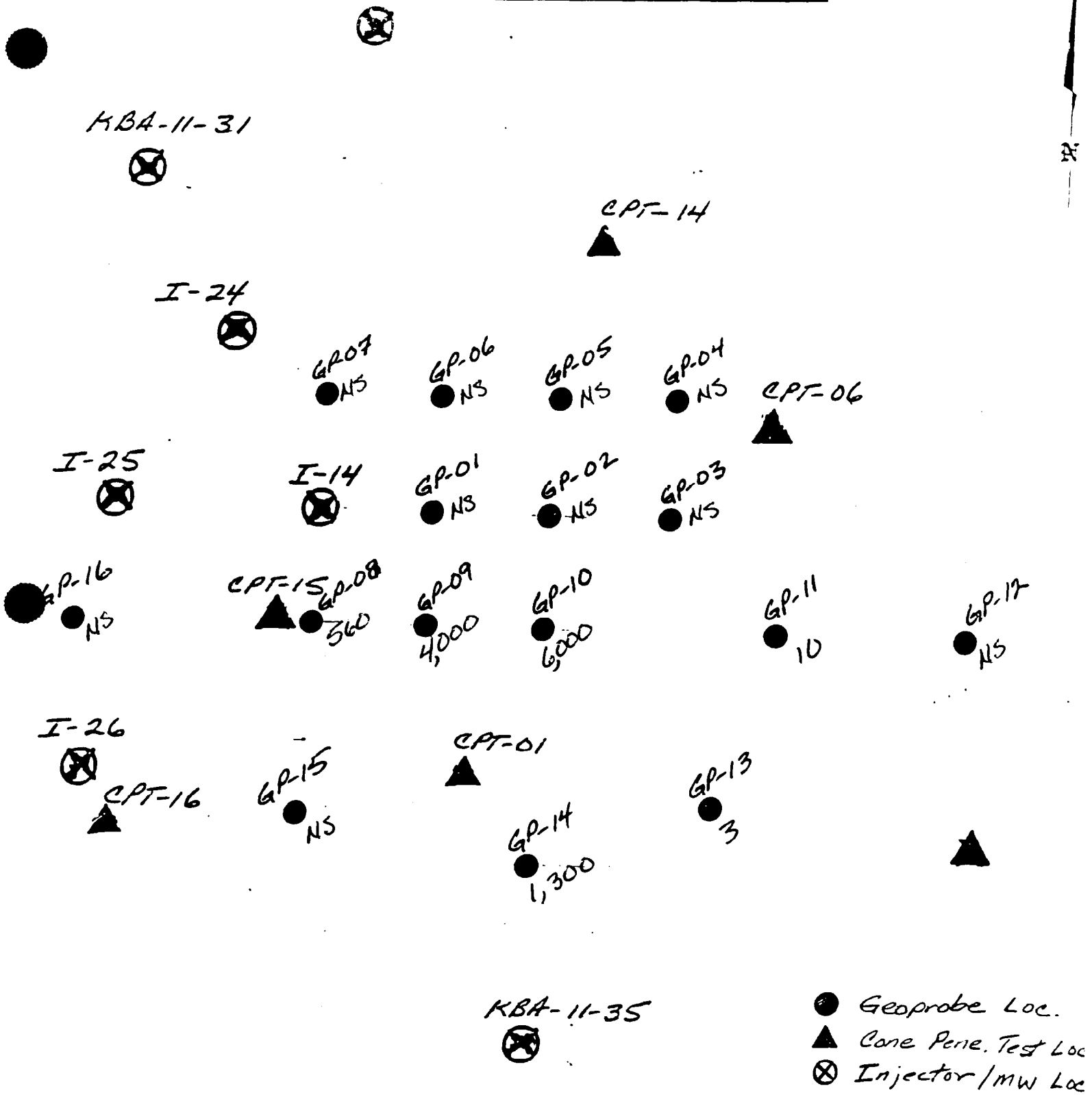


Figure 3

PCE Concentrations (ppb)
15-18 Ft Depth

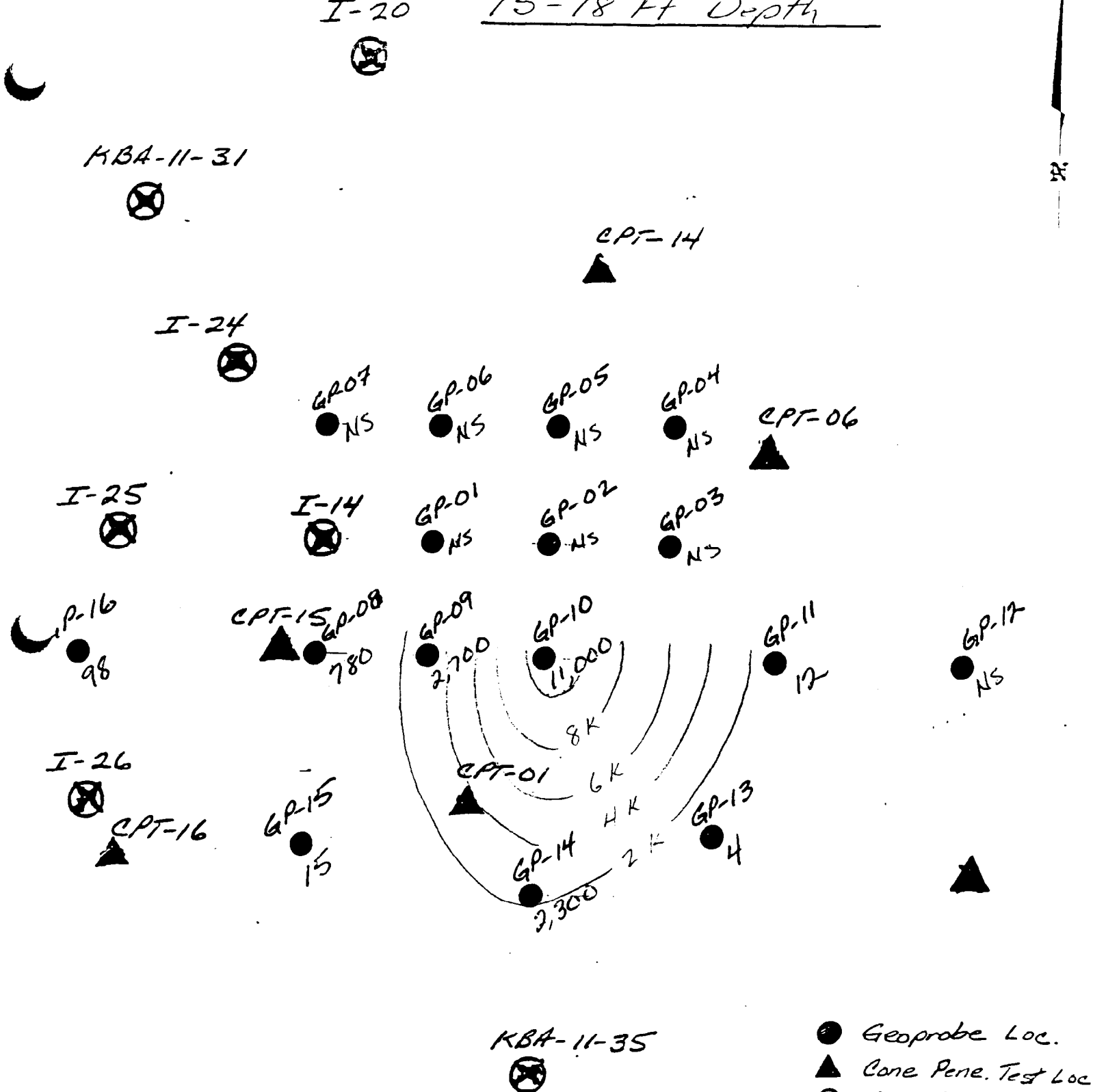


Figure 4

PCE Concentrations (ppb)
21 - 24 Ft Depth

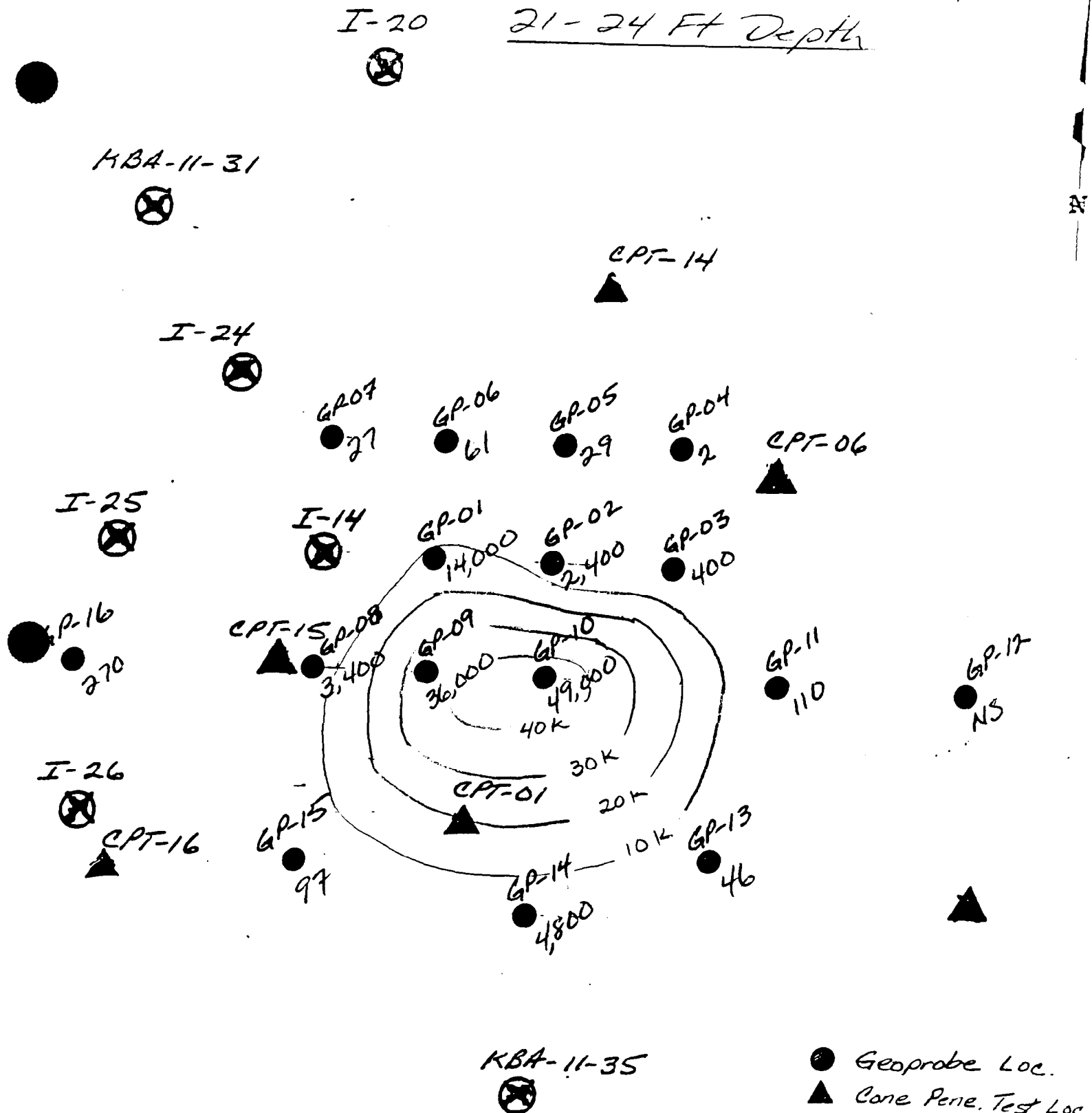


Figure 5

PCE Concentrations (ppb)
24-27 Ft Depth

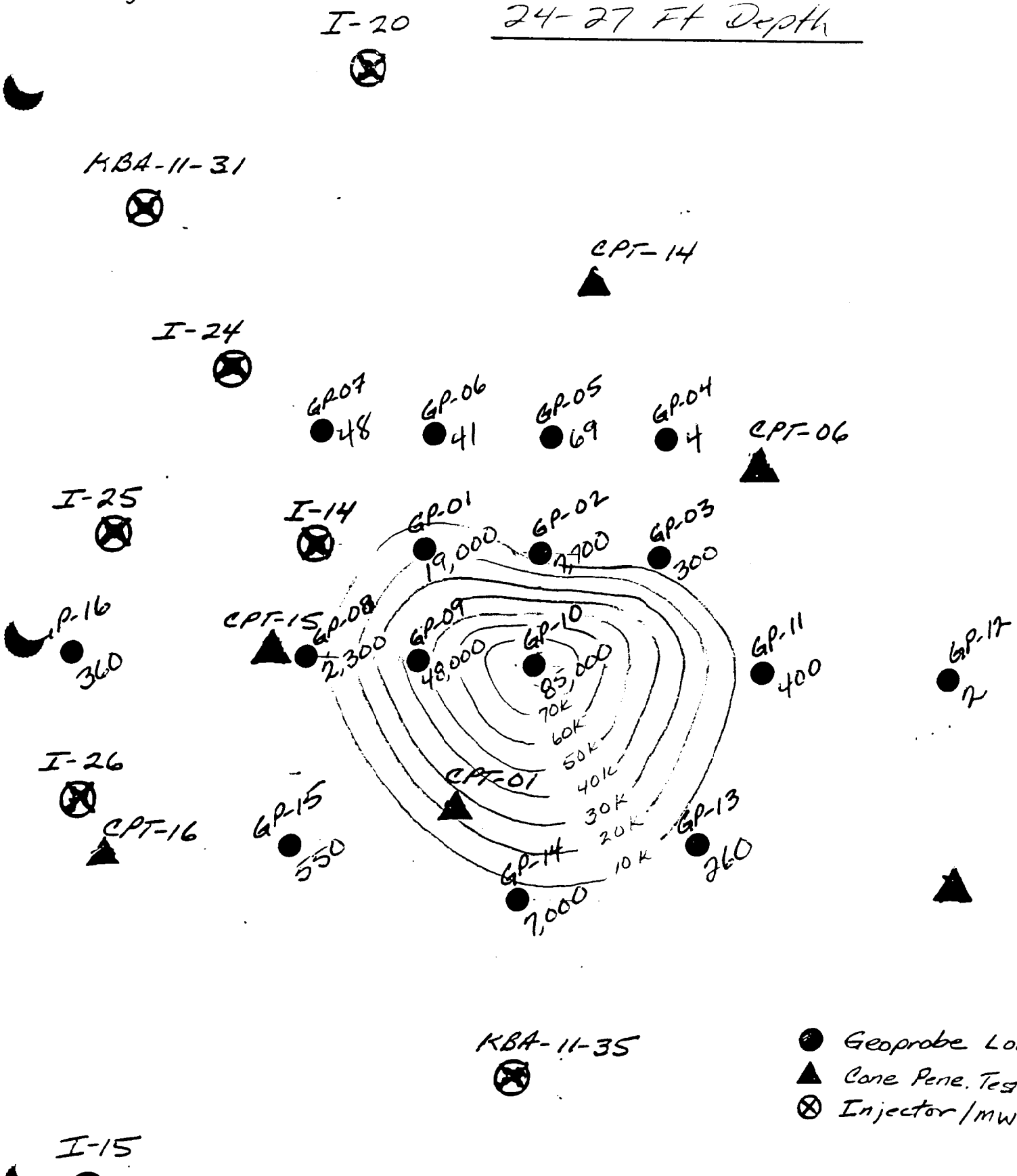


Figure 6

PCE Concentrations (ppb)
27-30 Ft Depth

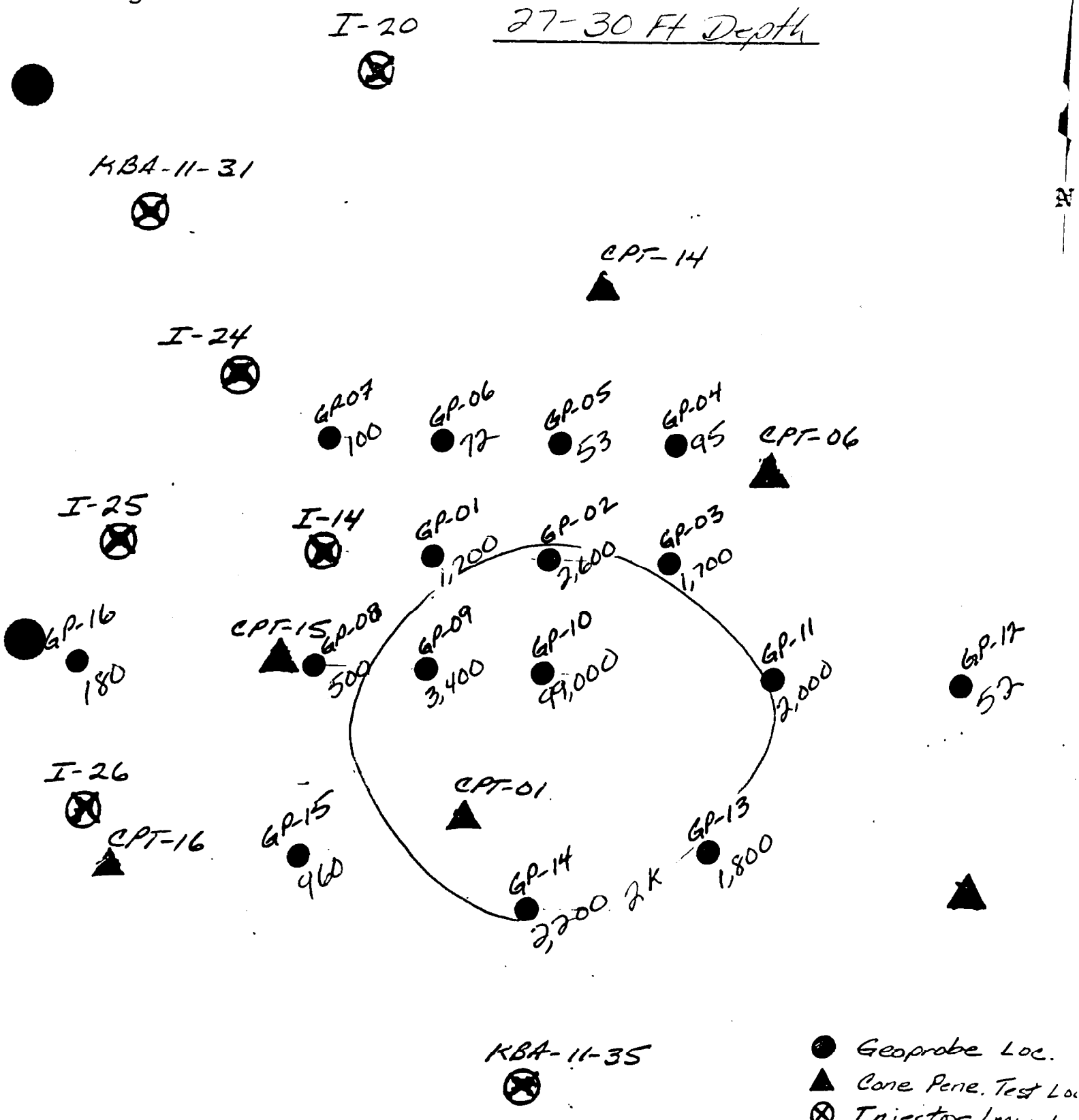


TABLE 1

Table 1. NSB Kings Bay Groundwater Chlorinated Aliphatic Compound (CAC) Results

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
KBA-11-31	9/17/98	<1	9	6	2	17
	10/30/98	<1	1	7	<1	8
	11/6/98	1	<1	<1	<1	1
	11/24/98	8	7	2	<1	17
	12/22/98	12	12	6	<1	30
	1/27/99	14	15	4	<1	33
	2/18/99	23	17	5	<1	45
	3/15/99	15	12	7	<1	34
	5/20/99	69	57	73	5	204
	6/21/99	6	<1	<1	<1	6
	7/26/99	4	<1	<1	<1	4
	8/16/99	7	<1	<1	<1	7
KBA-11-32	9/17/98	3	91	30	9	133
	10/30/98	<1	110	54	4	168
	11/13/98	<1	<1	<1	<1	0
	11/24/98	4	9	3	<1	16
	12/22/98	7	13	5	<1	25
	1/27/99	9	17	5	<1	31
	2/18/99	6	8	3	<1	17
	3/15/99	11	11	4	<1	26
	5/20/99	18	13	<1	<5	31
	6/21/99	12	6	1	<1	19
	7/26/99	9	4	<1	<1	13
	8/16/99	10	2	<1	<1	12
KBA-11-33	9/17/98	<1	<1	<1	<1	0
	10/30/98	<1	<1	<1	<1	0
	11/24/98	<1	<1	<1	<1	0
	12/22/98	<1	<1	<1	<1	0
	1/27/99	<3	<1	<1	<1	0
	2/18/99	<1	<1	<1	<1	0
	3/15/99	<1	<1	<1	<1	0
	5/20/99	<3	<1	<1	<5	0
	6/22/99	<3	<1	<1	<1	0
	7/26/99	<3	<1	<1	<1	0
	8/16/99	<1	<1	<1	<1	0
KBA-11-34	9/17/98	3,200	350	8	<1	3,558
	9/17/98 (dup)	2,500	320	8	<1	2,828
	10/30/98	8,500	550	24	<1	9,074
	11/13/98	180	30	<5	<5	210
	11/24/98	200	19	<1	<1	219
	11/24/98 (dup)	130	15	<1	<1	145
	12/22/98	87	6	<1	<1	93
	1/27/99	83	7	<1	<1	90
	2/18/99	9	<1	<1	<1	9
	3/15/99	62	3	<1	<1	65
	3/15/99 (dup)	57	2	<1	<1	59
	5/20/99	83	3	<1	<5	86
	6/22/99	10	<1	<1	<1	10
	7/26/99	24	<1	<1	<1	24
	8/16/99	16	<	<1	<1	16

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
RW8	10/30/98	<1	83	57	10	150
	11/24/98	<1	57	110	10	177
	1/27/99[1]	<3	2	2	<1	4
	2/18/99	5	17	110	7	139
	5/20/99	11	14	22	22	69
	6/23/99	4	4	23	<1	31
	7/27/99	<3	5	7	<1	12
	8/17/99	1	2	3	<1	6
USGS-1	8/6/98	<5	1,140	919	314	2,373
	11/4/98	<3	28	340	33	401
	11/25/98	<5	120	580	61	761
	1/7/99	<5	78	213	<5	291
	4/7/99	<1	198	731	64	993
	5/20/99[4]	500	240	25	<5	765
	5/26/99	<3	190	820	120	1,130
	6/23/99	<30	150	400	21	571
	6/23/99 (dup)	<30	170	420	21	611
	7/27/99	<3	13	77	<1	90
	8/17/99	<1	8	34	<1	42
USGS-2	8/6/98	<5	160	290	219	669
	11/4/98	<3	560	660	45	1,265
	11/25/98	<5	180	300	22	502
	1/7/99	<5	34	293	39	366
	4/7/99	<1	49	500	56	605
	5/20/99[4]	15	96	190	16	317
	6/3/99	<3	130	440	11	581
	6/23/99	4	57	170	<1	231
	7/27/99	<3	2	34	<1	36
	8/17/99	<1	3	13	<1	16
USGS-3	8/6/98	<5	45	328	327	700
	11/4/98	<3	350	1,300	74	1,724
	11/25/98	<5	260	860	26	1,146
	1/7/99	<5	290	1,070	64	1,424
	4/7/99	5	97	492	54	648
	5/20/99[4]	6	71	430	24	531
	6/3/99	20	130	130	9	289
	6/23/99	70	67	60	<1	197
	7/27/99	<3	1	15	<1	16
	8/17/99	<1	2	10	<1	12
USGS-15	11/4/98	<1	9	3	7	19
	11/25/98	<5	7	34	6	47
	1/7/99	<5	25	29	<5	54
	4/7/99	29	42	8	<1	79
	5/20/99[4]	<3	160	840	110	1,110
	6/3/99	330	170	13	<1	513
	6/23/99	310	160	25	<5	495
	7/27/99	6	7	2	<1	15
	8/17/99	26	28	7	<1	61
I-1	10/30/98	<1	<1	9	<1	9
	12/22/98	<1	<1	<1	<1	0
	3/16/99	<1	<1	<1	<1	0
	5/20/99	<3	<1	<1	<5	0
	6/22/99	4	<1	<1	<1	4

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-2	12/22/98	290	9	<1	<1	299
	1/27/99	4	<1	4	<1	8
	2/18/99	52	1	<1	<1	53
	3/16/99	230	3	<1	<1	233
	3/16/99 (dup)	250	4	<1	<1	254
	5/20/99	27	3	5	<5	35
	6/22/99	10	<1	7	<1	17
	7/27/99	<3	<1	2	<1	2
	8/16/99	15	<1	<1	<1	15
I-3	12/22/98	<1	<1	1	<1	1
	3/16/99	56	2	<1	<1	58
	5/20/99	8	<1	<1	<5	8
	6/22/99	22	<1	<3	<1	22
I-4	11/24/98	290	43	<1	<1	333
	12/22/98	900	30	1	<1	931
	1/27/99	230	18	17	<1	265
	2/18/99	97	2	<1	<1	99
	3/16/99	88	2	<1	<1	90
	3/16/99 (dup)	87	2	<1	<1	89
	5/20/99	13	3	3	<5	19
	6/22/99	32	1	<1	<1	33
	6/22/99 (dup)	21	<1	<1	<1	21
	7/27/99	<3	1	15	<1	16
	8/17/99	30	<1	<1	<1	30
	8/17/99 (dup)	6	<1	<1	<1	6
I-5	2/18/99	<1	<1	1	<1	1
	3/16/99	<1	<1	<1	<1	0
	5/20/99	77	4	1	<5	82
	6/22/99	<3	<1	3	<1	3
I-6	2/18/99	2	<1	<1	<1	2
	3/16/99	2	<1	<1	<1	2
	5/20/99	<3	<1	<1	<5	0
	6/22/99	<3	<1	<1	<1	0
I-7	2/18/99	<1	<1	210	3	213
	3/16/99	<1	<1	85	2	87
	5/21/99	4	1	240	<1	245
	6/22/99	<3	<1	13	<1	13
	7/27/99	<3	<1	16	<1	16
	8/16/99	6	1	10	<1	17
I-8	12/22/98	13	15	1	<1	29
	3/16/99	7	<1	<1	<1	7
	5/20/99	3	2	5	<5	10
	6/22/99	5	<1	<1	<1	5
I-9	12/22/98	9	1	37	1	48
	1/27/99	<3	1	13	<1	14
	3/16/99	8	3	12	<1	23
	5/20/99	<3	<1	20	<5	20
	6/22/99	70	3	2	<1	75
I-10	12/22/98	27	8	<1	<1	35
	1/27/99	25	4	<1	<1	29
	3/16/99	22	1	<1	<1	23
	5/20/99	22	3	<1	<5	25
	6/22/99	<3	<1	<1	<1	0

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-11	11/13/98	<1	<1	200	<1	200
	12/22/98	5	<1	66	<1	71
	12/22/98 (dup)	3	<1	57	<1	60
	2/18/99	1	<1	27	1	29
	3/16/99	<1	<1	10	<1	10
	5/21/99	<3	<1	4	<1	4
	6/21/99	5	<1	4	<1	9
	7/26/99	4	<1	4	<1	8
	8/16/99	3	<1	2	<1	5
I-12	11/13/98	170	44	<5	<5	214
	11/24/98	29	8	<1	<1	37
	12/22/98	76	2	<1	<1	78
	12/22/98 (dup)	65	1	<1	<1	66
	1/27/99	43	2	<1	<1	45
	2/18/99	25	<1	<1	<1	25
	3/16/99	44	<1	<1	<1	44
	5/20/99	27	<1	<1	<5	27
	6/21/99	22	<1	<1	<1	22
	7/26/99	8	<1	<1	<1	8
	8/16/99	13	<1	<1	<1	13
I-13	12/22/98	<1	<1	33	2	35
	1/27/99	<3	<1	14	<1	14
	2/18/99	<1	<1	79	<1	79
	2/18/99 (dup)	<1	<1	61	2	63
	3/16/99	6	<1	12	<1	18
	5/21/99	<3	<1	8	<1	8
	6/21/99	4	<1	4	<1	8
I-14	3/16/99	3,500	300	<10	<10	3,800
	3/31/99	3,200	200	<50	<50	3,400
	4/12/99	2,420	220	11	5	2,656
	5/20/99	5,000	870	15	<5	5,885
	5/20/99 (dup)	4,600	730	12	<5	5,342
	6/21/99	48	14	<1	<1	62
	6/21/99 (dup)	59	18	<1	<1	77
	7/26/99	110	26	<1	<1	136
	7/26/99 (dup)	110	27	<1	<1	137
	8/16/99	1,600	100	<50	<50	1,700
	8/16/99 (dup)	2,500	160	<50	<50	2,660
I-15	3/16/99	<1	<1	<1	<1	0
	5/20/99	<3	<1	<1	<5	0
	6/21/99	<3	<1	<1	<1	0
I-16	10/30/98	<1	<1	<1	<1	0
	12/22/98	71	<1	<1	<1	71
	1/27/99	33	<1	<1	<1	33
	3/16/99	140	<10	<10	<10	140
	3/31/99	68	<1	<1	<1	68
	5/20/99	17	<1	<1	<5	17
	6/21/99	210	2	<1	<1	212
	7/26/99	<3	<1	<1	<1	0
	8/16/99	56	<1	<1	<1	56
I-17	12/22/98	<1	<1	<1	<1	0
	3/16/99	4	<1	<1	<1	4
	5/20/99	22	<1	1	<5	23
	6/21/99	51	<1	<1	<1	51

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-18	12/22/98	16	<1	<1	<1	16
	3/16/99	96	3	<1	<1	99
	5/20/99	180	7	<1	<5	187
	6/21/99	<3	<1	<1	<1	0
	7/26/99	15	<1	<1	<1	15
	8/16/99	31	<1	<1	<1	31
I-19	12/22/98	<1	<1	100	<1	100
	2/18/99	<1	<1	110	2	112
	3/16/99	1	<1	8	2	11
	5/21/99	7	<1	34	<1	41
	6/22/99	<3	<1	18	<1	18
	7/26/99	<3	<1	3	<1	3
	8/16/99	4	<1	6	<1	10
I-20	3/16/99	<1	<1	<1	<1	0
	5/20/99	<3	3	1	<5	4
	6/21/99	<3	<1	6	<1	6
I-21	3/16/99	<1	<1	210	13	223
	5/21/99	4	<1	110	7	121
	6/21/99	<3	1	110	5	116
	7/26/99	<3	<1	100	<1	100
	8/16/99	<1	<1	14	<1	14
I-22	3/16/99	14	30	28	<1	72
	5/20/99	33	24	12	5	74
	6/21/99	4	1	<1	<1	5
I-23	3/16/99	6	8	4	<1	18
	5/21/99	19	13	5	<1	37
	6/22/99	24	21	5	<1	50
I-24	5/21/99	30	15	4	<1	49
	6/21/99	8	5	<1	<1	13
I-25	5/25/99	390	42	2	<1	434
	6/21/99	<3	<1	9	<1	9
	7/26/99	<3	<1	<1	<1	0
	8/16/99	<1	<1	1	<1	1
I-26	5/25/99	550	11	1	<1	562
	6/21/99	73	<1	<1	<1	73
	7/26/99	12	<1	<1	<1	12
	8/16/99	18	<1	<1	<1	18
I-27	5/21/99	1,400	220	2	<1	1,622
	6/21/99	26	3	<1	<1	29
	7/26/99	4	<1	<1	<1	4
	8/16/99	34	<1	<1	<1	34
I-28	5/24/99	84	4	<1	<1	88
	6/22/99	5	<1	<1	<1	5
	7/26/99	14	<1	<1	<1	14
	8/16/99	26	<1	<1	<1	26
I-29	5/25/99	150	8	<1	<1	158
	6/22/99	7	<1	5	<1	12
	7/27/99	30	3	<1	<1	33
	8/16/99	40	1	<1	<1	41
I-30	5/25/99	250	18	<1	<1	268
	6/22/99	16	1	<1	<1	17
	7/27/99	6	<1	<1	<1	6
	8/16/99	17	<1	<1	<1	17

Location	Date	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Total CACs (µg/L)[2,3]
I-31	5/26/99	14	1	1	<1	16
	6/22/99	24	3	1	<1	28
I-32	5/26/99	<3	<1	<1	<1	0
	6/22/99	11	<1	<1	<1	11
I-33	5/26/99	<3	<1	<1	<1	0
	6/22/99	17	3	1	<1	21
I-34	5/26/99	9	<1	<1	<1	9
	6/23/99	9	3	1	<1	13
I-35	5/27/99	11	49	150	23	233
	6/23/99	<3	<1	<1	<1	0
	7/27/99	6	1	<1	<1	7
	8/17/99	11	2	<1	<1	13
I-36	5/26/99	26	15	10	<1	51
	6/23/99	20	5	2	<1	27
I-37	5/27/99	13	5	170	<1	188
	6/22/99	<3	3	43	<1	46
	7/27/99	3	3	11	<1	17
	8/17/99	10	3	5	<1	18
I-38	5/27/99	9	34	31	<1	74
	6/23/99	9	15	8	<1	32
	7/27/99	<3	6	7	<1	13
	8/16/99	2	7	9	<1	18
I-39	5/27/99	<3	17	73	23	113
	6/23/99	<3	26	220	<1	246
	7/27/99	<3	3	2	<1	5
	8/17/99	<1	3	3	<1	6
I-40	5/27/99	<3	130	810	140	1,080
	6/23/99	3	22	12	<1	37
	7/27/99	<3	7	16	<1	23
	8/17/99	2	14	50	<1	66
I-41	5/27/99	<3	23	560	53	636
	6/23/99	<30	27	330	<10	357
	7/27/99	<3	6	32	<1	38
	8/17/99	<1	10	40	<1	50
I-42	5/27/99	<3	4	31	<1	35
	6/23/99	<3	3	33	<1	36
I-43	5/27/99	120	210	79	<1	409
	6/23/99	15	11	4	<1	30
	7/27/99	3	2	3	<1	8
	8/17/99	2	2	1	<1	5
I-44	5/27/99	120	16	1	<1	137
	6/23/99	23	8	2	<1	33
	7/27/99	20	7	<1	<1	27
	8/17/99	15	4	<1	<1	19

Notes:

1. Results for RW7 and RW8 on 1/27/99 are not considered valid due to inadequate purging prior to sample collection.
2. Total Chlorinated Aliphatics (CACs) = sum of tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride concentrations.
3. For computation of Total Chlorinated Aliphatics (CACs), all non-detect values were assumed to be zero.
4. Data are considered suspect, and the wells were re-sampled on 5/26/99 or 6/3/99.

ATTACHMENT

ANALYTICAL RESULTS
AND
CHAIN OF CUSTODY RECORDS

Analytical Laboratories of Florida: Field Screening Data

Site Project Name: Landfill Site 11
Site Location: Naval Submarine Base, Kings Bay, Georgia
Client Name: Bechtel Environmental (Oak Ridge, Tn office)
Client Contact: Mark Gage (423-220-2889)
Analysis Methodology: EPA 8021 (Subset)

Project Number:22567-625
Laboratory Project Name:BEC991
Laboratory Address: 3838 Sterling Street
Cocoa, Florida 32926
(800) 859 - 2384

Field Chemist: Dale A. Schamp
Signature: Dale A. Schamp
(Draft copy unless signature is present)
Date: 9/2/99
FDEP QAP Number 920332G

Target Compound	Concentration Levels in Parts per Billion					
Field Laboratory Number:	W-01	W-02	W-02 Duplicate	W-03	W-04	W-05
Field Number:	GP-01 @ 27 - 30 ft.	GP-01 @ 24 - 27 ft.	GP-01 @ 24 - 27 ft.	GP-01 @ 21 - 24 ft.	GP-02 @ 27 - 30 ft.	GP-02 @ 24 - 27 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	0.5 / 0.25 ml	0.5 / 0.025 ml	0.5 / 0.025 ml	0.5 / 0.05 ml	0.25 ml	0.025 ml
Sample Collection / Analysis Date:	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99
Vinyl chloride	20 U	400 U	400 U	200 U	40 U	400 U
1,1-Dichloroethene	20 U	400 U	400 U	200 U	40 U	400 U
trans-1,2-Dichloroethene	20 U	400 U	400 U	200 U	40 U	400 U
cis-1,2-Dichloroethene	20 U	400 U	400 U	200 U	40 U	400 U
Trichloroethene	270	940	920	200 U	190	480
Perchloroethene	1200	19,000	18,000	14,000	2600	7700
Benzene	20 U	400 U	400 U	200 U	40 U	400 U
Chlorobenzene	20 U	400 U	400 U	200 U	40 U	400 U
Field Laboratory Number:	W-06	W-06 Spike	W-07	W-08	W-09	W-10
Field Number:	GP-02 @ 21 - 24 ft.	GP-02 @ 21 - 24 ft.	GP-03 @ 27 - 30 ft.	GP-03 @ 24 - 27 ft.	GP-03 @ 21 - 24 ft.	GP-04 @ 27 - 30 ft.
Matrix:	Water	Water & 1000 ppb	Water	Water	Water	Water
Sample Size:	0.1 ml	0.1 ml	0.25 ml	0.5 ml	1.0 ml	0.5 ml
Sample Collection / Analysis Date:	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99
Vinyl chloride	100 U	1061 (106.1 % Rec.)	40 U	20 U	10 U	20 U
1,1-Dichloroethene	100 U	9639 (96.4 % Rec.)	40 U	20 U	10 U	20 U
trans-1,2-Dichloroethene	100 U	9749 (97.5 % Rec.)	40 U	20 U	10 U	20 U
cis-1,2-Dichloroethene	100 U	10138 (101.4 % Rec.)	40 U	20 U	10 U	20 U
Trichloroethene	100 U	10120 (101.2 % Rec.)	40	20 U	10 U	20 U
Perchloroethene	2400	34085 (100.5 % Rec.)	1700	300	400	95
Benzene	100 U	9350 (93.5 % Rec.)	40 U	20 U	10 U	20 U
Chlorobenzene	100 U	9752 (97.5 % Rec.)	40 U	20 U	10 U	20 U
Field Laboratory Number:	W-11	W-12	W-13	W-14	W-15	W-16
Field Number:	GP-04 @ 24 - 27 ft.	GP-04 @ 21 - 24 ft.	GP-05 @ 27 - 30 ft.	GP-05 @ 24 - 27 ft.	GP-05 @ 21 - 24 ft.	GP-06 @ 27 - 30 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	10 ml	10 ml	5 ml	1 ml	1 ml	2 ml
Sample Collection / Analysis Date:	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99
Vinyl chloride	1 U	1 U	2 U	10 U	10 U	5 U
1,1-Dichloroethene	1 U	1 U	2 U	10 U	10 U	5 U
trans-1,2-Dichloroethene	1 U	1 U	2 U	10 U	10 U	5 U
cis-1,2-Dichloroethene	1 U	1 U	2 U	10 U	10 U	5 U
Trichloroethene	1 U	1 U	8	10 U	10 U	45
Perchloroethene	4	2	53	69	29	72
Benzene	1 U	1 U	2 U	10 U	10 U	5 U
Chlorobenzene	1 U	1 U	2 U	10 U	10 U	5 U

Note(s):

FDER Data Qualifier Codes (Document Reference: DER QA-001/92) Section 10.0 Table 10.2. per Mr. Schamp's data review.

U = Indicates that the compound was analyzed for but not detected at the quantitation limit. The value associated with the qualifier shall be the method detection limit.

Analytical Laboratories of Florida: Field Screening Data

Site Project Name: Landfill Site 11
Site Location: Naval Submarine Base, Kings Bay, Georgia
Client Name: Bechtal Environmental (Oak Ridge, Tn.)
Client Contact: Mark Gage (423-220-2889)
Analysis Methodology: EPA 8021 (Subset)

Project Number:22567-625
Laboratory Project Name:BEC991
Laboratory Address: 3838 Sterling Street
Cocoa, Florida 32926
(800) 859 - 2384

Field Chemist: Dale A. Schamp
Signature: Dale A. Schamp
(Draft copy unless signature is present)
Date: 9/2/99
FDEP QAP Number: 920332G

Target Compound	Concentration Levels in Parts per Billion					
Field Laboratory Number:	W-17	W-18	W-19	W-20	W-21	W-22
Field Number:	GP-06 @ 24 - 27 ft.	GP-06 @ 21 - 24 ft.	GP-07 @ 27 - 30 ft.	GP-07 @ 24 - 27 ft.	GP-07 @ 21 - 24 ft.	GP-07 @ 18 - 21 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	3 ml	1 ml	0.5 ml	2 ml	2 ml	10 ml
Sample Collection / Analysis Date:	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99
Vinyl chloride	3 U	10 U	20 U	5 U	5 U	2
1,1-Dichloroethene	3 U	10 U	20 U	5 U	5 U	1 U
trans-1,2-Dichloroethene	3 U	10 U	20 U	5 U	5 U	2
cis-1,2-Dichloroethene	3 U	10 U	26	5 U	9	24
Trichloroethene	23	10 U	44	7	11	17
Perchloroethene	41	61	100	48	27	62
Benzene	3 U	10 U	20 U	5 U	5 U	1 U
Chlorobenzene	3 U	10 U	20 U	5 U	5 U	1 U
Field Laboratory Number:	W-23	W-24	W-24 Duplicate	W-25	W-26	W-27
Field Number:	GP-08 @ 27 - 30 ft.	GP-08 @ 24 - 27 ft.	GP-08 @ 24 - 27 ft.	GP-08 @ 21 - 24 ft.	GP-08 @ 15 - 18 ft.	GP-08 @ 11 - 14 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	1 ml	1 ml	0.1 ml	0.1 ml	0.5 ml	0.5 ml
Sample Collection / Analysis Date:	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99
Vinyl chloride	10 U	10 U	100 U	100 U	20 U	20 U
1,1-Dichloroethene	10 U	10 U	100 U	100 U	20 U	20 U
trans-1,2-Dichloroethene	10 U	10 U	100 U	100 U	20 U	20 U
cis-1,2-Dichloroethene	10 U	10 U	100 U	100 U	20 U	20 U
Trichloroethene	97	10 U	100 U	100 U	20 U	20
Perchloroethene	500	2300	2500	3400	780	560
Benzene	10 U	10 U	100 U	100 U	20 U	20 U
Chlorobenzene	10 U	10 U	100 U	100 U	20 U	20 U
Field Laboratory Number:	W-27 Spike	W-28	W-29	W-30	W-31	W-32
Field Number:	GP-08 @ 11 - 14 ft.	GP-09 @ 27 - 30 ft.	GP-09 @ 24 - 27 ft.	GP-09 @ 21 - 24 ft.	GP-09 @ 15 - 18 ft.	GP-09 @ 11 - 14 ft.
Matrix:	Water & 200 ppb	Water	Water	Water	Water	Water
Sample Size:	0.5 ml	0.1 ml	0.01 ml	0.01 ml	0.1 ml	0.05 ml
Sample Collection / Analysis Date:	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99
Vinyl chloride	212 (106.1 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
1,1-Dichloroethene	170 (85.0 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
trans-1,2-Dichloroethene	206 (103.3 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
cis-1,2-Dichloroethene	230 (115.0 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
Trichloroethene	216 (97.6 % Rec.)	480	1000 U	1000 U	100 U	200 U
Perchloroethene	732 (87.3 % Rec.)	3400	48,000	36,000	2700	4000
Benzene	220 (110.2 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
Chlorobenzene	192 (95.8 % Rec.)	100 U	1000 U	1000 U	100 U	200 U

Note(s):

FDER Data Qualifier Codes (Document Reference: DER QA-001/92) Section 10.0 Table 10.2. per Mr. Schamp's data review.
U = Indicates that the compound was analyzed for but not detected at the quantitation limit. The value associated with the qualifier shall be the method detection limit.

Analytical Laboratories of Florida: Field Screening Data

Site Project Name: Landfill Site 11
Site Location: Naval Submarine Base, Kings Bay, Georgia
Client Name: Bechtel Environmental (Oak Ridge, Tn.)
Client Contact: Mark Gage (423-220-2889)
Analysis Methodology: EPA 8021 (Subset)

Project Number:22567-625
Laboratory Project Name:BEC991
Laboratory Address: 3838 Sterling Street
Cocoa, Florida 32926
(800) 859 - 2384

Field Chemist: Dale A. Schamp
Signature: Dale A Schamp
(Draft copy unless signature is present)
Date: 9/2/99
FDEP QAP Number: 920332G

Target Compound	Concentration Levels in Parts per Billion					
Field Laboratory Number:	W-33	W-34	W-35	W-36	W-37	W-38
Field Number:	GP-10 @ 27 - 30 ft.	GP-10 @ 24 - 27 ft.	GP-10 @ 21 - 24 ft.	GP-10 @ 15 - 18 ft.	GP-10 @ 11 - 14 ft.	GP-11 @ 27 - 30 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	0.005 ml	0.002 ml	0.005 ml	0.03 ml	0.05 ml	0.2 ml
Sample Collection / Analysis Date:	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99
Vinyl chloride	2000 U	5000 U	2000 U	333 U	200 U	50 U
1,1-Dichloroethene	2000 U	5000 U	2000 U	333 U	200 U	50 U
trans-1,2-Dichloroethene	2000 U	5000 U	2000 U	333 U	200 U	50 U
cis-1,2-Dichloroethene	2000 U	5000 U	2000 U	333 U	200 U	50 U
Trichloroethene	2000 U	5000 U	2000 U	333 U	200 U	50 U
Perchloroethene	99,000	85,000	49,000	11,000	6000	2000
Benzene	2000 U	5000 U	2000 U	333 U	200 U	50 U
Chlorobenzene	2000 U	5000 U	2000 U	333 U	200 U	50 U
Field Laboratory Number:	W-39	W-40	W-41	W-42	W-43	W-44
Field Number:	GP-11 @ 24 - 27 ft.	GP-11 @ 21 - 24 ft.	GP-11 @ 15 - 18 ft.	GP-11 @ 11 - 14 ft.	GP-12 @ 30 - 33 ft.	GP-12 @ 27 - 30 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	2 ml	2 ml	5 ml	5 ml	10 ml	10 ml
Sample Collection / Analysis Date:	9/1/99	9/1/99	9/1/99	9/1/99	9/2/99	9/2/99
Vinyl chloride	5 U	5 U	2 U	2 U	1 U	1 U
1,1-Dichloroethene	5 U	5 U	2 U	2 U	1 U	1 U
trans-1,2-Dichloroethene	5 U	5 U	2 U	2 U	1 U	1 U
cis-1,2-Dichloroethene	5 U	5 U	2 U	2 U	1 U	1 U
Trichloroethene	5 U	5 U	2 U	2 U	1 U	1 U
Perchloroethene	400	110	12	10	2	52
Benzene	5 U	5 U	2 U	2 U	1 U	1 U
Chlorobenzene	5 U	5 U	2 U	2 U	1 U	1 U
Field Laboratory Number:	W-44 Duplicate	W-45	W-46	W-47	W-48	W-49
Field Number:	GP-12 @ 27 - 30 ft.	GP-12 @ 24 - 27 ft.	GP-13 @ 27 - 30 ft.	GP-13 @ 24 - 27 ft.	GP-13 @ 21 - 24 ft.	GP-13 @ 15 - 18 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	10 ml	10 ml	0.25 ml	0.25 ml	3 ml	5 ml
Sample Collection / Analysis Date:	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99
Vinyl chloride	1 U	1 U	40 U	40 U	3 U	2 U
1,1-Dichloroethene	1 U	1 U	40 U	40 U	3 U	2 U
trans-1,2-Dichloroethene	1 U	1 U	40 U	40 U	3 U	2 U
cis-1,2-Dichloroethene	1 U	1 U	40 U	40 U	3 U	2 U
Trichloroethene	1 U	1 U	40 U	40 U	3 U	2 U
Perchloroethene	50	2	1800	260	46	4
Benzene	1 U	1 U	40 U	40 U	3 U	2 U
Chlorobenzene	1 U	1 U	40 U	40 U	3 U	2 U

Note(s):

FDER Data Qualifier Codes (Document Reference: DER QA-001/92) Section 10.0 Table 10.2. per Mr. Schamp's data review.
U = Indicates that the compound was analyzed for but not detected at the quantitation limit. The value associated with the qualifier shall be the method detection limit.

Analytical Laboratories of Florida: Field Screening Data

Site Project Name: Landfill Site 11
Site Location: Naval Submarine Base, Kings Bay, Georgia
Client Name: Bechtel Environmental (Oak Ridge, Tn.)
Client Contact: Mark Gage (423-220-2889)
Analysis Methodology: EPA 8021 (Subset)

Project Number:22567-625
Laboratory Project Name:BEC991
Laboratory Address: 3838 Sterling Street
Cocoa, Florida 32926
(800) 859 - 2384

Field Chemist: Dale A. Schamp
Signature: Dale A Schamp
(Draft copy unless signature is present)
Date: 9/2/99
FDEP QAP Number: 920332G

Target Compound	Concentration Levels in Parts per Billion					
Field Laboratory Number:	W-50	W-51	W-52	W-53	W-54	W-55
Field Number:	GP-13 @ 11 - 14 ft.	GP-14 @ 27 - 30 ft.	GP-14 @ 24 - 27 ft.	GP-14 @ 21 - 24 ft.	GP-14 @ 15 - 18 ft.	GP-14 @ 11 - 14 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	5 ml	0.1 ml	0.1 ml	0.1 ml	0.25 ml	0.5 ml
Sample Collection / Analysis Date:	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99
Vinyl chloride	2 U	100 U	100 U	100 U	40 U	20 U
1,1-Dichloroethene	2 U	100 U	100 U	100 U	40 U	20 U
trans-1,2-Dichloroethene	2 U	100 U	100 U	100 U	40 U	20 U
cis-1,2-Dichloroethene	2 U	100 U	100 U	100 U	40 U	20 U
Trichloroethene	2 U	100 U	100 U	100 U	40 U	20 U
Perchloroethene	3	2200	7000	4800	2300	1300
Benzene	2 U	100 U	100 U	100 U	40 U	20 U
Chlorobenzene	2 U	100 U	100 U	100 U	40 U	20 U
Field Laboratory Number:	W-56	W-57	W-57 Spike	W-58	W-59	W-60
Field Number:	GP-15 @ 30 - 33 ft.	GP-15 @ 27 - 30 ft.	GP-15 @ 27 - 30 ft.	GP-15 @ 24 - 27 ft.	GP-15 @ 21 - 24 ft.	GP-15 @ 15 - 18 ft.
Matrix:	Water	Water	Water & 400 ppb	Water	Water	Water
Sample Size:	0.5 ml	0.25 ml	0.25 ml	0.5 ml	1 ml	2 ml
Sample Collection / Analysis Date:	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99
Vinyl chloride	20 U	40 U	420 (105.1 % Rec.)	20 U	10 U	5 U
1,1-Dichloroethene	20 U	40 U	413 (103.3 % Rec.)	20 U	10 U	5 U
trans-1,2-Dichloroethene	20 U	40 U	374 (93.7 % Rec.)	20 U	10 U	5 U
cis-1,2-Dichloroethene	20 U	40 U	423 (105.8 % Rec.)	20 U	10 U	5 U
Trichloroethene	20 U	40 U	440 (109.9 % Rec.)	20 U	10 U	5 U
Perchloroethene	360	960	1500 (123.4 % Rec.)	550	97	15
Benzene	20 U	40 U	372 (92.9 % Rec.)	20 U	10 U	5 U
Chlorobenzene	20 U	40 U	450 (112.1 % Rec.)	20 U	10 U	5 U
Field Laboratory Number:	W-61	W-62	W-63	W-64	W-65	N/A
Field Number:	GP-16 @ 30 - 33 ft.	GP-16 @ 27 - 30 ft.	GP-16 @ 24 - 27 ft.	GP-16 @ 21 - 24 ft.	GP-16 @ 15 - 18 ft.	N/A
Matrix:	Water	Water	Water	Water	Water	N/A
Sample Size:	2 ml	1 ml	2 ml	2 ml	2 ml	N/A
Sample Collection / Analysis Date:	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99	N/A
Vinyl chloride	5 U	10 U	5 U	5 U	5 U	N/A
1,1-Dichloroethene	5 U	10 U	5 U	5 U	5 U	N/A
trans-1,2-Dichloroethene	5 U	10 U	5 U	5 U	5 U	N/A
cis-1,2-Dichloroethene	5 U	10 U	5 U	5 U	5 U	N/A
Trichloroethene	5 U	10 U	5 U	5 U	5 U	N/A
Perchloroethene	93	180	360	270	98	N/A
Benzene	5 U	10 U	5 U	5 U	5 U	N/A
Chlorobenzene	5 U	10 U	5 U	5 U	5 U	N/A

Note(s):

FDER Data Qualifier Codes (Document Reference: DER QA-001/92) Section 10.0 Table 10.2. per Mr. Schamp's data review.
U = Indicates that the compound was analyzed for but not detected at the quantitation limit. The value associated with the qualifier shall be the method detection limit

Environmental Conservation Laboratories, Inc.
4810 Executive Park Court, Suite 211
Jacksonville, Florida 32216-6069
904 / 296-3007
Fax 904 / 296-6210
www.encolabs.com

ENCO Laboratories

DHRS Certification No. E82277

CLIENT : Bechtel Environmental, Inc.
ADDRESS: NAS Cecil Field
P.O. Box 171
Jacksonville, FL 32215

REPORT # : JR8387
DATE SUBMITTED: September 3, 1999
DATE REPORTED : September 8, 1999

ATTENTION: Mr. M. Gage

SAMPLE IDENTIFICATION

Samples submitted and
identified by client as:

Site 11 Kings Bay

#1 - GP-01 @ 10:06 (08/31/99) (24-27')
#2 - GP-09 @ 10:35 (09/01/99) (24-27')

PROJECT MANAGER Scott D Mart
Scott D. Martin

ENCO LABORATORIES
REPORT # : JR8387
DATE REPORTED: September 8, 1999
PROJECT NAME : Site 11 Kings Bay

RESULTS OF ANALYSIS

EPA METHOD 8021 - VOLATILE ORGANICS	(24-27') **GP-01**		(24-27') **GP-09**		**Units**
Dichlorodifluoromethane	50 U	D1	100 U	D2	µg/L
Chloromethane	100 U	D1	200 U	D2	µg/L
Vinyl Chloride	50 U	D1	100 U	D2	µg/L
Bromomethane	50 U	D1	100 U	D2	µg/L
Chloroethane	100 U	D1	200 U	D2	µg/L
Trichlorofluoromethane	100 U	D1	200 U	D2	µg/L
1,1-Dichloroethene	50 U	D1	100 U	D2	µg/L
Methylene Chloride	100 U	D1	200 U	D2	µg/L
t-1,2-Dichloroethene	50 U	D1	100 U	D2	µg/L
1,1-Dichloroethane	50 U	D1	100 U	D2	µg/L
c-1,2-Dichloroethene	50 U	D1	100 U	D2	µg/L
Chloroform	50 U	D1	100 U	D2	µg/L
1,1,1-Trichloroethane	50 U	D1	100 U	D2	µg/L
Carbon Tetrachloride	50 U	D1	100 U	D2	µg/L
1,2-Dichloroethane	50 U	D1	100 U	D2	µg/L
Trichloroethene	**720**	D1	**510**	D2	µg/L
1,2-Dichloropropane	50 U	D1	100 U	D2	µg/L
Bromodichloromethane	50 U	D1	100 U	D2	µg/L
c-1,3-Dichloropropene	50 U	D1	100 U	D2	µg/L
t-1,3-Dichloropropene	50 U	D1	100 U	D2	µg/L
1,1,2-Trichloroethane	50 U	D1	100 U	D2	µg/L
Tetrachloroethene	**9200**	D3	**35000**	D3	µg/L
Dibromochloromethane	50 U	D1	100 U	D2	µg/L
Chlorobenzene	50 U	D1	100 U	D2	µg/L
Bromoform	50 U	D1	100 U	D2	µg/L
1,1,2,2-Tetrachloroethane	50 U	D1	100 U	D2	µg/L
1,3-Dichlorobenzene	50 U	D1	100 U	D2	µg/L
1,4-Dichlorobenzene	50 U	D1	100 U	D2	µg/L
1,2-Dichlorobenzene	50 U	D1	100 U	D2	µg/L
Surrogate:	**% RECOV**		**% RECOV**		**LIMITS**
Bromofluorobenzene	61		63		52-167
Date Analyzed	09/05/99		09/05/99		

U = Compound was analyzed for but not detected to the level shown.
D1 = Analyte value determined from a 1:50 dilution.
D2 = Analyte value determined from a 1:100 dilution.
D3 = Analyte value determined from a 1:500 dilution.

ENCO LABORATORIES
REPORT # : JR8387
DATE REPORTED: September 8, 1999
PROJECT NAME : Site 11 Kings Bay

RESULTS OF ANALYSIS

EPA METHOD 8021 - VOLATILE ORGANICS	LAB BLANK	Units
Dichlorodifluoromethane	1.0 U	µg/L
Chloromethane	2.0 U	µg/L
Vinyl Chloride	1.0 U	µg/L
Bromomethane	1.0 U	µg/L
Chloroethane	2.0 U	µg/L
Trichlorofluoromethane	2.0 U	µg/L
1,1-Dichloroethene	1.0 U	µg/L
Methylene Chloride	2.0 U	µg/L
t-1,2-Dichloroethene	1.0 U	µg/L
1,1-Dichloroethane	1.0 U	µg/L
c-1,2-Dichloroethene	1.0 U	µg/L
Chloroform	1.0 U	µg/L
1,1,1-Trichloroethane	1.0 U	µg/L
Carbon Tetrachloride	1.0 U	µg/L
1,2-Dichloroethane	1.0 U	µg/L
Trichloroethene	1.0 U	µg/L
1,2-Dichloropropane	1.0 U	µg/L
Bromodichloromethane	1.0 U	µg/L
c-1,3-Dichloropropene	1.0 U	µg/L
t-1,3-Dichloropropene	1.0 U	µg/L
1,1,2-Trichloroethane	1.0 U	µg/L
Tetrachloroethene	1.0 U	µg/L
Dibromochloromethane	1.0 U	µg/L
Chlorobenzene	1.0 U	µg/L
Bromoform	1.0 U	µg/L
1,1,2,2-Tetrachloroethane	1.0 U	µg/L
1,3-Dichlorobenzene	1.0 U	µg/L
1,4-Dichlorobenzene	1.0 U	µg/L
1,2-Dichlorobenzene	1.0 U	µg/L
Surrogate:	**% RECOV**	**LIMITS**
Bromofluorobenzene	62	52-167
Date Analyzed	09/08/99	

U : Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8387
DATE REPORTED: September 8, 1999
PROJECT NAME : Site 11 Kings Bay

QUALITY CONTROL DATA

Parameter	% RECOVERY MS/MSD/LCS	ACCEPT LIMITS	% RPD MS/MSD	ACCEPT LIMITS
EPA Method 601/6230D/8010/8021				
Methylene Chloride	95/104/ 94	51-155	9	29
Chloroform	109/114/108	63-145	4	16
Carbon Tetrachloride	100/100/ 98	64-146	<1	21
Trichloroethene	95/ 96/ 90	60-140	1	24
Tetrachloroethene	100/105/100	66-146	5	21
Chlorobenzene	102/110/ 92	70-137	8	19

Environmental Conservation Laboratories Comprehensive QA Plan #960038

< = Less Than
MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Standard
RPD = Relative Percent Difference

CHAIN OF CUSTODY RECORD

Site Name: Site 11 Kings Bay NSB
Delivery Order No.:
Cooler/Crate No.:

SEIR No.:
COC Number:
Lab: Alf Mobile Labs
Field Logbook No.:
Logbook Pg. No.:

Sampled by: M. A. Gage (Print) M. A. Gage (Sign) James R. Layman (Print) James R. Layman (Sign)

Legend — SAMPLE TYPE

PSB	Preservative Blank	BLS	Blind Spike
FDP	Field Duplicate	BLB	Blink Blank
ENV	Environmental	PTS	Point Source
FDB	Field Blank	FRP	Field Replicate
GEO	Geotechnical Sample	RSB	Rinsate Blank
MXD	Matrix Spike Duplicate	SPL	Split
MXS	Matrix Spike	TRP	Trip Blank

MATRIX

AIR	Air	SBS	Subsurface Soil	PTW	Potable Water
FLO	Flora	SED	Sediment	SEP	Seeps
FAU	Fauna	SFS	Surface Soil	SOL	Solid
GWT	Groundwater	SPW	Surface Water	WWT	Waste Water
LCH	Leachate	SLG	Sludge	SLW	Solid Waste
OIL	Oil	SST	Surface Water Storm Event		

QC LEVELS

S Sample Results and QC
C Reported
D Sample results, QC and raw data reported
E Sample resuts, blanks, and calibration reportred
S Screening level analysis

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Code
GP-01	(27-30')	ENV	GWT	8-31-99/0950	01, 02	None		8021		S
	(24-27')			1006						
	(21-24')			1025						
GP-02	(27-30')			1105						
	(24-27')			1120						
	(21-24')			1140						

RELINQUISHED BY	RECEIVED BY	DATE	TIME	REASON FOR TRANSFER
M. A. Gage	D. Schamp	8/31/99		Analyses

COMMENTS/INSTRUCTIONS
Mobil / Onsite Lab
QC Data duplicate & Spike

CONTAMINATION	YES	NO
Radiological		✓
Chemical	✓	

Shipper: NA

Ship to:

Airbill No. NA Traffic Report No. NA

CHAIN OF CUSTODY RECORD (continued)

COC Number _____

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Level
GP-09 (24-27')		ENV	GWT	9/1/99 1035	01,02			8021		8
(21-24')				1050	01,02					
(15-18')				1105	01,02					
(11-14')				1120	01,02					
GP-10 (27-30')				1230						
(24-27')				1400						
(21-24')				1415						
(15-18')				1430						
(11-14')				1450						
GP-11 (27-30')				1540						
(24-27')				1550						
(21-24')				1603						
(15-18')				1625						
(11-14')				1640						

Geoprobe Test Data

Analytical Laboratories of Florida: Field Screening Data

Site Project Name: Landfill Site 11
Site Location: Naval Submarine Base, Kings Bay, Georgia
Client Name: Bechtel Environmental (Oak Ridge, Tn office)
Client Contact: Mark Gage (423-220-2889)
Analysis Methodology: EPA 8021 (Subset)

Project Number:22567-625
Laboratory Project Name:BEC991
Laboratory Address: 3838 Sterling Street
Cocoa, Florida 32926
(800) 859 - 2384

Field Chemist: Dale A. Schamp
Signature: Dale A Schamp
(Draft copy unless signature is present)
Date: 9/2/99
FDEP QAP Number: 920332G

Target Compound	Concentration Levels in Parts per Billion					
Field Laboratory Number:	W-01	W-02	W-02 Duplicate	W-03	W-04	W-05
Field Number:	GP-01 @ 27 - 30 ft.	GP-01 @ 24 - 27 ft.	GP-01 @ 24 - 27 ft.	GP-01 @ 21 - 24 ft.	GP-02 @ 27 - 30 ft.	GP-02 @ 24 - 27 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	0.5 / 0.25 ml	0.5 / 0.025 ml	0.5 / 0.025 ml	0.5 / 0.05 ml	0.25 ml	0.025 ml
Sample Collection / Analysis Date:	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99
Vinyl chloride	20 U	400 U	400 U	200 U	40 U	400 U
1,1-Dichloroethene	20 U	400 U	400 U	200 U	40 U	400 U
trans-1,2-Dichloroethene	20 U	400 U	400 U	200 U	40 U	400 U
cis-1,2-Dichloroethene	20 U	400 U	400 U	200 U	40 U	400 U
Trichloroethene	270	940	920	200 U	190	480
Perchloroethene	1200	19,000	18,000	14,000	2600	7700
Benzene	20 U	400 U	400 U	200 U	40 U	400 U
Chlorobenzene	20 U	400 U	400 U	200 U	40 U	400 U
Field Laboratory Number:	W-06	W-06 Spike	W-07	W-08	W-09	W-10
Field Number:	GP-02 @ 21 - 24 ft.	GP-02 @ 21 - 24 ft.	GP-03 @ 27 - 30 ft.	GP-03 @ 24 - 27 ft.	GP-03 @ 21 - 24 ft.	GP-04 @ 27 - 30 ft.
Matrix:	Water	Water & 1000 ppb	Water	Water	Water	Water
Sample Size:	0.1 ml	0.1 ml	0.25 ml	0.5 ml	1.0 ml	0.5 ml
Sample Collection / Analysis Date:	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99
Vinyl chloride	100 U	1061 (106.1 % Rec.)	40 U	20 U	10 U	20 U
1,1-Dichloroethene	100 U	9639 (96.4 % Rec.)	40 U	20 U	10 U	20 U
trans-1,2-Dichloroethene	100 U	9749 (97.5 % Rec.)	40 U	20 U	10 U	20 U
cis-1,2-Dichloroethene	100 U	10138 (101.4 % Rec.)	40 U	20 U	10 U	20 U
Trichloroethene	100 U	10120 (101.2 % Rec.)	40	20 U	10 U	20 U
Perchloroethene	2400	34085 (100.5 % Rec.)	1700	300	400	95
Benzene	100 U	9350 (93.5 % Rec.)	40 U	20 U	10 U	20 U
Chlorobenzene	100 U	9752 (97.5 % Rec.)	40 U	20 U	10 U	20 U
Field Laboratory Number:	W-11	W-12	W-13	W-14	W-15	W-16
Field Number:	GP-04 @ 24 - 27 ft.	GP-04 @ 21 - 24 ft.	GP-05 @ 27 - 30 ft.	GP-05 @ 24 - 27 ft.	GP-05 @ 21 - 24 ft.	GP-06 @ 27 - 30 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	10 ml	10 ml	5 ml	1 ml	1 ml	2 ml
Sample Collection / Analysis Date:	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99
Vinyl chloride	1 U	1 U	2 U	10 U	10 U	5 U
1,1-Dichloroethene	1 U	1 U	2 U	10 U	10 U	5 U
trans-1,2-Dichloroethene	1 U	1 U	2 U	10 U	10 U	5 U
cis-1,2-Dichloroethene	1 U	1 U	2 U	10 U	10 U	5 U
Trichloroethene	1 U	1 U	8	10 U	10 U	45
Perchloroethene	4	2	53	69	29	72
Benzene	1 U	1 U	2 U	10 U	10 U	5 U
Chlorobenzene	1 U	1 U	2 U	10 U	10 U	5 U

Note(s):

FDER Data Qualifier Codes (Document Reference: DER QA-001/92) Section 10.0 Table 10.2. per Mr. Schamp's data review.
U = Indicates that the compound was analyzed for but not detected at the quantitation limit. The value associated with the qualifier shall be the method detection limit.

Analytical Laboratories of Florida: Field Screening Data

Site Project Name: Landfill Site 11
Site Location: Naval Submarine Base, Kings Bay, Georgia
Client Name: Bechtal Environmental (Oak Ridge, Tn.)
Client Contact: Mark Gage (423-220-2889)
Analysis Methodology: EPA 8021 (Subset)

Project Number:22567-625
Laboratory Project Name:BEC991
Laboratory Address: 3838 Sterling Street
Cocoa, Florida 32926
(800) 859 - 2384

Field Chemist: Dale A. Schamp
Signature: Dale A. Schamp
(Draft copy unless signature is present)
Date: 9/2/99
FDEP QAP Number: 920332G

Target Compound	Concentration Levels in Parts per Billion					
Field Laboratory Number:	W-17	W-18	W-19	W-20	W-21	W-22
Field Number:	GP-06 @ 24 - 27 ft.	GP-06 @ 21 - 24 ft.	GP-07 @ 27 - 30 ft.	GP-07 @ 24 - 27 ft.	GP-07 @ 21 - 24 ft.	GP-07 @ 18 - 21 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	3 ml	1 ml	0.5 ml	2 ml	2 ml	10 ml
Sample Collection / Analysis Date:	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99	8/31/99
Vinyl chloride	3 U	10 U	20 U	5 U	5 U	2
1,1-Dichloroethene	3 U	10 U	20 U	5 U	5 U	1 U
trans-1,2-Dichloroethene	3 U	10 U	20 U	5 U	5 U	2
cis-1,2-Dichloroethene	3 U	10 U	26	5 U	9	24
Trichloroethene	23	10 U	44	7	11	17
Perchloroethene	41	61	100	48	27	62
Benzene	3 U	10 U	20 U	5 U	5 U	1 U
Chlorobenzene	3 U	10 U	20 U	5 U	5 U	1 U
Field Laboratory Number:	W-23	W-24	W-24 Duplicate	W-25	W-26	W-27
Field Number:	GP-08 @ 27 - 30 ft.	GP-08 @ 24 - 27 ft.	GP-08 @ 24 - 27 ft.	GP-08 @ 21 - 24 ft.	GP-08 @ 15 - 18 ft.	GP-08 @ 11 - 14 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	1 ml	1 ml	0.1 ml	0.1 ml	0.5 ml	0.5 ml
Sample Collection / Analysis Date:	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99
Vinyl chloride	10 U	10 U	100 U	100 U	20 U	20 U
1,1-Dichloroethene	10 U	10 U	100 U	100 U	20 U	20 U
trans-1,2-Dichloroethene	10 U	10 U	100 U	100 U	20 U	20 U
cis-1,2-Dichloroethene	10 U	10 U	100 U	100 U	20 U	20 U
Trichloroethene	97	10 U	100 U	100 U	20 U	20
Perchloroethene	500	2300	2500	3400	780	560
Benzene	10 U	10 U	100 U	100 U	20 U	20 U
Chlorobenzene	10 U	10 U	100 U	100 U	20 U	20 U
Field Laboratory Number:	W-27 Spike	W-28	W-29	W-30	W-31	W-32
Field Number:	GP-08 @ 11 - 14 ft.	GP-09 @ 27 - 30 ft.	GP-09 @ 24 - 27 ft.	GP-09 @ 21 - 24 ft.	GP-09 @ 15 - 18 ft.	GP-09 @ 11 - 14 ft.
Matrix:	Water & 200 ppb	Water	Water	Water	Water	Water
Sample Size:	0.5 ml	0.1 ml	0.01 ml	0.01 ml	0.1 ml	0.05 ml
Sample Collection / Analysis Date:	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99
Vinyl chloride	212 (106.1 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
1,1-Dichloroethene	170 (85.0 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
trans-1,2-Dichloroethene	206 (103.3 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
cis-1,2-Dichloroethene	230 (115.0 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
Trichloroethene	216 (97.6 % Rec.)	480	1000 U 1100	1000 U	100 U	200 U
Perchloroethene	732 (87.3 % Rec.)	3400	48,000 35,000	36,000	2700	4000
Benzene	220 (110.2 % Rec.)	100 U	1000 U	1000 U	100 U	200 U
Chlorobenzene	192 (95.8 % Rec.)	100 U	1000 U	1000 U	100 U	200 U

Note(s):

FDER Data Qualifier Codes (Document Reference: DER QA-001/92) Section 10.0 Table 10.2. per Mr. Schamp's data review.
U = Indicates that the compound was analyzed for but not detected at the quantitation limit. The value associated with the qualifier shall be the method detection limit.

Analytical Laboratories of Florida: Field Screening Data

Site Project Name: Landfill Site 11
Site Location: Naval Submarine Base, Kings Bay, Georgia
Client Name: Bechtel Environmental (Oak Ridge, Tn.)
Client Contact: Mark Gage (423-220-2889)
Analysis Methodology: EPA 8021 (Subset)

Project Number:22567-625
Laboratory Project Name:BEC991
Laboratory Address: 3838 Sterling Street
Cocoa, Florida 32926
(800) 859 - 2384

Field Chemist: Dale A. Schamp
Signature: Dale A Schamp
(Draft copy unless signature is present)
Date: 9/2/99
FDEP QAP Number: 920332G

Target Compound	Concentration Levels in Parts per Billion					
Field Laboratory Number:	W-33	W-34	W-35	W-36	W-37	W-38
Field Number:	GP-10 @ 27 - 30 ft.	GP-10 @ 24 - 27 ft.	GP-10 @ 21 - 24 ft.	GP-10 @ 15 - 18 ft.	GP-10 @ 11 - 14 ft.	GP-11 @ 27 - 30 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	0.005 ml	0.002 ml	0.005 ml	0.03 ml	0.05 ml	0.2 ml
Sample Collection / Analysis Date:	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99	9/1/99
Vinyl chloride	2000 U	5000 U	2000 U	333 U	200 U	50 U
1,1-Dichloroethene	2000 U	5000 U	2000 U	333 U	200 U	50 U
trans-1,2-Dichloroethene	2000 U	5000 U	2000 U	333 U	200 U	50 U
cis-1,2-Dichloroethene	2000 U	5000 U	2000 U	333 U	200 U	50 U
Trichloroethene	2000 U	5000 U	2000 U	333 U	200 U	50 U
Perchloroethene	99,000	85,000	49,000	11,000	6000	2000
Benzene	2000 U	5000 U	2000 U	333 U	200 U	50 U
Chlorobenzene	2000 U	5000 U	2000 U	333 U	200 U	50 U
Field Laboratory Number:	W-39	W-40	W-41	W-42	W-43	W-44
Field Number:	GP-11 @ 24 - 27 ft.	GP-11 @ 21 - 24 ft.	GP-11 @ 15 - 18 ft.	GP-11 @ 11 - 14 ft.	GP-12 @ 30 - 33 ft.	GP-12 @ 27 - 30 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	2 ml	2 ml	5 ml	5 ml	10 ml	10 ml
Sample Collection / Analysis Date:	9/1/99	9/1/99	9/1/99	9/1/99	9/2/99	9/2/99
Vinyl chloride	5 U	5 U	2 U	2 U	1 U	1 U
1,1-Dichloroethene	5 U	5 U	2 U	2 U	1 U	1 U
trans-1,2-Dichloroethene	5 U	5 U	2 U	2 U	1 U	1 U
cis-1,2-Dichloroethene	5 U	5 U	2 U	2 U	1 U	1 U
Trichloroethene	5 U	5 U	2 U	2 U	1 U	1 U
Perchloroethene	400	110	12	10	2	52
Benzene	5 U	5 U	2 U	2 U	1 U	1 U
Chlorobenzene	5 U	5 U	2 U	2 U	1 U	1 U
Field Laboratory Number:	W-44 Duplicate	W-45	W-46	W-47	W-48	W-49
Field Number:	GP-12 @ 27 - 30 ft.	GP-12 @ 24 - 27 ft.	GP-13 @ 27 - 30 ft.	GP-13 @ 24 - 27 ft.	GP-13 @ 21 - 24 ft.	GP-13 @ 15 - 18 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	10 ml	10 ml	0.25 ml	0.25 ml	3 ml	5 ml
Sample Collection / Analysis Date:	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99
Vinyl chloride	1 U	1 U	40 U	40 U	3 U	2 U
1,1-Dichloroethene	1 U	1 U	40 U	40 U	3 U	2 U
trans-1,2-Dichloroethene	1 U	1 U	40 U	40 U	3 U	2 U
cis-1,2-Dichloroethene	1 U	1 U	40 U	40 U	3 U	2 U
Trichloroethene	1 U	1 U	40 U	40 U	3 U	2 U
Perchloroethene	50	2	1800	260	46	4
Benzene	1 U	1 U	40 U	40 U	3 U	2 U
Chlorobenzene	1 U	1 U	40 U	40 U	3 U	2 U

Note(s):

FDER Data Qualifier Codes (Document Reference: DER QA-001/92) Section 10.0 Table 10.2. per Mr. Schamp's data review.
U = Indicates that the compound was analyzed for but not detected at the quantitation limit. The value associated with the qualifier shall be the method detection limit.

Analytical Laboratories of Florida: Field Screening Data

Site Project Name: Landfill Site 11
Site Location: Naval Submarine Base, Kings Bay, Georgia
Client Name: Bechtel Environmental (Oak Ridge, Tn.)
Client Contact: Mark Gage (423-220-2889)
Analysis Methodology: EPA 8021 (Subset)

Project Number:22567 - 625
Laboratory Project Name:BEC991
Laboratory Address: 3838 Sterling Street
Cocoa, Florida 32926
(800) 859 - 2384

Field Chemist: Dale A. Schamp
Signature: Dale A Schamp
(Draft copy unless signature is present)
Date: 9/2/99
FDEP QAP Number: 920332G

Target Compound	Concentration Levels in Parts per Billion					
Field Laboratory Number:	W-50	W-51	W-52	W-53	W-54	W-55
Field Number:	GP-13 @ 11 - 14 ft.	GP-14 @ 27 - 30 ft.	GP-14 @ 24 - 27 ft.	GP-14 @ 21 - 24 ft.	GP-14 @ 15 - 18 ft.	GP-14 @ 11 - 14 ft.
Matrix:	Water	Water	Water	Water	Water	Water
Sample Size:	5 ml	0.1 ml	0.1 ml	0.1 ml	0.25 ml	0.5 ml
Sample Collection / Analysis Date:	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99
Vinyl chloride	2 U	100 U	100 U	100 U	40 U	20 U
1,1-Dichloroethene	2 U	100 U	100 U	100 U	40 U	20 U
trans-1,2-Dichloroethene	2 U	100 U	100 U	100 U	40 U	20 U
cis-1,2-Dichloroethene	2 U	100 U	100 U	100 U	40 U	20 U
Trichloroethene	2 U	100 U	100 U	100 U	40 U	20 U
Perchloroethene	3	2200	7000	4800	2300	1300
Benzene	2 U	100 U	100 U	100 U	40 U	20 U
Chlorobenzene	2 U	100 U	100 U	100 U	40 U	20 U
Field Laboratory Number:	W-56	W-57	W-57 Spike	W-58	W-59	W-60
Field Number:	GP-15 @ 30 - 33 ft.	GP-15 @ 27 - 30 ft.	GP-15 @ 27 - 30 ft.	GP-15 @ 24 - 27 ft.	GP-15 @ 21 - 24 ft.	GP-15 @ 15 - 18 ft.
Matrix:	Water	Water	Water & 400 ppb	Water	Water	Water
Sample Size:	0.5 ml	0.25 ml	0.25 ml	0.5 ml	1 ml	2 ml
Sample Collection / Analysis Date:	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99
Vinyl chloride	20 U	40 U	420 (105.1 % Rec.)	20 U	10 U	5 U
1,1-Dichloroethene	20 U	40 U	413 (103.3 % Rec.)	20 U	10 U	5 U
trans-1,2-Dichloroethene	20 U	40 U	374 (93.7 % Rec.)	20 U	10 U	5 U
cis-1,2-Dichloroethene	20 U	40 U	423 (105.8 % Rec.)	20 U	10 U	5 U
Trichloroethene	20 U	40 U	440 (109.9 % Rec.)	20 U	10 U	5 U
Perchloroethene	360	960	1500 (123.4 % Rec.)	550	97	15
Benzene	20 U	40 U	372 (92.9 % Rec.)	20 U	10 U	5 U
Chlorobenzene	20 U	40 U	450 (112.1 % Rec.)	20 U	10 U	5 U
Field Laboratory Number:	W-61	W-62	W-63	W-64	W-65	N/A
Field Number:	GP-16 @ 30 - 33 ft.	GP-16 @ 27 - 30 ft.	GP-16 @ 24 - 27 ft.	GP-16 @ 21 - 24 ft.	GP-16 @ 15 - 18 ft.	N/A
Matrix:	Water	Water	Water	Water	Water	N/A
Sample Size:	2 ml	1 ml	2 ml	2 ml	2 ml	N/A
Sample Collection / Analysis Date:	9/2/99	9/2/99	9/2/99	9/2/99	9/2/99	N/A
Vinyl chloride	5 U	10 U	5 U	5 U	5 U	N/A
1,1-Dichloroethene	5 U	10 U	5 U	5 U	5 U	N/A
trans-1,2-Dichloroethene	5 U	10 U	5 U	5 U	5 U	N/A
cis-1,2-Dichloroethene	5 U	10 U	5 U	5 U	5 U	N/A
Trichloroethene	5 U	10 U	5 U	5 U	5 U	N/A
Perchloroethene	93	180	360	270	98	N/A
Benzene	5 U	10 U	5 U	5 U	5 U	N/A
Chlorobenzene	5 U	10 U	5 U	5 U	5 U	N/A

Note(s):

FDER Data Qualifier Codes (Document Reference: DER QA-001/92) Section 10.0 Table 10.2. per Mr. Schamp's data review.
U = Indicates that the compound was analyzed for but not detected at the quantitation limit. The value associated with the qualifier shall be the method detection limit.

CHAIN OF CUSTODY RECORD (Continued)

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Level
GP-13	(15-18')	ENV	GWT	9/2/99 1008	01,02	None		8021		5
↓	(11-14')	↓	↓	1020	↓	↓		↓		↓
GP-14	(27-30')			1055						
	(24-27')			1108						
	(21-24')			1120						
	(15-18')			1130						
↓	11-14			1145						
GP-15	(30-33')			1235						
	(27-30')			1305						
	(24-27')			1320						
	(21-24')			1335						
↓	(15-18')			1355						
GP-16	30-33'			1430						
	27-30'			1450						
	24-27			1505						
	15-18			1520						
↓	21-24	↓	↓	1540	↓	↓		↓		↓

CHAIN OF CUSTODY RECORD

Page ___ of ___

BECHTEL

Site Name: [illegible]	SEIR No.:
Delivery Order No.:	COC Number: [illegible]
Cooler/Crate No.:	Lab: [illegible]
	Field Logbook No.:
	Logbook Pg. No.:

Sampled by: [illegible] (Print) [illegible] (Sign) ______ (Print) ______ (Sign)

Legend

SAMPLE TYPE

PSB Preservative Blank
FDP Field Duplicate
ENV Environmental
FDB Field Blank
GEO Geotechnical Sample
MXD Matrix Spike Duplicate
MXS Matrix Spike
BLS Blind Spike
BLB Blink Blank
PTS Point Source
FRP Field Replicate
RSB Rinsate Blank
SPL Split
TRP Trip Blank

MATRIX

AIR Air
FLO Flora
FAU Fauna
GWT Groundwater
LCH Leachate
OIL Oil
SBS Subsurface Soil
SED Sediment
SFS Surface Soil
SPW Surface Water
SLG Sludge
SST Surface Water Storm Event
PTW Potable Water
SEP Seeps
SOL Solid
WWT Waste Water
SLW Solid Waste

QC LEVELS

S Sample Results and QC
C Reported
D Sample results, QC and raw data reported
E Sample resuts, blanks, and calibration reportred
S Screening level analysis

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Code
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01	NONE		[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01	[illegible]		[illegible]	[illegible]	
					[illegible]					

RELINQUISHED BY	RECEIVED BY	DATE	TIME	REASON FOR TRANSFER
[illegible]				

COMMENTS/INSTRUCTIONS

[illegible]

CONTAMINATION	YES	NO
Radiological		[illegible]
Chemical	[illegible]	

Shipper: [illegible]

Ship to: [illegible]

[illegible]

Airbill No. ______ Traffic Report No. ______

CHAIN OF CUSTODY RECORD

Site Name: Site 11 Kings Bay NSB
Delivery Order No.:
Cooler/Crate No.:

SEIR No.:
COC Number:
Lab: ALF Mobile Lab
Field Logbook No.:
Logbook Pg. No.:

Sampled by: M. A. Bass (Print) M. A. Bass (Sign) _____ (Print) _____ (Sign)

Legend — SAMPLE TYPE

PSB	Preservative Blank	BLS	Blind Spike
FDP	Field Duplicate	BLB	Blink Blank
ENV	Environmental	PTS	Point Source
FDB	Field Blank	FRP	Field Replicate
GEO	Geotechnical Sample	RSB	Rinsate Blank
MXD	Matrix Spike Duplicate	SPL	Split
MXS	Matrix Spike	TRP	Trip Blank

MATRIX

AIR	Air	SBS	Subsurface Soil	PTW	Potable Water
FLO	Flora	SED	Sediment	SEP	Seeps
FAU	Fauna	SFS	Surface Soil	SOL	Solid
GWT	Groundwater	SPW	Surface Water	WWT	Waste Water
LCH	Leachate	SLG	Sludge	SLW	Solid Waste
OIL	Oil	SST	Surface Water Storm Event		

QC LEVELS

S Sample Results and QC
C Reported
D Sample results, QC and raw data reported
E Sample resuts, blanks, and calibration reported
S Screening level analysis

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Code
GP-12	(30-33')	ENV	GWT	9/2/99 0835	01,02	None		8021		S
	(27-30')			0845						
	(24-27')			0900						
GP-13	(27-30')			0930						
	(24-27')			0943						
	(21-24')			0955						

RELINQUISHED BY	RECEIVED BY	DATE	TIME	REASON FOR TRANSFER
M. A. Bass	D. A. Schamp	9/2/99		Analysis

COMMENTS/INSTRUCTIONS

CONTAMINATION	YES	NO
Radiological		✓
Chemical	✓	

Shipper: NA

Ship to:

Airbill No. NA Traffic Report No. NA

This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s., UN2910.

CHAIN OF CUSTODY RECORD (Continued)

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Level
GP-13	(15-18)	CRV	GWT	7/6/99 1008	0102	None		8021		
↓	(11 11)	↓	↓	1020	↓	↓		↓		↓
GP-14	(27-30)			1055						
↓	(24-27)			1108						
	(21-24)			1120						
	(15-18)			1131						
↓	11 11			1145						
GP-15	(30-33)			1205						
↓	(27-30)			1215						
	(24-27)			1320						
	(21-24)			1335						
↓	(15-18)			1355						
GP-16	30-33			1430						
↓	27-30			1450						
	24-27			1505						
	15-18			1520						
↓	21-24	↓	↓	1540	↓	↓		↓		↓

CHAIN OF CUSTODY RECORD

Site Name: Site 11 Kings Bay NSB
Delivery Order No.:
Cooler/Crate No.:

SEIR No.:
COC Number:
Lab: ALF Frontier Env.
Field Logbook No.:
Logbook Pg. No.:

Sampled by: M. A Quinn (Print) M. A Quinn (Sign) (Print) (Sign)

Legend — SAMPLE TYPE

PSB	Preservative Blank	BLS	Blind Spike
FDP	Field Duplicate	BLB	Blink Blank
ENV	Environmental	PTS	Point Source
FDB	Field Blank	FRP	Field Replicate
GEO	Geotechnical Sample	RSB	Rinsate Blank
MXD	Matrix Spike Duplicate	SPL	Split
MXS	Matrix Spike	TRP	Trip Blank

MATRIX

AIR	Air	SBS	Subsurface Soil	PTW	Potable Water
FLO	Flora	SED	Sediment	SEP	Seeps
FAU	Fauna	SFS	Surface Soil	SOL	Solid
GWT	Groundwater	SPW	Surface Water	WWT	Waste Water
LCH	Leachate	SLG	Sludge	SLW	Solid Waste
OIL	Oil	SST	Surface Water Storm Event		

QC LEVELS

S Sample Results and QC
C Reported
D Sample results, QC and raw data reported
E Sample resuts, blanks, and calibration reportred
S Screening level analysis

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Code
GP-08	(27-30')	ENV	GWT	9-1-99 / 0855	01,02	None		Suite 1		S
	(24-27')			0905						
	(21-24')			0915						
	(15-18')			0930						
	(11-14')			0945						
GP-09	(27-30')			1015						

RELINQUISHED BY	RECEIVED BY	DATE	TIME	REASON FOR TRANSFER
M. A Quinn	Dabbs Stamps	9/1/99		

COMMENTS/INSTRUCTIONS

CONTAMINATION	YES	NO
Radiological		✓
Chemical	✓	

Shipper:
Ship to:
Airbill No.
Traffic Report No.

CHAIN OF CUSTODY RECORD (continued)

COC Number _____

Page 2 of ___

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Level
GP-09 (24-27)		GRAB	GW	9/1/00 1035	0100					
(21-24)				1050	0102					
(15-18)				1105	0100					
(11-14)				1120	0102					
GP-10 (27-30)				1230						
(24-27)				1400						
(21-24)				1415						
(15-18)				1430						
(11-14)				1450						
GP-11 (27-30)				1540						
24-27				1550						
(21-24)				1603						
(15-18)				1625						
(11-14)				1640						

CHAIN OF CUSTODY RECORD

BECHTEL

Site Name: Site 11 Kings Bay NSB
Delivery Order No.:
Cooler/Crate No.:

SEIR No.:
COC Number:
Lab: Alf Mobile Lab
Field Logbook No.:
Logbook Pg. No.:

Sampled by: M. A Gage (Print) [signature] (Sign) James R. Laymon (Print) [signature] (Sign)

Legend

SAMPLE TYPE

PSB	Preservative Blank	BLS	Blind Spike
FDP	Field Duplicate	BLB	Blink Blank
ENV	Environmental	PTS	Point Source
FDB	Field Blank	FRP	Field Replicate
GEO	Geotechnical Sample	RSB	Rinsate Blank
MXD	Matrix Spike Duplicate	SPL	Split
MXS	Matrix Spike	TRP	Trip Blank

MATRIX

AIR	Air	SBS	Subsurface Soil	PTW	Potable Water
FLO	Flora	SED	Sediment	SEP	Seeps
FAU	Fauna	SFS	Surface Soil	SOL	Solid
GWT	Groundwater	SPW	Surface Water	WWT	Waste Water
LCH	Leachate	SLG	Sludge	SLW	Solid Waste
OIL	Oil	SST	Surface Water Storm Event		

QC LEVELS

- S Sample Results and QC
- C Reported
- D Sample results, QC and raw data reported
- E Sample resuts, blanks, and calibration reportred
- S Screening level analysis

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Code
GP-01	(27-30')	ENV	GWT	8-31-99/0950	01, 02	None		8021		
↓	(24-27')	↓	↓	1006	↓	↓		↓		↓
↓	(21-24')	↓	↓	1025	↓	↓		↓		↓
GP-02	(27-30')	↓	↓	1105	↓	↓		↓		↓
↓	(24-27')	↓	↓	1120	↓	↓		↓		↓
↓	(21-24')	↓	↓	1140	↓	↓		↓		↓

RELINQUISHED BY	RECEIVED BY	DATE	TIME	REASON FOR TRANSFER
[signature]	[signature]	8/31/99		Analyses

COMMENTS/INSTRUCTIONS

Mobile / Onsite lab
QC data due on site.

CONTAMINATION	YES	NO
Radiological		✓
Chemical		

Shipper: NA

Ship to:

Airbill No. NA   Traffic Report No.

This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s., UN2910.

CHAIN OF CUSTODY RECORD (Continued)

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter	Priority	QC Level
GP03	(27-30')	GRAB	GWT	3/19/1305	01 02	None		5021		
	(24-27')			1320						
	(21-24')			1335						
GP04	(27-30')			1406						
	(24-27')			1420						
	(21-24')			1440						
GP05	(27-30')			1521						
	(24-27')			1540						
	(21-24')			1550						
GP06	(27-30')			1630						
	(24-27')			1645						
	(21-24')			1657						
GP07	(27-30')			1735						
	(24-27')			1745						
	(21-24')			1800						
	(18-21')			1815						

ATTACHMENT 3

SOURCE AREA EXCAVATED REPORT

BECHTEL

Interoffice Memorandum

To	Hermann Bauer	File No.	3025
Subject	Source Area Excavation at Site 11, Naval Submarine Base Kings Bay	Date	October 13, 1999
		From	Mark A. Gage
		Of	BEI/Geotech
Copies to		At	315C Ext. 2889

This letter report has been prepared to document the excavation activities performed at site 11 during September 1999. The purpose for this evacuation was to locate the source of tetrachloroethylene (PCE) rebounding at injector I-14. A geoprobe investigation (BEI 1999a) conducted adjacent to I-14 showed a maximum PCE concentration of 99,000 µg/L in groundwater at a depth of 27 to 30 ft. This was the highest concentration of PCE observed at the site to date. To investigate the potential source of the PCE in the groundwater, excavation of the landfill material above the contamination was proposed and approved by the Navy. Work performed for this task included preparing an execution plan for staging pile excavation, mobilization, establishing work zone, excavation, containerizing suspected waste, backfilling and site restoration.

Execution Plan

Bechtel prepared a plan title "Execution Plan for Staging Pile Excavation at Site 11" on September 9, 1999. The plan was forwarded to Navy Facilities Commend Southern Division on September 10, 1999.

Mobilization

Mobilization commenced on September 20, 1999. Equipment mobilized to the site included a CAT 320 excavator, a 20 cubic yard roll-off, wooden stakes, caution tape, and miscellaneous supplies and safety and health equipment. The excavator was checked for proper working condition and positioned at the excavation area.

Work Zones

Work zones were established on September 21, 1999 and include the excavation area, exclusion zone, and staging pile areas. A 20 x 30 ft excavation area was clearly marked using colored flagging. An exclusion zone was established using 4-ft wooden stakes and wrapped with caution tape in three layers, upper, middle, and lower at each stake. Staging pile areas were established adjacent to the excavation areas and were lined with heavy-duty poly sheeting to prevent excavated material from contacting the ground surface and thereby minimizing cross-media transfer of contaminated material.

Excavation

Excavation started and was completed on September 21, 1999. The excavation proceeded from the area of greatest contamination to areas of lesser contamination. An 20 x 30 x 8 ft deep area was excavated as shown in the attached Sketch. Excavation photographs are provided in Attachment 1. Excavated material was placed on the poly sheeting at the staging pile areas and visually inspected for containers or drums which may contain PCE waste. The material was also scanned with an potoionization detection (PID) meter to check for the presence of volatile organic compounds. The excavation encountered two crushed and partial, 5-gallon containers, 1 intact 5-gallon container, and one crushed, estimated 20-gallon container. The intact 5-gallon container contained approximately 1 gallon of gray, paint-looking waste and had a PID reading of 900 ppm. The 20-gallon crushed container contained less than 1-gallon of black, sludge looking waste and had a PID reading of 200 ppm. Four containers were placed into a drum over pack for later disposal by the base public works contractor. All material except the above mentioned containers were returned to the excavation. The material was compacted during backfilling using the excavator bucket and by tracking over the material with the excavator. Approximately 2 ft of soil was placed on top of the backfilled refuse and and complacted. The roll-off was not used and was demobilized from the site on September 22 and the excavator was demobilized on September 30, 1999.

Sampling and Analyses

One waste samples was collected from the intact 5-galon (sample G Waste) and the crushed 20-gallon (sample B Waste) containers and submitted to ENCO Laboratories of Jacksonville, FL for chemical analyses. The samples were analyzed for volatile organics targeting chlorinated hydrocarbons using EPA method 8021, and full TCLP analyses including pesticides, herbicides volatile, semivolatile, and metals.

Volatile results for the G Waste sample only detected chlorobenzene at 2,500 µg/kg. Volatile results for the B Waste results were 14,000 µg/kg PCE, 3,800 µg/kg c-1,2-dichloroethene, 3,000 µg/kg chlorobenzene, 2,000 1,4-dichlorobenzene, and 3,100 1,2-dichlorobenzene. TCLP detectable results included 400 µg/kg total creosol in the B Waste, and 8.7 µg/kg lead in the G Waste sample. Results for all other analytes were less than the detection limit. Complete analytical results are provided Attachment 2.

Waste Management

All excavated refuse was returned to the excavation. The containers were placed into the drum over pack and will be transported to the base waste storage facility for temporary storage and disposal by the base public works contractor. The excavator was decontaminated at the excavation prior to placing and spreading top soil over the excavation.

References

Bechtel Environmental Inc., 1999. *Geoprobe Investigation Report, Site 11, Old Camden County Landfill Naval Submarine Base Kings Bay, Georgia.* Prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina (September).

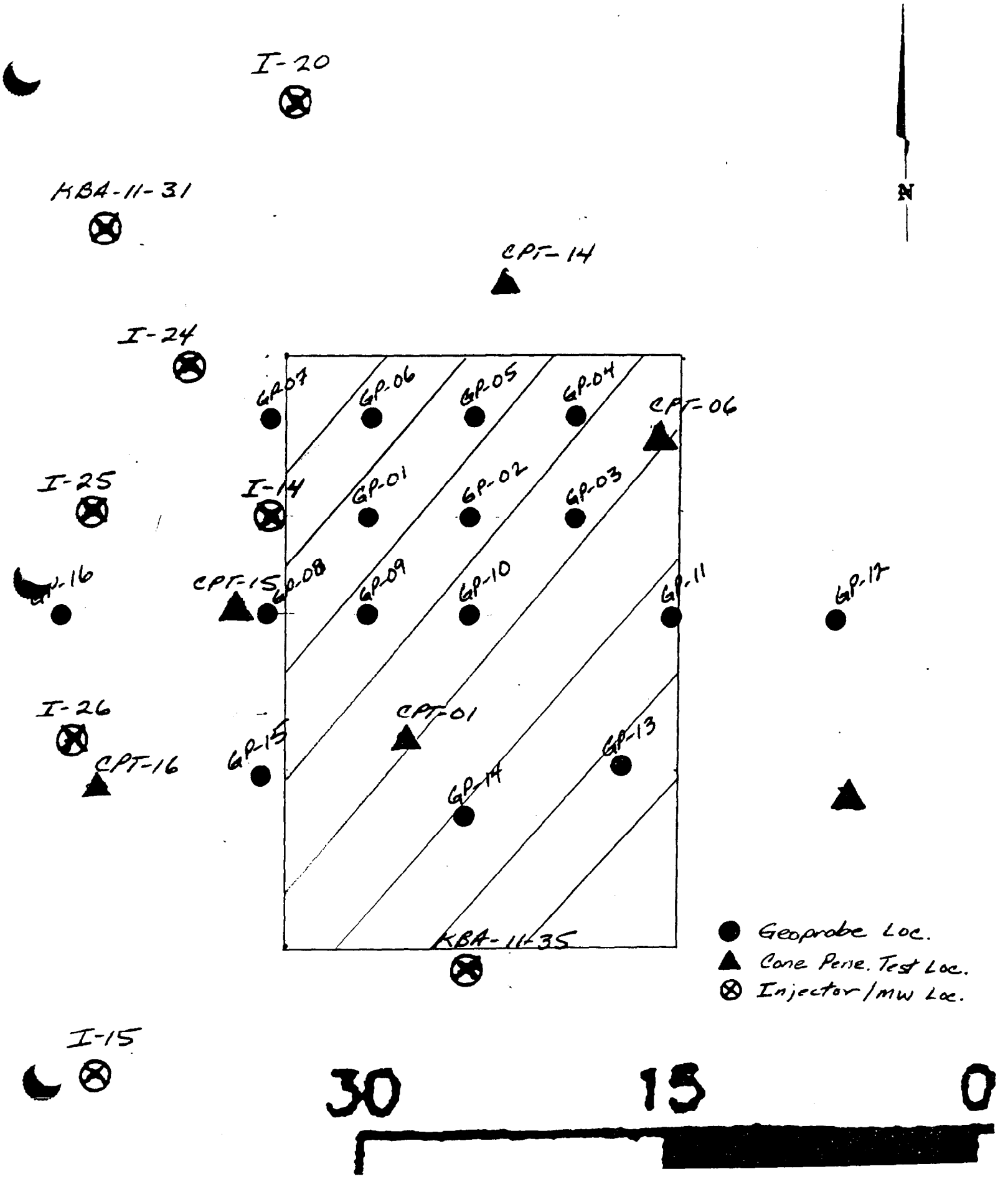
If you have any question please call me at 423-220-2889.

Mark A. Gage

Distribution:
PDCC
M. Gage

016048

Excavated Area
9/21/99



Attachment 1

Site Photographs

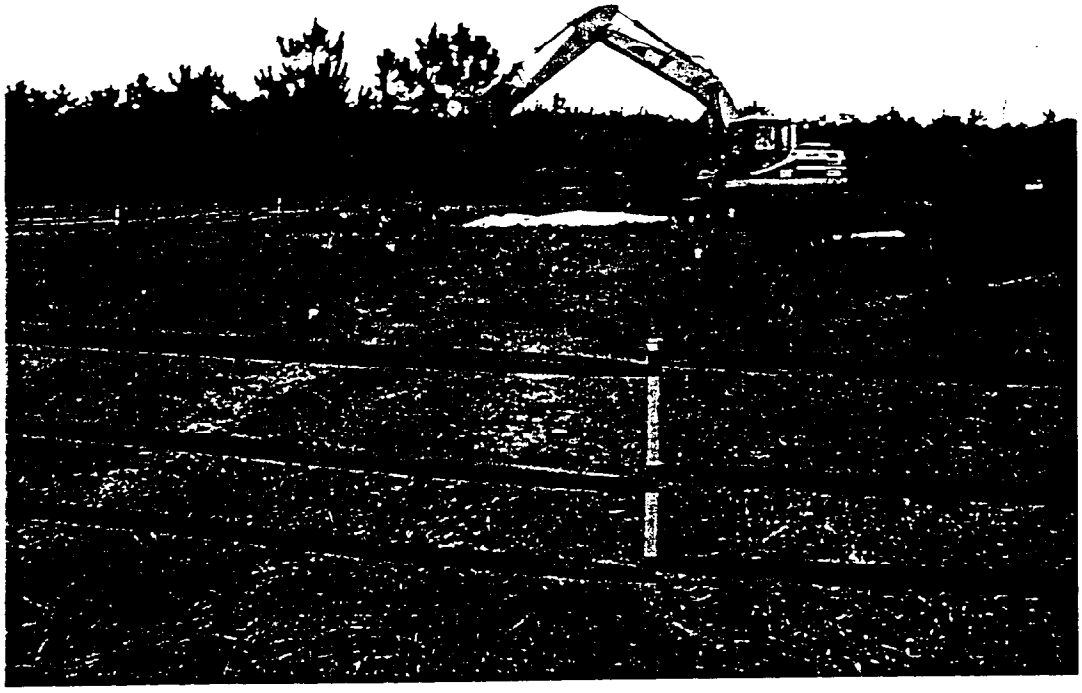


Photo Number: 1-1 Date: 9/21/99
Exclusion zone, CAT 320 excavator, poly sheeting at staging area, and 20 cy roll-off.

Photo Number: 1-2 Date: 9/21/99
Excavating top soil cover. Note injector I-14 in foreground.

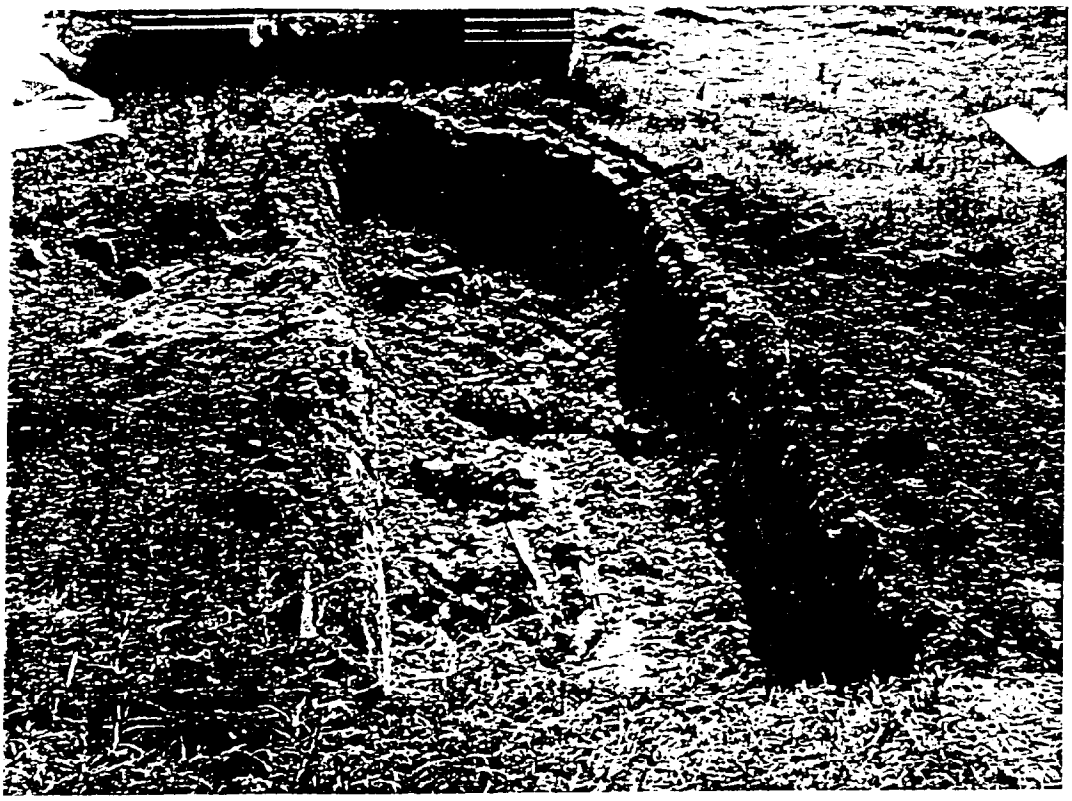


Photo Number: 1-3 Date: 9/21/99
Refuse approximately 2 ft below grade.

Photo Number: 1-4 Date: 9/21/99
Inspecting excavated material for containers and scanning material with photoionization detection (PID) meter for organic vapors.

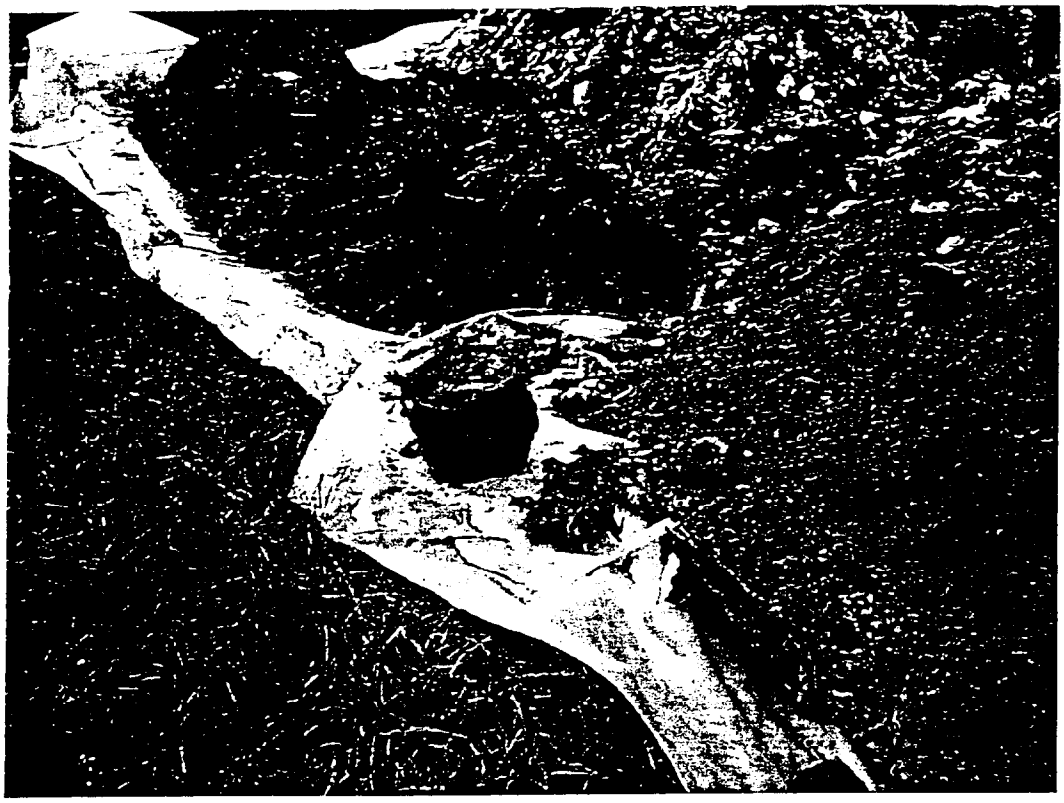


Photo Number: 1-5 Date: 9/21/99
View of 5-gallon intact container and crushed and partial containers.

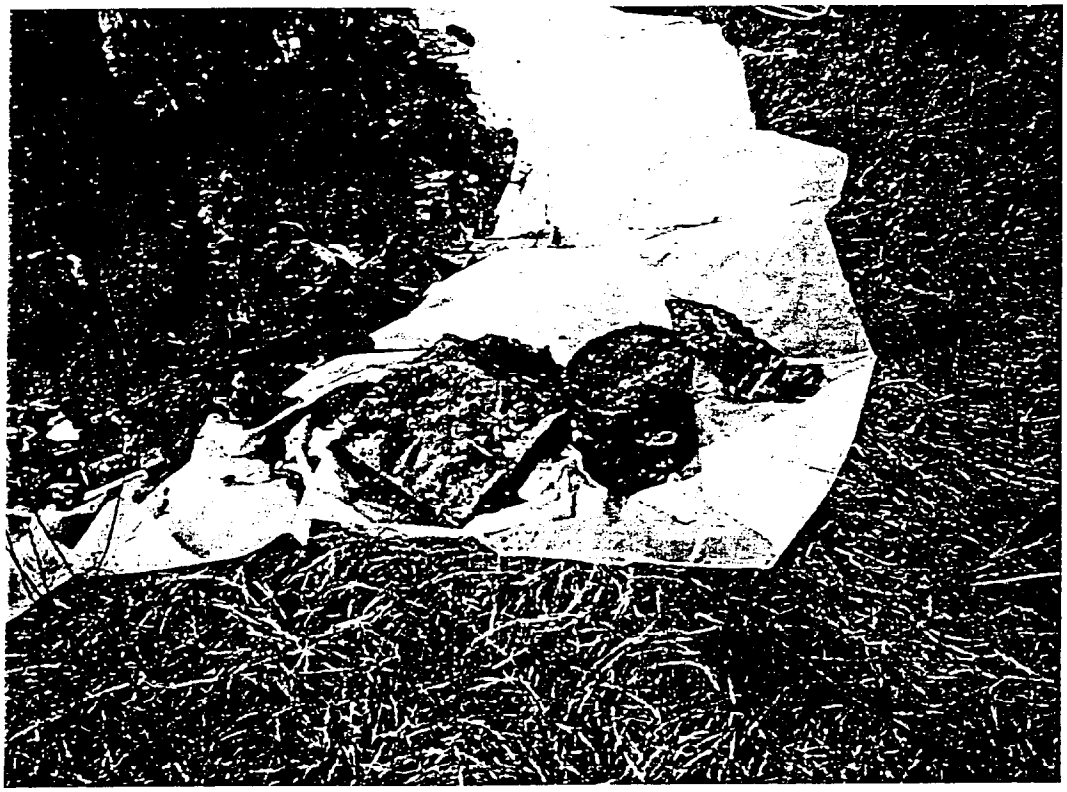


Photo Number: 1-6 Date: 9/21/99
View of 5-gallon intact container and 20-gallon crushed container.

Photo Number: 1-7 Date: 9/21/99
Checking containers with PID to check for organic vapors.

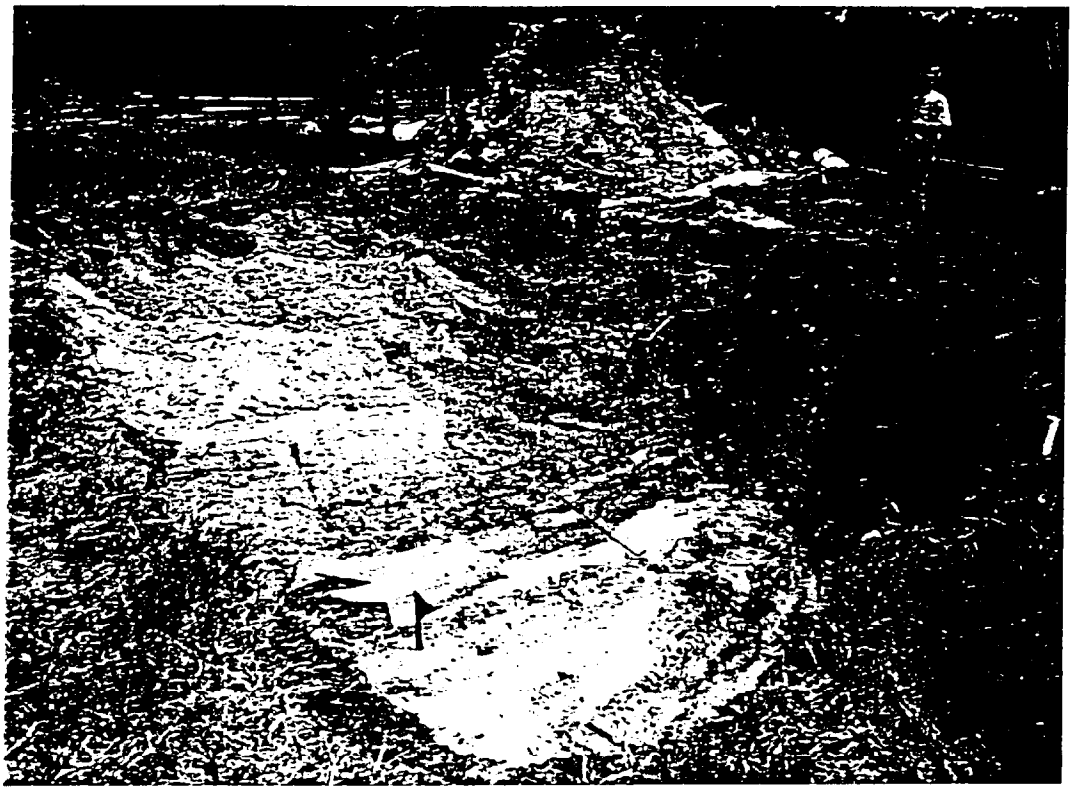


Photo Number: 1-8 Date: 9/21/99
Excavation prior to backfilling. Note native soil at the bottom of the excavation at an approximate depth of 8 ft.

Photo Number: 1-9 Date: 9/21/99
Backfilled and compacted excavation. Injectors I-14 and I-24 in foreground.

Attachment 2

Analytical Results

CLIENT : Bechtel Environmental, Inc.
ADDRESS: NAS Cecil Field
P.O. Box 171
Jacksonville, FL 32215

REPORT # : JR8604
DATE SUBMITTED: September 22, 1999
DATE REPORTED : October 4, 1999

ATTENTION: Mr. Mark Gage

SAMPLE IDENTIFICATION

Samples submitted and
identified by client as:

PROJECT #: WO# JX148

NSB Escavation Waste

09/21/99

#1 - B WASTE @ 17:00
#2 - G WASTE @ 17:00

PROJECT MANAGER _____
Scott D. Martin

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

EPA METHOD 8021 - VOLATILE ORGANICS	B WASTE		G WASTE		Units
Dichlorodifluoromethane	1400 U	D1	1600 U	D1	µg/Kg
Chloromethane	2800 U	D1	3100 U	D1	µg/Kg
Vinyl Chloride	1400 U	D1	1600 U	D1	µg/Kg
Bromomethane	1400 U	D1	1600 U	D1	µg/Kg
Chloroethane	2800 U	D1	3100 U	D1	µg/Kg
Trichlorofluoromethane	2800 U	D1	3100 U	D1	µg/Kg
1,1-Dichloroethene	1400 U	D1	1600 U	D1	µg/Kg
Methylene Chloride	2800 U	D1	3100 U	D1	µg/Kg
t-1,2-Dichloroethene	1400 U	D1	1600 U	D1	µg/Kg
1,1-Dichloroethane	1400 U	D1	1600 U	D1	µg/Kg
c-1,2-Dichloroethene	**3800**	D1	1600 U	D1	µg/Kg
Chloroform /	1400 U	D1	1600 U	D1	µg/Kg
1,1,1-Trichloroethane	1400 U	D1	1600 U	D1	µg/Kg
rbon Tetrachloride	1400 U	D1	1600 U	D1	µg/Kg
2-Dichloroethane	1400 U	D1	1600 U	D1	µg/Kg
Trichloroethene	1400 U	D1	1600 U	D1	µg/Kg
1,2-Dichloropropane	1400 U	D1	1600 U	D1	µg/Kg
Bromodichloromethane	1400 U	D1	1600 U	D1	µg/Kg
c-1,3-Dichloropropene	1400 U	D1	1600 U	D1	µg/Kg
t-1,3-Dichloropropene	1400 U	D1	1600 U	D1	µg/Kg
1,1,2-Trichloroethane	1400 U	D1	1600 U	D1	µg/Kg
Tetrachloroethene	**14000**	D1	1600 U	D1	µg/Kg
Dibromochloromethane	1400 U	D1	1600 U	D1	µg/Kg
Chlorobenzene	**3000**	D1	**2500** I	D1	µg/Kg
Bromoform	1400 U	D1	1600 U	D1	µg/Kg
1,1,2,2-Tetrachloroethane	1400 U	D1	1600 U	D1	µg/Kg
1,3-Dichlorobenzene	1400 U	D1	1600 U	D1	µg/Kg
1,4-Dichlorobenzene	**2000** I	D1	1600 U	D1	µg/Kg
1,2-Dichlorobenzene	**3100** I	D1	1600 U	D1	µg/Kg

Surrogate:	% RECOV	% RECOV	LIMITS
Bromofluorobenzene	*	*	52-167
Date Analyzed	09/22/99	09/22/99	

U = Compound was analyzed for but not detected to the level shown.
I = Analyte detected; value is between the Method Detection Level (MDL) and the Practical Quantitation Level (PQL).
= Analysis is reported on a "dry weight" basis.
D1 = Analyte value determined from a 1:1000 dilution.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

EPA METHOD 1311/8081 - TCLP PESTICIDES BY GC/ECD	B WASTE	G WASTE	Units
Chlordane (Total)	1.0 U	1.0 U	µg/L
Endrin	0.050 U	0.050 U	µg/L
Heptachlor	0.050 U	0.050 U	µg/L
Heptachlor Epoxide	0.050 U	0.050 U	µg/L
gamma-BHC (Lindane)	0.050 U	0.050 U	µg/L
Methoxychlor	0.050 U	0.050 U	µg/L
Toxaphene	2.0 U	2.0 U	µg/L
Surrogate:	**% RECOV**	**% RECOV**	**LIMITS**
DBC	31	95	55-152
2,4,5,6-TCMX	110	97	50-150
Date Extracted	09/28/99	09/28/99	
Date Analyzed	09/29/99	09/29/99	

EPA METHOD 1311/8151 - TCLP HERBICIDES BY GC/ECD	B WASTE	G WASTE	Units
2,4-D	1.0 U	1.0 U	µg/L
2,4,5-TP (Silvex)	1.0 U	1.0 U	µg/L
Surrogate:	**% RECOV**	**% RECOV**	**LIMITS**
2,4-DCAA	87	81	35-105
Date Extracted	09/29/99	09/29/99	
Date Analyzed	10/01/99	10/01/99	

U = Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

EPA METHOD 1311/8260 - TCLP VOLATILES	B WASTE	G WASTE	Units
Benzene	50 U D2	50 U D2	µg/L
Carbon tetrachloride	50 U D2	50 U D2	µg/L
Chlorobenzene	50 U D2	50 U D2	µg/L
Chloroform	50 U D2	50 U D2	µg/L
1,2-Dichloroethane	50 U D2	50 U D2	µg/L
1,1-Dichloroethene	50 U D2	50 U D2	µg/L
2-Butanone	100 U D2	100 U D2	µg/L
Tetrachloroethene	100 U D2	100 U D2	µg/L
Trichloroethene	50 U D2	50 U D2	µg/L
Vinyl Chloride	50 U D2	50 U D2	µg/L
rogate:	**% RECOV**	**% RECOV**	**LIMITS**
Dibromofluoromethane	98	97	59-143
D8-Toluene	96	98	73-119
Bromofluorobenzene	97	97	77-121
Date Analyzed	09/28/99	09/28/99	

Compound was analyzed for but not detected to the level shown.
= Analyte value determined from a 1:10 dilution.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

EPA METHOD 1311/8270 - TCLP SVOAS BY GC/MS	B WASTE	G WASTE	Units
Total Cresol	400	300 U	µg/L
1,4-Dichlorobenzene	100 U	100 U	µg/L
2,4-Dinitrotoluene	100 U	100 U	µg/L
Hexachlorobenzene	100 U	100 U	µg/L
Hexachlorobutadiene	100 U	100 U	µg/L
Hexachloroethane	100 U	100 U	µg/L
Nitrobenzene	100 U	100 U	µg/L
Pentachlorophenol	100 U	100 U	µg/L
Pyridine	100 U	100 U	µg/L
2,4,5-Trichlorophenol	100 U	100 U	µg/L
2,4,6-Trichlorophenol	100 U	100 U	µg/L
Surrogate:	**% RECOV**	**% RECOV**	**LIMITS**
Nitrobenzene -D5	78	87	30-106
2-Fluorobiphenyl	85	88	38-107
Terphenyl -D14	97	93	29-131
Phenol -D5	60	63	12-87
2-Fluorophenol	70	63	19-115
2,4,6-Tribromophenol	79	83	35-126
Date Extracted	09/27/99	09/27/99	
Date Analyzed	09/27/99	09/27/99	

MISCELLANEOUS	METHOD	B WASTE	G WASTE	Units
Percent Solids	SM2540G	71	64	%
Date Analyzed		09/24/99	09/24/99	

U = Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

TCLP METALS	METHOD	B WASTE	G WASTE	Units
TCLP Arsenic	1311/6010	0.20 U	0.20 U	mg/L
Date Analyzed		09/28/99	09/28/99	
TCLP Barium	1311/6010	10 U	10 U	mg/L
Date Analyzed		09/28/99	09/28/99	
TCLP Cadmium	1311/6010	0.50 U	0.50 U	mg/L
Date Analyzed		09/28/99	09/28/99	
TCLP Chromium	1311/6010	1.0 U	1.0 U	mg/L
Date Analyzed		09/28/99	09/28/99	
TCLP Lead	1311/6010	1.0 U	**8.7**	mg/L
Date Analyzed		09/28/99	09/28/99	
TCLP Mercury	1311/7470	0.0050 U	0.0050 U	mg/L
Date Analyzed		09/29/99	09/29/99	
TCLP Selenium	1311/6010	0.50 U	0.50 U	mg/L
Date Analyzed		09/28/99	09/28/99	
TCLP Silver	1311/6010	1.0 U	1.0 U	mg/L
Date Analyzed		09/28/99	09/28/99	

J Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

EPA METHOD 8021 - VOLATILE ORGANICS	LAB BLANK	Units
Dichlorodifluoromethane	1.0 U	µg/Kg
Chloromethane	2.0 U	µg/Kg
Vinyl Chloride	1.0 U	µg/Kg
Bromomethane	1.0 U	µg/Kg
Chloroethane	2.0 U	µg/Kg
Trichlorofluoromethane	2.0 U	µg/Kg
1,1-Dichloroethene	1.0 U	µg/Kg
Methylene Chloride	2.0 U	µg/Kg
t-1,2-Dichloroethene	1.0 U	µg/Kg
1,1-Dichloroethane	1.0 U	µg/Kg
,2-Dichloroethene	1.0 U	µg/Kg
loroform	1.0 U	µg/Kg
1,1,1-Trichloroethane	1.0 U	µg/Kg
Carbon Tetrachloride	1.0 U	µg/Kg
1,2-Dichloroethane	1.0 U	µg/Kg
Trichloroethene	1.0 U	µg/Kg
1,2-Dichloropropane	1.0 U	µg/Kg
Bromodichloromethane	1.0 U	µg/Kg
c-1,3-Dichloropropene	1.0 U	µg/Kg
t-1,3-Dichloropropene	1.0 U	µg/Kg
1,1,2-Trichloroethane	1.0 U	µg/Kg
Tetrachloroethene	1.0 U	µg/Kg
Dibromochloromethane	1.0 U	µg/Kg
Chlorobenzene	1.0 U	µg/Kg
Bromoform	1.0 U	µg/Kg
1,1,2,2-Tetrachloroethane	1.0 U	µg/Kg
1,3-Dichlorobenzene	1.0 U	µg/Kg
1,4-Dichlorobenzene	1.0 U	µg/Kg
1,2-Dichlorobenzene	1.0 U	µg/Kg

Surrogate:	% RECOV	LIMITS
Bromofluorobenzene	52	52-167
Date Analyzed	09/22/99	

U = Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

EPA METHOD 1311/8081 - TCLP PESTICIDES BY GC/ECD	LAB BLANK	Units
Chlordane (Total)	1.0 U	µg/L
Endrin	0.050 U	µg/L
Heptachlor	0.050 U	µg/L
Heptachlor Epoxide	0.050 U	µg/L
gamma-BHC (Lindane)	0.050 U	µg/L
Methoxychlor	0.050 U	µg/L
Toxaphene	2.0 U	µg/L
Surrogate: /	**% RECOV**	**LIMITS**
DBC	79	55-152
4,5,6-TCMX	85	50-150
te Extracted	09/28/99	
Date Analyzed	09/29/99	

EPA METHOD 1311/8151 - TCLP HERBICIDES BY GC/ECD	LAB BLANK	Units
2,4-D	1.0 U	µg/L
2,4,5-TP (Silvex)	1.0 U	µg/L
Surrogate:	**% RECOV**	**LIMITS**
2,4-DCAA	116	35-105
Date Extracted	09/29/99	
Date Analyzed	10/01/99	

U = Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

EPA METHOD 1311/8260 - TCLP VOLATILES	LAB BLANK	Units
Benzene	5.0 U	µg/L
Carbon tetrachloride	5.0 U	µg/L
Chlorobenzene	5.0 U	µg/L
Chloroform	5.0 U	µg/L
1,2-Dichloroethane	5.0 U	µg/L
1,1-Dichloroethene	5.0 U	µg/L
2-Butanone	10 U	µg/L
Tetrachloroethene	10 U	µg/L
Trichloroethene	5.0 U	µg/L
Vinyl Chloride	5.0 U	µg/L
rrogate:	**% RECOV**	**LIMITS**
Dibromofluoromethane	96	59-143
D8-Toluene	97	73-119
Bromofluorobenzene	95	77-121
Date Analyzed	09/28/99	

U = Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

EPA METHOD 1311/8270 - TCLP SVOAS BY GC/MS	LAB BLANK	Units
Total Cresol	300 U	µg/L
1,4-Dichlorobenzene	100 U	µg/L
2,4-Dinitrotoluene	100 U	µg/L
Hexachlorobenzene	100 U	µg/L
Hexachlorobutadiene	100 U	µg/L
Hexachloroethane	100 U	µg/L
Nitrobenzene	100 U	µg/L
Pentachlorophenol	100 U	µg/L
Pyridine	100 U	µg/L
2,4,5-Trichlorophenol	100 U	µg/L
2,4,6-Trichlorophenol	100 U	µg/L
Surrogate:	**% RECOV**	**LIMITS**
Nitrobenzene -D5	79	30-106
2-Fluorobiphenyl	83	38-107
Terphenyl -D14	99	29-131
Phenol -D5	63	12-87
2-Fluorophenol	67	19-115
2,4,6-Tribromophenol	75	35-126
Date Extracted	09/27/99	
Date Analyzed	09/27/99	

U = Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

RESULTS OF ANALYSIS

TCLP METALS	METHOD	LAB BLANK	Units
TCLP Arsenic	1311/6010	0.20 U	mg/L
Date Analyzed		09/28/99	
TCLP Barium	1311/6010	10 U	mg/L
Date Analyzed		09/28/99	
TCLP Cadmium	1311/6010	0.50 U	mg/L
Date Analyzed		09/28/99	
TCLP Chromium	1311/6010	1.0 U	mg/L
Date Analyzed		09/28/99	
TCLP Lead	1311/6010	1.0 U	mg/L
Date Analyzed		09/28/99	
TCLP Mercury	1311/7470	0.0050 U	mg/L
Date Analyzed		09/29/99	
TCLP Selenium	1311/6010	0.50 U	mg/L
Date Analyzed		09/28/99	
TCLP Silver	1311/6010	1.0 U	mg/L
Date Analyzed		09/28/99	

U = Compound was analyzed for but not detected to the level shown.

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

QUALITY CONTROL DATA

Parameter	% RECOVERY MS/MSD/LCS	ACCEPT LIMITS	% RPD MS/MSD	ACCEPT LIMITS
EPA Method 8010/8021				
Methylene Chloride	81/ 80/ 74	16-187	1	27
Chloroform	87/ 88/ 75	50-153	1	19
Carbon Tetrachloride	82/ 81/ 81	54-150	1	21
Trichloroethene	81/ 81/ 79	36-162	<1	26
Tetrachloroethene	82/ 81/ 74	56-148	1	21
Chlorobenzene	94/100/ 97	62-136	6	20
EPA Method 8311/8081				
Endrin	109/105/114	29-162	4	22
Heptachlor	105/102/112	22-153	3	27
Heptachlor Epoxide	103/ 99/115	50-150	4	30
gamma-BHC (Lindane)	110/107/123	26-144	3	22
Methoxychlor	102/ 98/103	50-150	4	30

Environmental Conservation Laboratories Comprehensive QA Plan #960038

< = Less Than
MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Standard
RPD = Relative Percent Difference

ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

QUALITY CONTROL DATA

Parameter	% RECOVERY MS/MSD/LCS	ACCEPT LIMITS	% RPD MS/MSD	ACCEPT LIMITS
EPA Method 8151				
Dalapon	64/ 72/ 40	39-160	12	NA
Dicamba	90/ 96/102	36-231		
2,4-D	64/ 96/ 85	48-177		
2,4,5-TP (Silvex)	61/112/116	64-168		
2,4-DB	139/182/ 93	16-125		
EPA Method 624/8260				
1,1-Dichloroethene	104/100/105	45-167	4	30
Benzene	104/108/107	60-130	4	23
Trichloroethene	95/ 99/101	50-122	4	10
Toluene	102/100/110	57-136	2	12
Chlorobenzene	103/104/108	59-126	<1	11

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ENCO LABORATORIES
REPORT # : JR8604
DATE REPORTED: October 4, 1999
REFERENCE : WO# JX148
PROJECT NAME : NSB Escavation Waste

QUALITY CONTROL DATA

Parameter	% RECOVERY MS/MSD/LCS	ACCEPT LIMITS	% RPD MS/MSD	ACCEPT LIMITS
EPA Method 1311/8270				
1,4-Dichlorobenzene	71/ 73/ 80	37-127	3	18
2-Methylphenol	100/ 95/ 90	41-174	5	20
3 & 4-Methylphenol	101/ 92/101	45-168	9	19
Hexachloroethane	64/ 65/ 84	40-113	2	20
Nitrobenzene	101/ 94/ 80	40-152	7	23
Hexachlorobutadiene	61/ 64/ 70	24-116	5	23
2,4,6-Trichlorophenol	108/106/ 86	49-132	2	15
2,4,5-Trichlorophenol	121/118/ 89	42-141	2	21
Hexachlorobenzene	102/110/ 81	1-152	8	24
Pentachlorophenol	122/125/ 84	24-158	2	24
TCLP Metals				
TCLP Arsenic, 1311/6010	108/103/ 99	66-124	5	11
TCLP Barium, 1311/6010	103/ 97/100	74-118	6	13
TCLP Cadmium, 1311/6010	104/ 98/ 99	69-121	6	12
TCLP Chromium, 1311/6010	103/ 97/ 99	75-119	6	10
TCLP Lead, 1311/6010	105/100/102	68-126	5	17
TCLP Mercury, 1311/7470	98/ 96/102	70-136	2	12
TCLP Mercury, 1311/7470	98/ 96/102	70-136	2	12
TCLP Mercury, 1311/7470	98/ 96/102	70-136	2	12
TCLP Mercury, 1311/7470	98/ 96/102	70-136	2	12
TCLP Selenium, 1311/6010	105/100/ 96	71-127	5	9
TCLP Silver, 1311/6010	102/107/100	68-122	5	12

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RPD = Relative Percent Difference

CHAIN OF CUSTODY RECORD

Site Name: Site 11 NSB Kings Bay
Delivery Order No.: 109
Cooler/Crate No.:

SEIR No.:
COC Number: CF089
Lab: ENCO
Field Logbook No.:
Logbook Pg. No.:

Sampled by: M. A. Gage (Print) / M. A. Gage (Sign) / (Print) / (Sign)

Legend — SAMPLE TYPE

PSB	Preservative Blank	BLS	Blind Spike
FDP	Field Duplicate	BLB	Blink Blank
ENV	Environmental	PTS	Point Source
FDB	Field Blank	FRP	Field Replicate
GEO	Geotechnical Sample	RSB	Rinsate Blank
MXD	Matrix Spike Duplicate	SPL	Split
MXS	Matrix Spike	TRP	Trip Blank

MATRIX

AIR	Air	SBS	Subsurface Soil	PTW	Potable Water
FLO	Flora	SED	Sediment	SEP	Seeps
FAU	Fauna	SFS	Surface Soil	SOL	Solid
GWT	Groundwater	SPW	Surface Water	WWT	Waste Water
LCH	Leachate	SLG	Sludge	SLW	Solid Waste
OIL	Oil	SST	Surface Water Storm Event		

QC LEVELS

- S Sample Results and QC
- C Reported
- D Sample results, QC and raw data reported
- E Sample resuts, blanks, and calibration reportred
- S Screening level analysis

Station ID	BEI Sample ID	Sample Type	Matrix Code	Collection Date/Time	Container ID	Preservative	Pay Item	Parameter (see comments)	Priority	QC Code
B Waste		ENV	SLG	9-21-99/1700	01	Ice		1, 2	24 Hr TAT	S
A Waste		ENV	SLG	9-21-99/1700	01	Ice		1, 2	" "	S

RELINQUISHED BY	RECEIVED BY	DATE	TIME	REASON FOR TRANSFER
M. A. Gage				

COMMENTS/INSTRUCTIONS

1 - Full TCLP Analysis
2 - 8021 HALO Target All chlorinated Compounds

CONTAMINATION	YES	NO
Radiological		✓
Chemical	✓	

Shipper: NH

Ship to: NH

Report Results to Mark Gage

Airbill No. _____ Traffic Report No. _____