DRAPER CORPORATION
Corporate Offices

Post Office 18100
Greensboro, NC 27419
(919) 852-4200

January 19, 1993

Ms. Kelly C. Gage
Guilford County Emergency Services
P.O. Box 18807
Greensboro, NC 27419-8807

RE: Suspected Groundwater Contamination Moving Toward Draper Property, 5644 Hornaday Road, Greensboro, NC 27409

Dear Ms. Gage:

I am writing to you to present the evidence I have to date concerning a plume of contaminated groundwater that we suspect is moving onto the Draper property. We suspect that the plume may be moving onto the Draper site through the alluvium of Long Branch Creek or through fractures in the bedrock.

You were previously informed of this situation by copies of letters to Ms. Sherri V. Knight and Mr. Richard Sieg, NCDEM. The attached Figure 1 shows the Draper facility and the newly installed groundwater monitoring wells. Figure 2 shows a preliminary groundwater contour map of the surficial aquifer at the Draper facility.

Also, attached to this letter is a copy of a June 1989 report by ERM - Southeast, Inc., the December 1988 position of the plume is shown on Figure 8 of that report. Based on the key given at the bottom of Figure 8, the plume on the CIBA-GEIGY property contains the same organic compound, Tetrachloroethene, found in groundwater monitoring wells MW-2 and MW-4 at the Draper facility.

Please review these data and provide me with your recommendation as the best plan of action to address this situation.

Sincerely,

DRAPER CORPORATION

C. Denny Walker
Secretary

CDW:jm

Attachments

cc: Ms. Sherri V. Knight, NCDEM ✓
Jimmy Summers, Guilford Mills
Triad Environmental Consultants, Inc.

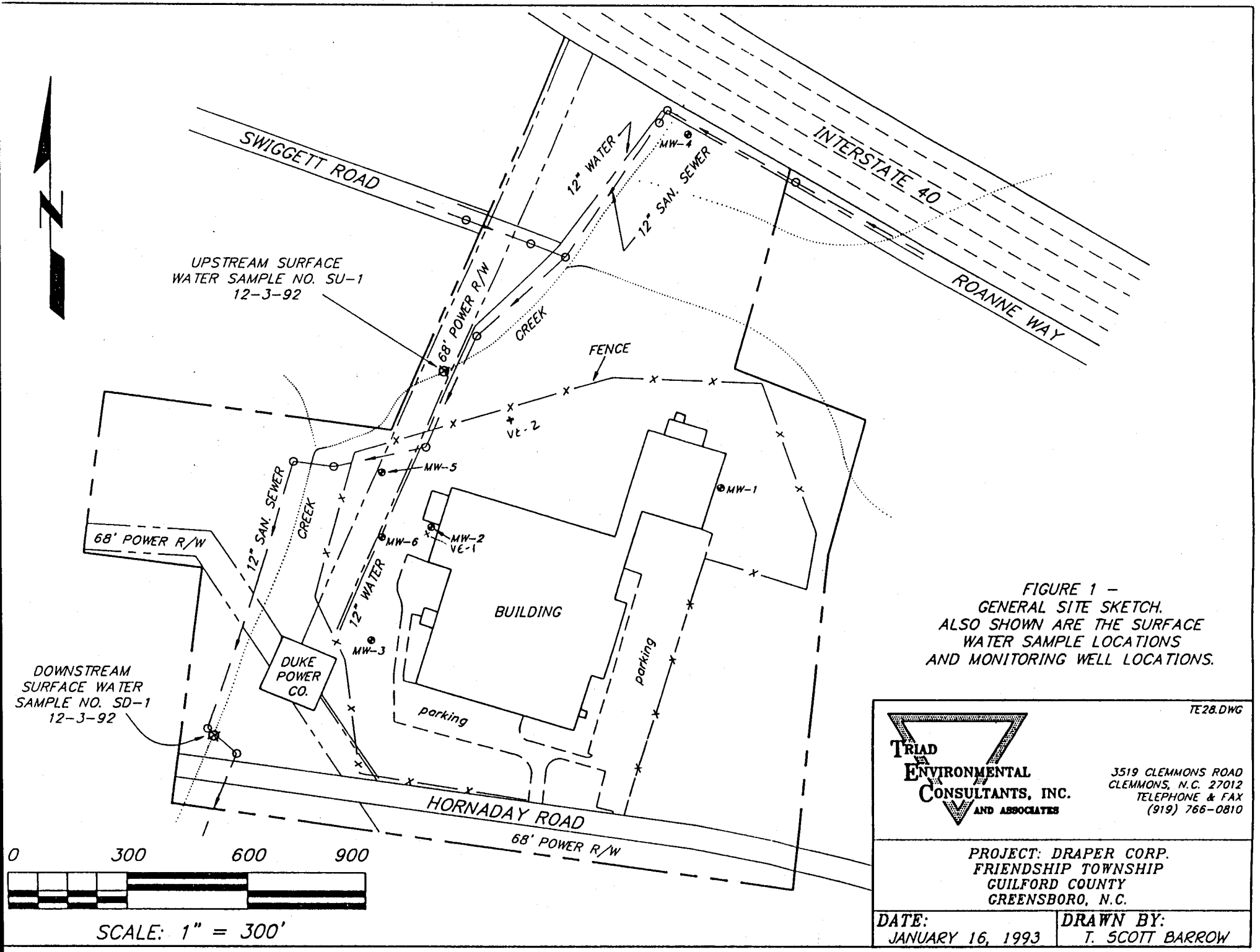

FIGURE 1 –
GENERAL SITE SKETCH.
ALSO SHOWN ARE THE SURFACE
WATER SAMPLE LOCATIONS
AND MONITORING WELL LOCATIONS.

TE28.DWG

TRIAD ENVIRONMENTAL CONSULTANTS, INC. AND ASSOCIATES

3519 CLEMMONS ROAD
CLEMMONS, N.C. 27012
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PROJECT: DRAPER CORP.
FRIENDSHIP TOWNSHIP
GUILFORD COUNTY
GREENSBORO, N.C.

DATE:	DRAWN BY:
JANUARY 16, 1993	T. SCOTT BARROW

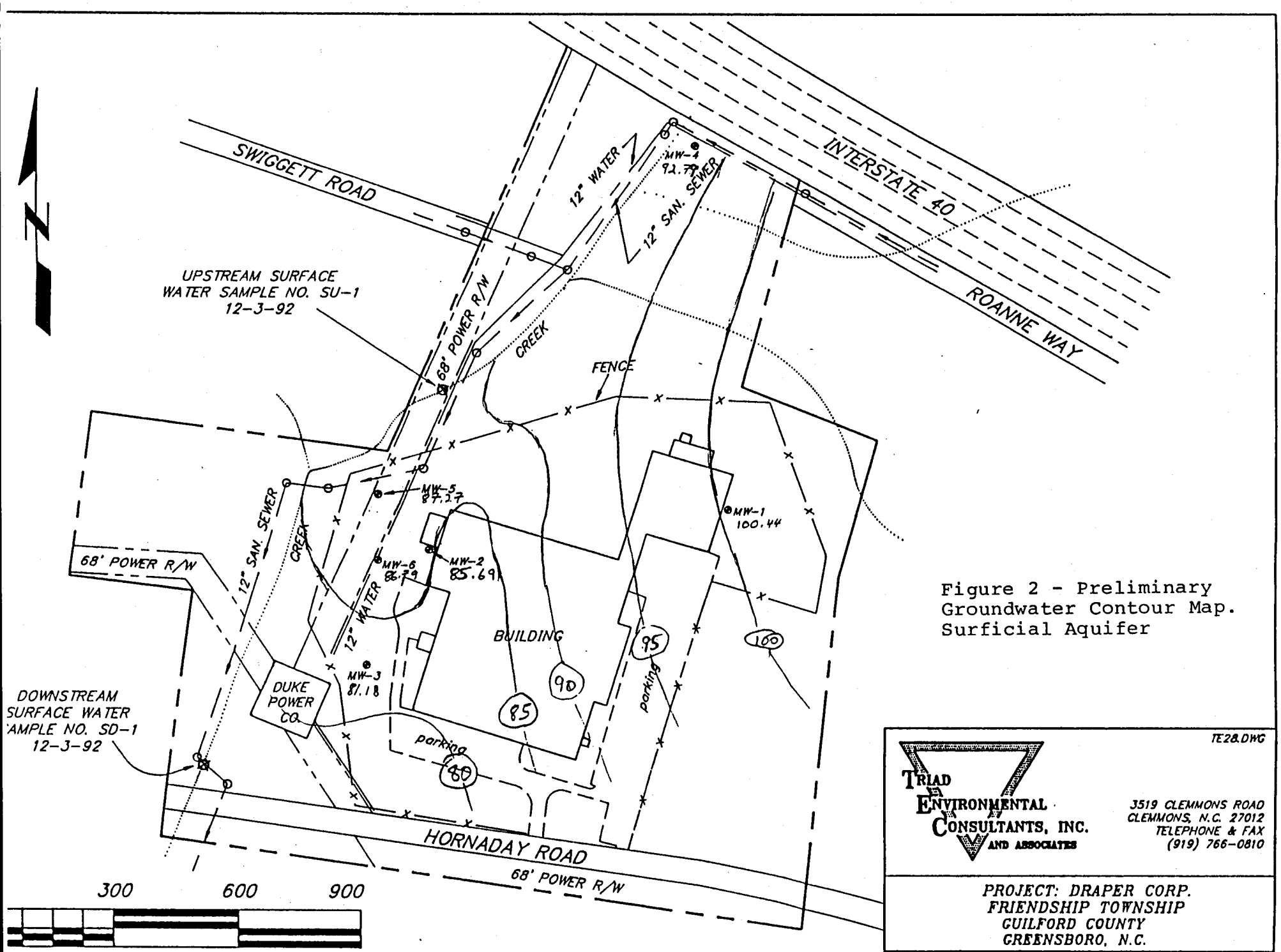

Figure 2 - Preliminary Groundwater Contour Map. Surficial Aquifer

TE28.DWG

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ERM-Southeast, Inc.

STATUS REPORT OF SITE INVESTIGATION CIBA-GEIGY CORPORATION GREENSBORO, NC JUNE 1989

Prepared For:

CIBA-GEIGY Corporation
410 Swing Rd.
Greensboro, NC 27409

Thomas M Wilson

Thomas M. Wilson, P.G.

Prepared By:

ERM-Southeast, Inc.
7621 Little Ave.
Suite 216
Charlotte, NC 28226

Project 7291

6-27-89

Section 1

INTRODUCTION

This report presents the results of investigative activities conducted by ERM-Southeast, Inc. at the Greensboro, North Carolina, CIBA-GEIGY facility (Figure 1) during the period of April 1988 to March 1989. The activities include a soil vapor survey in the loading dock area, the drilling, installation and development of two shallow monitor wells and two piezometer wells, a reconnaissance survey to identify additional water supply wells located near the facility, and semiannual sampling events for volatile organic and atrazine analyses of the ground water and surface water. These activities are part of the on-going site investigation and fulfill the NRCD-approved recommendations presented in the Summary Report (February 1988) prepared by ERM-Southeast. With the completion of the tasks described herein, CIBA-GEIGY considers the subsurface investigation to be complete.

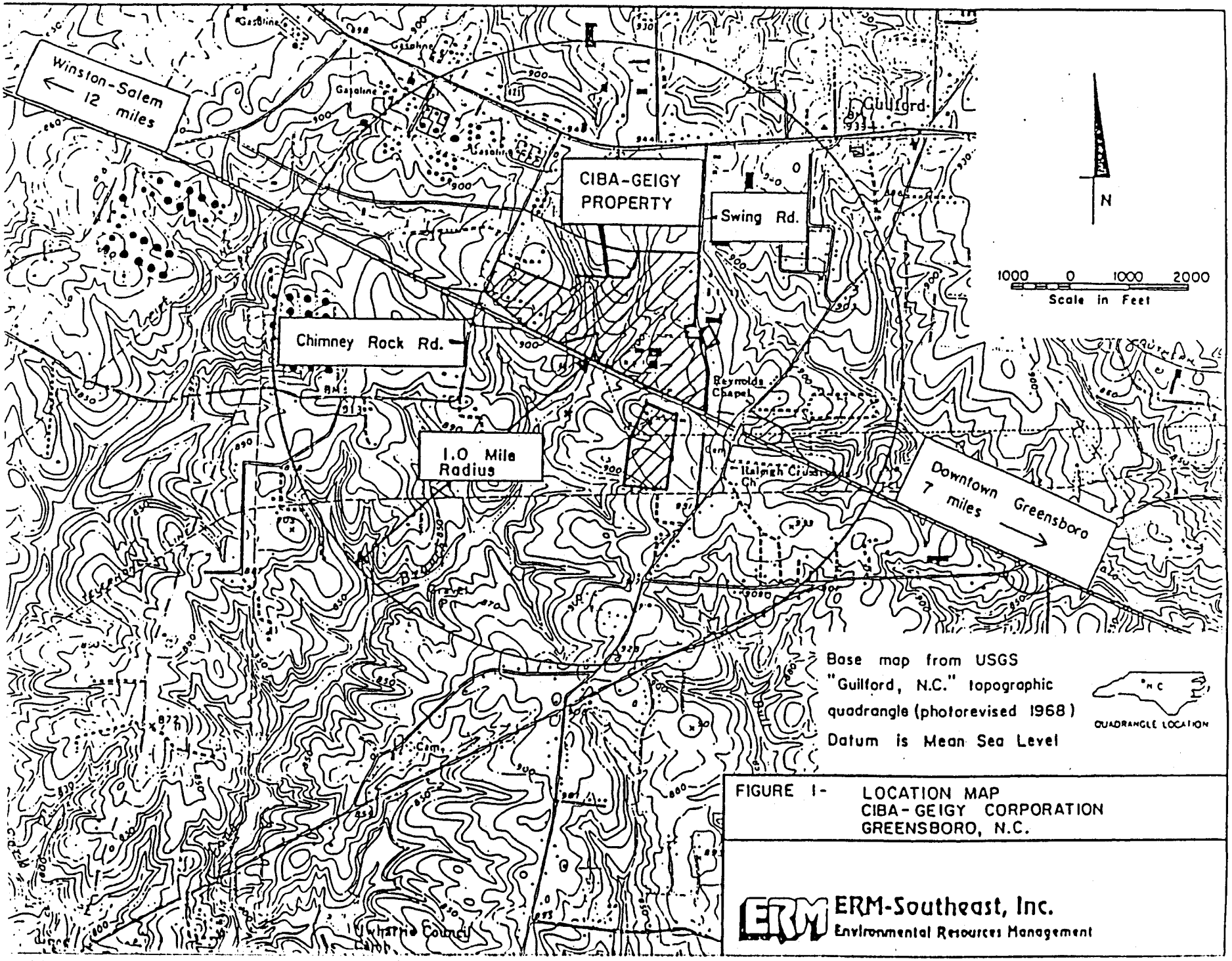


FIGURE 1- LOCATION MAP
CIBA-GEIGY CORPORATION
GREENSBORO, N.C.

ERM ERM-Southeast, Inc.
Environmental Resources Management

Section 2

SOIL VAPOR SURVEY

ERM-Southeast conducted a soil vapor survey in the loading dock area during the period of April 25-28, 1988. The purpose of the survey was to identify any "hot spots" of volatile organic contamination in the unsaturated soils which may be serving as source areas for the ground water plume centered near MW-1. A grid of fourteen boring locations (TB-5 thru TB-18) was established in the asphalt-paved area located west of the active loading dock (Figure 2). The northernmost line of borings was located immediately adjacent to a sanitary sewer line which was a potential source of past laboratory wastewater releases. Other borings were located near storm drain lines and other utility lines which might serve as preferential pathways of ground water migration.

The soil vapor survey was conducted by drilling with hollow stem augers through the asphalt and gravel base and sampling the soil at 2-foot intervals by the split-spoon method. Using a truck mounted drill rig, the auger was then advanced to the base of the sampling interval and a clean split spoon was used to sample the next 2-foot soil interval. This procedure was repeated to a total depth of approximately 8 feet which was within 1-foot of the water table as measured at MW-1. The augers were steam cleaned initially and between borings.

Each split spoon sample was removed from the sampler and manually scanned with a direct-reading PID instrument (HNU) to detect the presence of volatile organic compounds. The visual examination of each sample was logged by a hydrogeologist and a representative portion of each sample was collected in a new plastic jar, labelled and immediately placed on ice.

One sample from each boring; either exhibiting the highest HNU reading or if no significant increases were noted, was randomly selected, for laboratory analyses by EPA Method 601 (Purgeable Halocarbons). The analyses were performed by Industrial and Environmental Analysts, Inc. located in Cary, North Carolina.

The readings obtained in the field by the HNU instrument are summarized in Table 1. The organic vapor readings observed were at or near the background levels for all soil samples at all boring locations except at TB-17. The readings at 4.5-6.5 feet (1.0 ppm) and at 6.5-8.0 feet (0.6 ppm) at TB-17 were slightly elevated above the background level (0.2 ppm). We believe that these field readings are not considered indicative of substantially contaminated soils. The laboratory analyses (Table 1 & Appendix A) of selected soil samples supports this conclusion. Only trace levels of volatile organic compounds were detected at TB-11, (PCE = 1 ppb) and TB-17 (PCE = 7 ppb). All other samples were below quantitation limits.

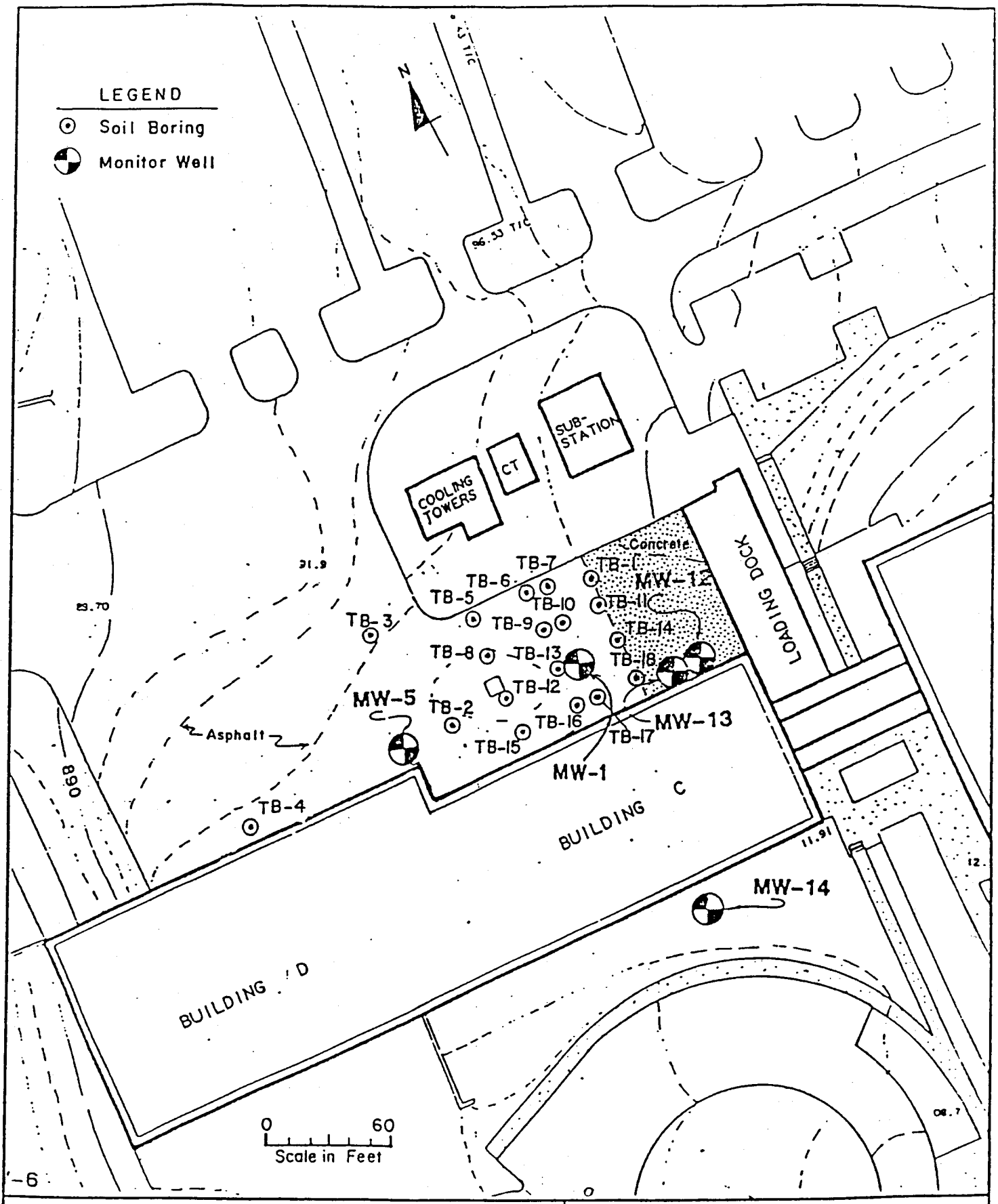


FIGURE 2 SOIL BORING LOCATIONS
CIBA-GEIGY FACILITY
GREENSBORO, NC

ERM-Southeast, Inc.

ERM-Southeast, inc.

TABLE 1 - Results of Soil Vapor Survey
Loading Dock Area, April 1988

Boring No.	Sample Depth/I.D.	OVA Response	EPA 601 Results
TB-5	Background	0.3	
	0.5-2.5'	0.3	
	2.5-4.5'	0.4	
	4.5-6.5'	0.3	BQL
	6.5-8.0'	0.3	
	Open borehole	0.3	
TB-6	Background	0.3	
	0.6-2.6'	0.3	
	2.6-4.6'	0.3	
	4.6-6.6'	0.3	BQL
	6.6-8.1'	0.3	
	Open borehole	0.3	
TB-7	Background	0.1	
	0.5-2.5'	0.2	BQL
	2.5-4.5'	0.1	
	4.5-6.5'	0.1	
	6.5-8.0'	0.1	
	Open borehole	0.1	
TB-8	Background	0.2	
	0.5-2.5'	0.2	
	2.5-4.5'	0.2	
	4.5-6.5'	0.2	BQL
	6.5-8.0'	0.2	
	Open borehole	0.2	
TB-9	Background	0.2	
	0.5-2.5'	0.2	
	2.5-4.5'	0.2	BQL
	(Utility encountered, boring terminated at 4.5')		
TB-10	Background	0.2	
	0.5-2.5'	0.2	
	2.5-4.5'	0.2	
	4.5-6.5'	0.2	BQL
	6.5-8.0'	0.2	
TB-11	Background	0.2	
	0.6-2.6'	0.3	
	2.6-4.6'	0.2	
	4.6-6.6'	0.4	PCE = 1ppb
	6.6-8.1'	0.2	

ERM-Southeast, inc.

Boring No.	Sample Depth/I.D.	OVA Response	EPA 601 Results
TB-12	Background	0.1	
	0.2-2.2	0.2	
	2.2-4.2'	0.2	BQL
	4.2-6.2'	0.1	
	6.2-8.2'	0.2	
	Open borehole	0.2	
TB-13	Background	0.1-0.2	
	0.5-2.5'	0.1	
	2.5-4.5'	0.1	
	4.5-6.5'	0.1	
	6.5-8.0'	0.2	BQL
	Open borehole	0.2	
TB-14	Background	0.2	
	0.6-2.6'	0.2	
	2.6-4.6'	0.3	
	4.6-6.6'	0.4	BQL
	6.6-8.1'	0.3	
	Open borehole	60-150	
TB-15	Background	1-4	
	1.0-3.0'	0.4	
	3.0-5.0'	0.2	
	5.0-7.0'	0.2	
	7.0-8.0'	0.6	BQL
	Open borehole	0.4	
TB-16	Background	0.2	
	0.5-2.5'	0.2	
	2.5-4.5'	0.2	
	4.5-6.0'	0.2	BQL
	6.0-8.0'	0.2	
TB-17	Background	0.2	
	0.5-2.5'	0.2	
	2.5-4.5'	0.3	
	4.5-6.5'	1.0	PCE = 7ppb
	6.5-8.0'	0.6	
TB-18	Background	0.2	
	0.6-2.6'	0.2	
	2.6-4.6'	0.2	
	4.6-6.6'	0.2	BQL
	6.6-8.1'	0.2	
	Open borehole	0.7	

Notes: BQL = Below Quantitation Limits
PCE = Tetrachloroethene
ppb = parts per billion

For most of the borings, a HNU reading was obtained from inside the open borehole after the augers were pulled. Elevated readings were measured in TB-11 (100-200 ppm), TB-14 (60-150 ppm) and, to a lesser degree, in TB-18 (0.7 ppm). Because the direct scan of the soil samples from these borings did not show elevated responses, it is believed that the open borehole readings represent volatilization of compounds from the saturated zone near the bottom of the boring. TB-11 and TB-14 are adjacent to MW-1, where the highest levels of volatile organic compounds have been observed in ground water samples. The constituents of the ground water plume in the area of MW-1 could readily volatilize and accumulate in a boring advanced to the top of the water table.

Section 3

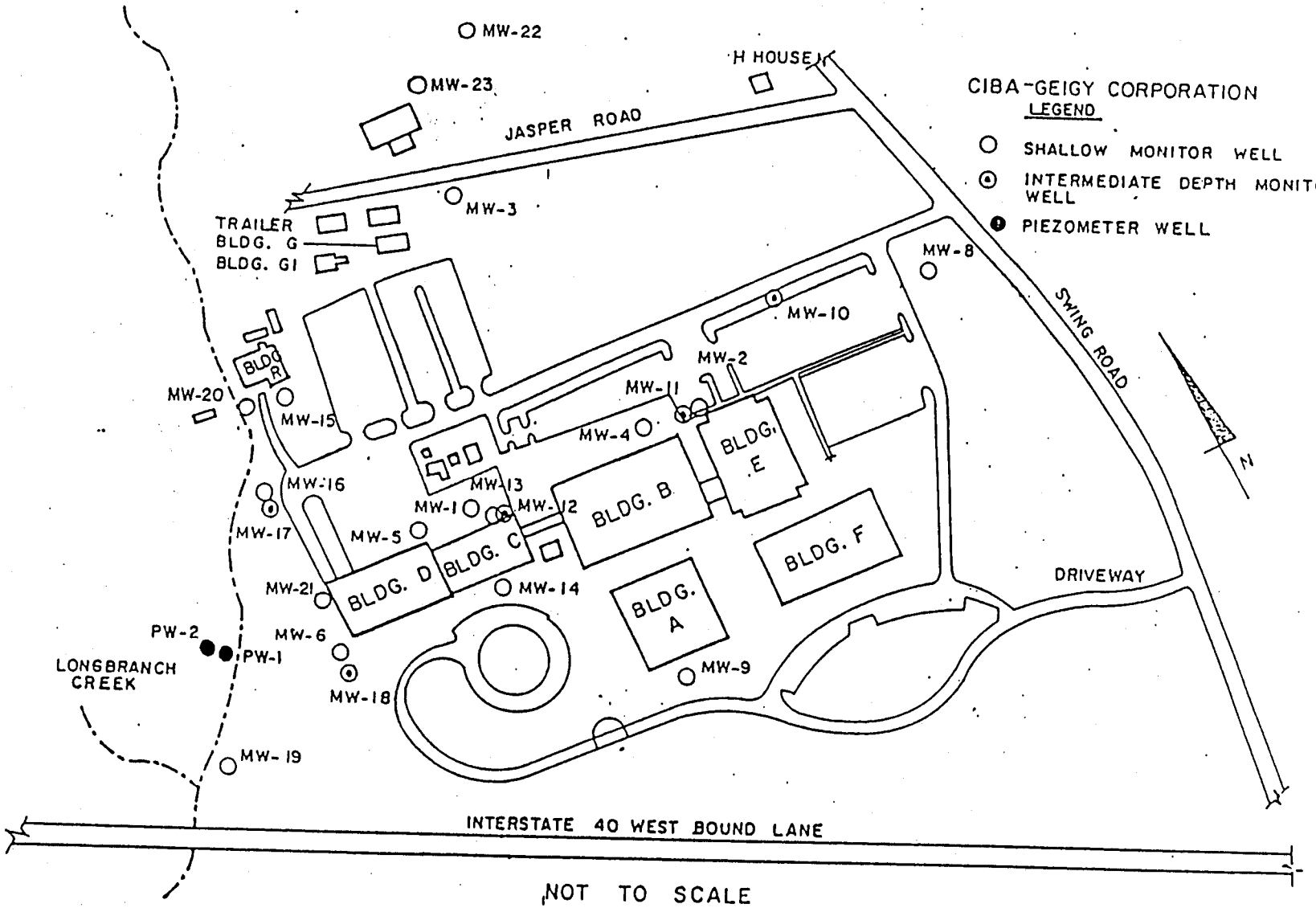
MONITOR WELL CONSTRUCTION

3.1 Monitor Wells

In order to provide better definition of the ground water plume, two shallow monitor wells, MW-20 and MW-21 (Figure 3), were constructed on April 26 and 27, 1988. MW-20, located near Building R, was installed to assess the water quality downgradient of MW-15 where elevated levels of atrazine were previously detected. MW-21, located on the west end of Building D, was installed to determine whether the sump associated with the pretreatment unit inside Building D was serving as a source area for atrazine ground water contamination. Both wells were drilled, completed and developed in accordance with the North Carolina well construction standards. Monitor well construction records and drilling logs are presented in Appendix B. The wells were installed by the same methods described in the previous Summary Report except that PVC screens were used in the new wells instead of stainless steel screens. In our professional judgement, the historical concentrations of the volatile organic compounds at the site did not warrant the use of stainless steel screens. Both wells were included in the May and December 1988 ground water sampling events.

3.2 Piezometer Wells

In order to assess the vertical ground water flow potential in the area west of Long Branch Creek, one shallow piezometer and one intermediate depth piezometer were constructed on March 13 and 14, 1989. The locations of the piezometer wells are depicted in Figure 3. Both wells were drilled, completed and developed in accordance with the North Carolina well construction standards. Well construction records and drilling logs for the two piezometers are presented in Appendix B.



CIBA-GEIGY CORPORATION

LEGEND

- SHALLOW MONITOR WELL
- INTERMEDIATE DEPTH MONITOR WELL
- PIEZOMETER WELL

FIGURE 3-SITE MAP
CIBA-GEIGY CORPORATION
GREENSBORO, NC

ERM-Southeast, Inc.
Environmental Resources Management

Section 4

GROUND WATER MONITORING

4.1 Ground Water Elevations

A semi-annual ground water monitoring program was approved by the NRCD in January 1988. The first monitoring event of 1988 was conducted on May 16-18; the second monitoring event was conducted on December 28-29.

Prior to sampling in May and December, water level elevations were measured in all monitor wells at the site. Following the construction of piezometer wells PW-1 and PW-2, water level elevations were again measured in selected monitoring wells and the two piezometer wells on March 30, 1989. Surface water elevations in Long Branch Creek were also measured at the Building R weir and the "LL" weir (Figure 6). Water table contour maps for May 1988, December 1988 and March 1989 are presented in Figures 4, 5 and 6. As indicated by the configuration of the water table contours, ground water flow is primarily westward across the site toward Long Branch Creek. This confirms our earlier water table findings as presented in the previous Summary Report. In May, during the seasonal high water table, the hydraulic gradient between MW-14 and MW-19 was 0.028 ft/ft. In December, during the seasonal low water table, the hydraulic gradient was 0.023 ft/ft. In March 1989, during a period of wet weather, the calculated hydraulic gradient between MW-14 and MW-19 was 0.028 ft/ft. The depths to ground water were generally greater in December than in May. One monitor well (MW-4) was dry during December.

A comparison of the ground water elevations between the shallow and intermediate-depth well pairs provides an indication of the potential for upward or downward vertical flow. At MW-2 and MW-11, the ground water elevations were identical in both May and December, thus indicating no vertical flow potential. For MW-6 and MW-18, the ground water elevations were higher in MW-6, the shallow well, indicating a potential for flow downward from the upper zone to the lower zone of the saprolite aquifer. However, at well pairs MW-12/MW-13 and MW-16/MW-17, the water level elevations were higher in the intermediate-depth wells, indicating a potential for flow upward from the lower zone to the upper zone. These observations occurred both in May and December. The vertical hydraulic gradients as determined from the March 30, 1989 water level elevations are 0.023 ft/ft downward at MW-2 and MW-11, 0.044 ft/ft upward at MW-12 and MW-13, 0.012 ft/ft downward at MW-6 and MW-18, 0.002 ft/ft upward at MW-16 and MW-17 and .069 ft/ft downward at PW-1 and PW-2. The magnitude of the vertical gradient at PW-1 and PW-2 is substantially greater than the gradients observed in the other well pairs located east of the Long Branch Creek. The piezometeric data from PW-1 and PW-2 suggest that, at the time of the measurements, potential for downward flow exists in the immediate vicinity of Long Branch Creek and that the stream is currently serving to

recharge the shallow aquifer. Characteristically, water tables in the Piedmont rise as a result of aquifer recharge from precipitation in early spring. Downward vertical flow potentials would be expected during recharge periods. The piezometric levels will continue to be monitored during the course of the year to fully characterize the vertical flow potentials under various seasonal conditions.

4.2 Ground Water Analyses

Ground water samples were collected from 17 monitor wells (MW-1, 2, 4, 5, 6, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 & 21). Dedicated Teflon bailers were used to purge a minimum of three well bore volumes from each well prior to sample collection. Samples were collected for purgeable halocarbon analysis by EPA Method 624 and atrazine analysis by the CIBA-GEIGY GC method. The analyses were conducted by Industrial and Environmental Analysts (IEA), Inc. labs and CIBA-GEIGY labs. In accordance with the approved monitoring program, MW-2 and MW-4 were analysed for purgeable halocarbons only. The selection of EPA Method 624 rather than EPA Method 601 as proposed in the Summary Report was made in order to comply with the GC/MS confirmation and library search requirements of the draft Special Order of Consent. Level II QA/QC procedures were followed which included blank analysis, duplicate analysis, blind splits, surrogate recoveries and chain-of-custody documentation. The sampling, handling and preservation procedures were in accordance with accepted protocol and are described in detail in the Methods section of the Summary Report.

During the December sampling event, MW-4 was dry and could not be sampled. MW-14 was nearly dry and yielded a minimal volume sufficient for purgeable halocarbon analyses only.

4.2.1 Volatile Organic Analyses

The results of volatile organic analyses of the May and December 1988 ground water samples are summarized in Table 2 along with the historical ground water analyses. The laboratory data sheets for the volatile analyses may be referenced in Appendices C and D. Overall, the 1988 analyses indicate a plume geometry and concentration range which are similar to the previous sampling events.

The primary constituents of the plume are tetrachloroethene (PCE), 1,1-dichloroethene (DCE), and 1,1,1-trichloroethane (TCA). Consistent with the historical data, the highest concentrations of PCE, DCE and TCA occur at MW-1. The concentrations decrease in the downgradient direction from MW-1 to MW-5, MW-21, MW-6 and MW-19 (Figures 7 and 8).

TABLE 2 - RESULTS OF VOLATILE ORGANIC ANALYSES (ug/l) OF GROUND WATER
CIBA-GEIGY GREENSBORO FACILITY

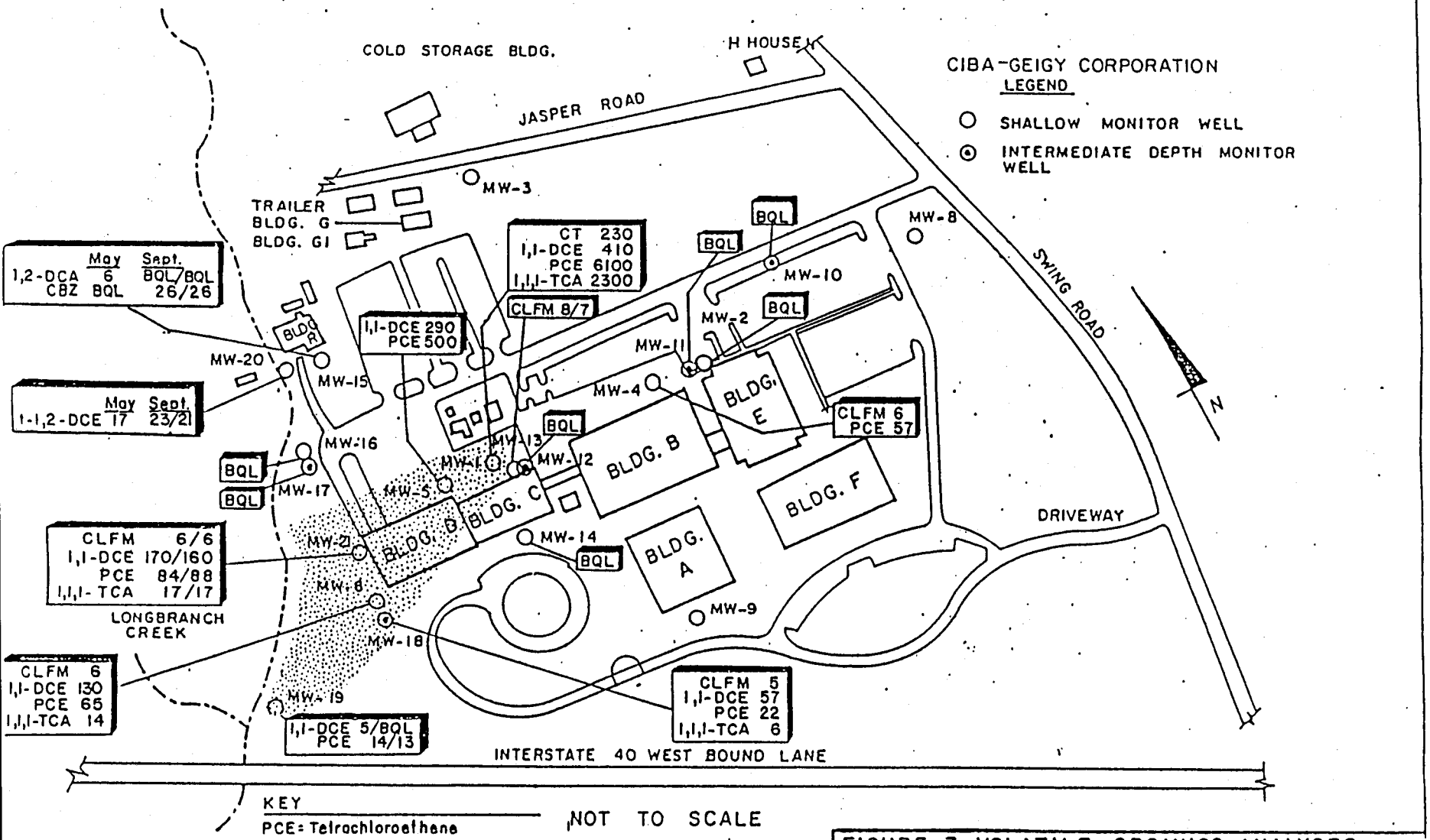
ETERS		MW-1																		MW-19		
IED (1)	MW-1	Split	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18	MW-19	Split	MW-20	MW-2
ER 30, 1986																							
ichloroethene	370	-	BQL	BQL	-	170	80/84	BQL	BQL	BQL	-	-	-	-	-	-	-	-	-	-	-		
chloroethene	10000	-	49	BQL	-	380	31/33	BQL	BQL	BQL	-	-	-	-	-	-	-	-	-	-	-		
Trichloroe-																							
thane	2700	-	BQL	BQL		BQL	9/10	BQL	BQL	BQL	-	-	-	-	-	-	-	-	-	-	-		
form	BQL	-	BQL	BQL	-	BQL	BQL/BQL	110	110	BQL	-	-	-	-	-	-	-	-	-	-	-		
ene Chloride	BQL	-	BQL	BQL	-	BQL	BQL/BQL	300	320	BQL	-	-	-	-	-	-	-	-	-	-	-		
ER 23, 1986																							
form	-	-	-	-	-	-	-	BQL	BQL	-	-	-	-	-	-	-	-	-	-	-	-		
ene Chloride	-	-	-	-	-	-	-	BQL	BQL	-	-	-	-	-	-	-	-	-	-	-	-		
5-6, 1987																							
chloroethene	BQL	-	BQL	-	BQL	210	130	-	BQL	-	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	24	BQL/BQL	BQL/BQL		
hloroethene	6000	3700	BQL	-	31	380	50	-	BQL	-	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL/BQL	BQL/BQL		
Trichloroe-																							
thane	2000	1600	BQL	-	BQL	BQL	13	-	BQL	-	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL/BQL	BQL/BQL		
form	BQL	-	BQL	-	BQL	BQL	BQL	-	BQL	-	32	10	BQL	10	BQL	BQL	BQL	BQL	BQL	BQL/BQL	BQL/BQL		
-18,1988																							
chloroethene	410	-	BQL	-	BQL	290	130	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	57	5/BQL	-	BQL	170/
loroethene	6100	-	BQL	-	57	500	65	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	22	14/13	-	BQL	84/
Trichloroe																							
thane	2300	-	BQL	-	BQL	BQL	14	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	6	BQL/BQL	-	BQL	17/
ichloroethene	BQL	-	BQL	-	BQL	BQL	BQL	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL/BQL	-	17	BQL/
chloroethane	BQL	-	BQL	-	BQL	BQL	BQL	-	-	-	BQL	BQL	BQL	BQL	BQL	6	BQL	BQL	BQL	BQL/BQL	-	BQL	BQL/
form	BQL	-	BQL	-	6	BQL	6	-	-	-	BQL	BQL	BQL	8/7	BQL	BQL	BQL	BQL	BQL	BQL/BQL	-	BQL	6/6
Tetrachlor																							
ide	230	-	BQL	-	BQL	BQL	BQL	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL/BQL	-	BQL	BQL/
er 1, 1988																							
enzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26/26	-	-	-	-	-	BQL/BQL	-
ichloroethene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BQL/BQL	-	-	-	-	-	23/21	-
chloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BQL/BQL	-	-	-	-	-	BQL/BQL	-

TABLE 2 - RESULTS OF VOLATILE ORGANIC ANALYSES (ug/l) OF GROUND WATER
CIBA-GEIGY GREENSBORO FACILITY

METERS CTED (1)	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18	MW-19	MW-20	MW-21
28-29, 1988																					
Dichloroethene	390	BQL	-	-	240	160	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL/BQL	BQL	BQL	79/77	BQL	BQL/BQL	42
ichloroethene	6600	5	-	-	390	73	-	-	-	BQL	7	BQL	BQL	BQL	BQL/BQL	BQL	BQL	34/30	13	BQL/BQL	27
-Trichloroe thane	2500	BQL	-	-	BQL	16	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL/BQL	BQL	BQL	9/8	BQL	BQL/BQL	5
Dichloroethene	BQL	BQL	-	-	BQL	BQL	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL/BQL	BQL	BQL	BQL/BQL	BQL	22/23	BQL
oform	BQL	BQL	-	-	16	6	-	-	-	BQL	6	BQL	7	BQL	BQL/BQL	BQL	BQL	6/BQL	BQL	BQL/BQL	BQL
n Tetrachlor ide	280	BQL	-	-	BQL	BQL	-	-	-	BQL	BQL	BQL	BQL	BQL	BQL/BQL	BQL	BQL	BQL/BQL	BQL	BQL/BQL	BQL
lene Chloride	BQL	BQL	-	-	BQL	BQL	-	-	-	BQL	BQL	BQL	BQL	BQL	6/BQL	BQL	BQL	6/BQL	6	6/BQL	6

NOTES

(1) All of the other 26 GC/MS Volatile Organics were at non-detectable levels.
(2) Slash symbol (/) separates results of initial and duplicate analyses (initial/duplicate).
(3) Analyses conducted by Industrial & Environmental Analysts, Inc. Cary, NC and/or Specialized Assays, Nashville, TN.
(4) Detection limits are included in the laboratory data sheets.
(5) BQL = Below Quantitation Limit.
(6) Dash (-) indicates no sample collected.



NOT TO SCALE

KEY

PCE = Tetrachloroethene
1,1-DCE = 1,1-Dichloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
1,2-DCA = 1,2-Dichloroethane
t-1,2-DCE = t-1,2-Dichloroethene
CLFM = Chloroform
CT = Carbon Tetrachloride
CBZ = Chlorobenzene
BQL = Below Quantitation Limit
Concentrations Reported in PPB
MW-15 & 20 Resampled Sept. 1, 1988

FIGURE 7 - VOLATILE ORGANICS ANALYSES
GROUND WATER
MAY 17-18, 1988

ERM-Southeast, Inc.
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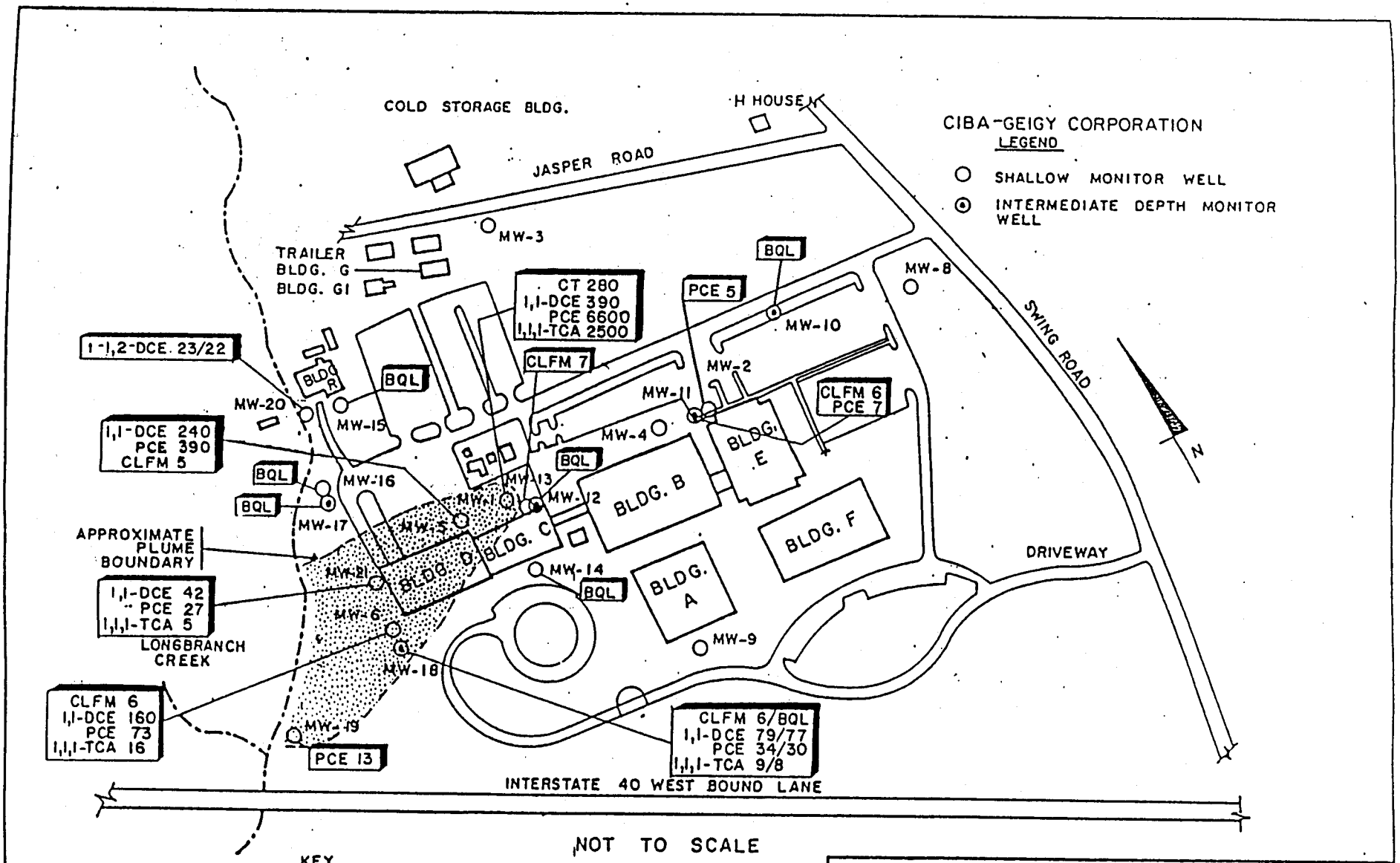

KEY

PCE = Tetrachloroethene
1,1-DCE = 1,1-Dichloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
t-1,2-DCE = t-1,2-Dichloroethene
CLFM = Chloroform
CT = Carbon Tetrachloride
BQL = Below Quantitation Limit
Concentrations Reported in PPB

FIGURE 8 - VOLATILE ORGANICS ANALYSES
GROUND WATER
DECEMBER 28-29, 1988

ERM-Southeast, Inc.
Environmental Resources Management

There are two notable changes in the plume evident from the 1988 analytical data. First, the occurrence of relatively low levels of PCE in May (14 and 13 ppb) and December (13 ppb) indicates that the leading edge of the plume has reached MW-19. Therefore, the plume is continuing to migrate downgradient.

Second, at MW-18, an intermediate depth well, the first occurrences of TCE and TCA and the increasing concentrations of DCE suggest that the volatile organic plume is migrating vertically as well as laterally. Since August 1987, the concentrations in the adjacent shallow well (MW-6) are increasing at a lower rate than increases at MW-18.

At MW-20, a relatively low concentration (17 ppb) of trans,1,2-dichloroethene (t,1,2-DCE) was observed in May. This volatile compound had not been observed in any of the other monitor wells during the ground water assessment program, including MW-15 located immediately upgradient of MW-20. Likewise, the 6 ppb of 1,2-dichloroethane (1,2-DCA) observed at MW-15 is the first occurrence of that compound in any of the monitor wells.

Because the appearance of t,1,2-DCE and 1,2-DCA is not readily explained and considering the close proximity of Long Branch Creek, duplicate samples were collected from MW-20 and MW-15 on September 1 to resolve whether these previously undetected compounds are indeed present. The September samples collected from MW-20 each confirmed the presence of t,1,2-DCE (23 and 21 ppb). Subsequent sampling of MW-20 in December also showed similar levels of t,1,2-DCE (22 and 23 ppb). Samples collected from MW-15 in both September and December revealed no quantifiable levels of 1,2-DCA. Chlorobenzene was detected in MW-15 in the September samples but was not detected in the December samples.

MW-21 is located directly downgradient and within 50 feet of the concrete sump at the wastewater pretreatment unit in Building D. If the sump was indeed a source area, we would expect to see increased volatile organic concentrations at MW-21. Instead, MW-21 is part of a line of wells along which the volatile organic concentrations steadily diminish from MW-1 to MW-19. Thus, the concentrations at MW-21 do not necessarily indicate that the sump is a major source of volatile organics.

Trace levels of chloroform and methylene chloride were observed in various monitor wells in 1988.

4.2.2 Atrazine Analyses

The results of the May and December atrazine analyses of ground water are presented in Table 3 and are illustrated in Figures 9 and 10. The laboratory data sheets may be referenced in Appendices E and F.

Comparing the May and December 1988 results with the historical results, the most significant changes occur at MW-13, MW-15 and MW-21. The atrazine concentration at MW-13 decreased from 10 ppb in August 1987 to less than 1 ppb in May, 1988 and 2 ppb in December, 1988. At MW-15, located adjacent to the concrete wastewater tank at Building R, an overall decreasing trend in the maximum concentrations was observed between August 1987 (4450 ppb), May 1988 (730 ppb), and December, 1988 (920 ppb). These concentration changes may be due to plume migration, plume heterogeneities or the difference between the dry weather conditions of August 1987 and the wet weather conditions of May and December 1988. The wastewater tank was pumped out in January 1989 and is no longer in use.

At MW-21, atrazine was observed at concentrations in May (300 & 454 ppb) and in December (91 ppb) which were at least 10 times greater than the levels in wells located upgradient in the loading dock area. The concentration pattern suggests that the elevated atrazine values at MW-21 are due to suspected releases from the concrete sump and/or piping in the northwest corner of Building D.

The 1988 atrazine results also showed a continuing trend of elevated atrazine levels at MW-1, MW-6, MW-18 and MW-19.

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TABLE 3 - RESULTS OF ATRAZINE ANALYSES (ug/l) OF GROUND WATER

CIBA-GEIGY GREENSBORO FACILITY

SAMPLE LOCATION	October 30, 1986	January 15, 1987
MW-1	15/36	15/20
MW-2	<2/<1	-
MW-3	<1/<1	-
MW-4	-	-
MW-5	<1/<1	-
MW-6	63/250	150/190
MW-7	<2/<1	-
MW-8	<2/<1	-
MW-9	<2/<1	-
MW-10	-	-
MW-11	-	-
MW-12	-	-
MW-13	-	-
MW-14	-	-
MW-15	-	-
MW-16	-	-
MW-17	-	-
MW-18	-	-
MW-19	-	-
MW-20	-	-
MW-21	-	-

TABLE 3 - RESULTS OF ATRAZINE ANALYSES (ug/l) OF GROUND WATER (con't)

CIBA-GEIGY GREENSBORO FACILITY

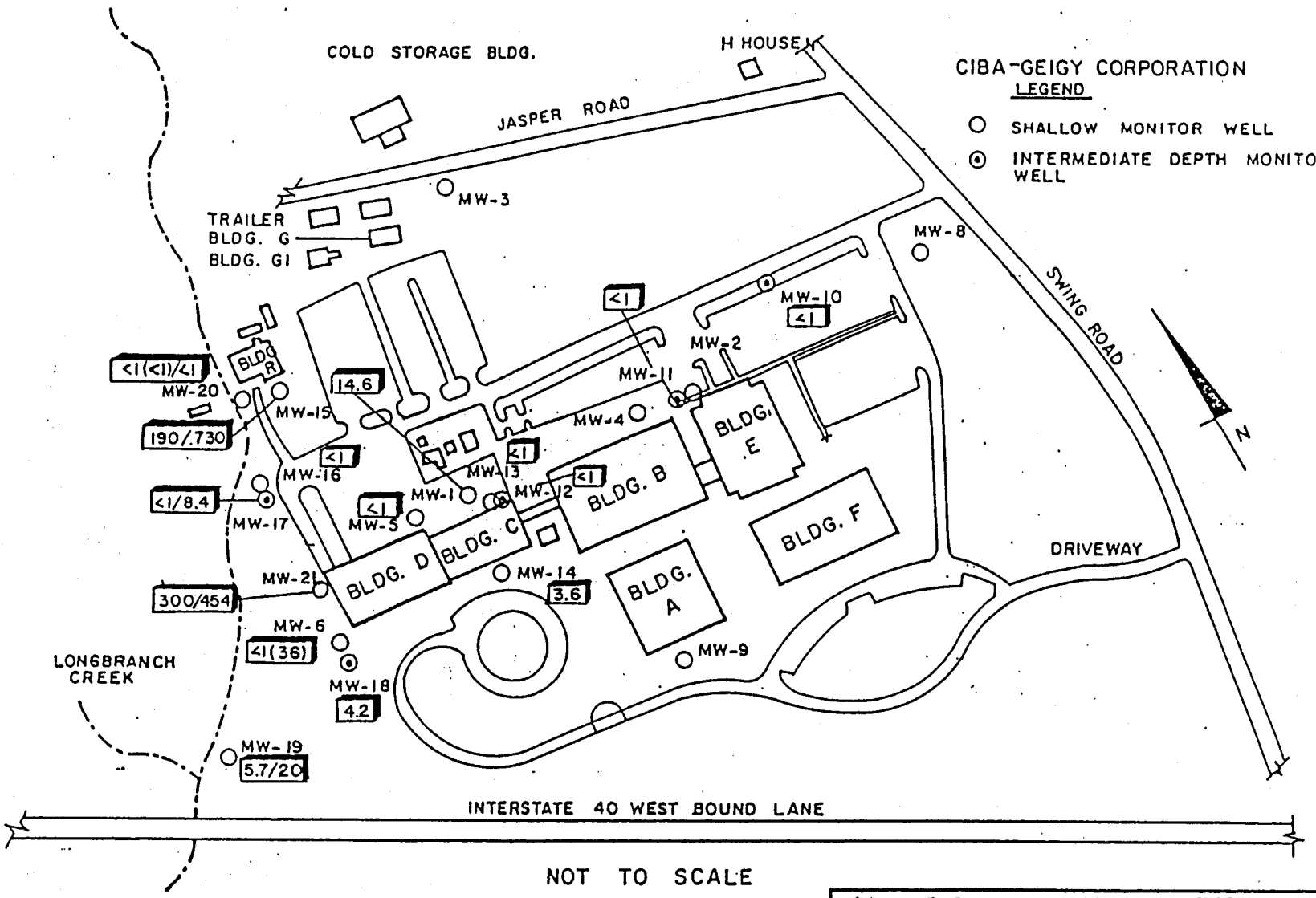
SAMPLE LOCALTION	August 5 & 6, 1987	May 17 & 18 1988
MW-1	11/18.8 (19.2)	14.6
MW-2	<1	-
MW-3	-	-
MW-4	BQL	-
MW-5	<1	<1
MW-6	120(120)/116 (91,166)	<1(36)
MW-7	-	-
MW-8	BQL	-
MW-9	-	-
MW-10	BQL	<1
MW-11	BQL	<1
MW-12	<1 (<1)/<1 (<1)	<1
MW-13	10	<1
MW-14	BQL	3.6
MW-15	3500/2892 (3024,4450)*	190/730(680)
MW-16	5.4	<1
MW-17	3.5 (3.4)	<1/8.4
MW-18	<1/1.5	4.2
MW-19	3.0	5.7/20
MW-20	-	<1/<1
MW-21	-	300/454(360)

TABLE 3 - RESULTS OF ATRAZINE ANALYSES (ug/l) OF GROUND WATER (con't)

CIBA-GEIGY GREENSBORO FACILITY

SAMPLE LOCATION	December 28 - 29, 1988
MW-1	7
MW-2	-
MW-3	-
MW-4	-
MW-5	<1(<1)
MW-6	112
MW-7	-
MW-8	-
MW-9	-
MW-10	<1
MW-11	<1(<1)
MW-12	<1
MW-13	2(<1)
MW-14	-
MW-15	920
MW-16	<1(<1)
MW-17	<1
MW-18	6(5)(2)
MW-19	7(4)
MW-20	<1(<1)
MW-21	91

NOTES: Analysed by IEA Lab, Cary, NC.
Results of duplicate analyses shown in parentheses.
Results of split sample analyses shown separated by slash (IEA Lab/C-G Lab).
BQL = Below Quantitation Levels.
Dash (-) denotes sample was not collected.
* Samples collected one day apart. Not true split sample.



CIBA-GEIGY CORPORATION

LEGEND

- ○ SHALLOW MONITOR WELL
- ⊙ INTERMEDIATE DEPTH MONITOR WELL

NOT TO SCALE

NOTES:

Concentrations in ppb.

Results of split sample analyses shown separated by slash (IEA/C-G).

Results of duplicate analyses shown in parentheses.

FIGURE 9-ATRAZINE ANALYSES
GROUND WATER
MAY 17-18, 1988

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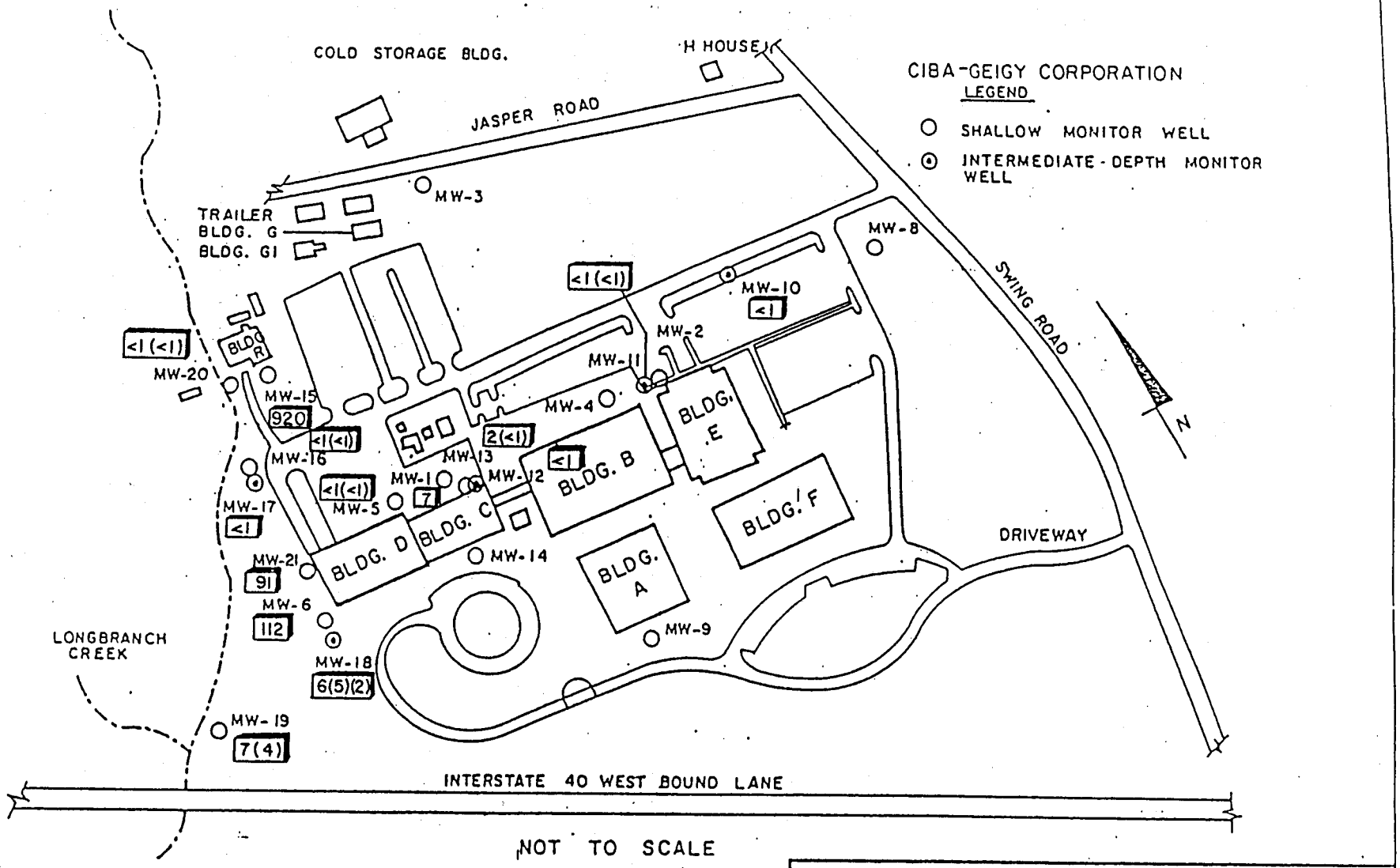
Environmental Resources Management



NOTES:

Concentrations in ppb.

Results of duplicate analyses shown in parentheses

FIGURE 10-ATRAZINE ANALYSES
GROUND WATER
DECEMBER 28-29, 1988

ERM-Southeast, Inc.
Environmental Resources Management

Section 5

SURFACE WATER MONITORING

Stream samples were collected from Long Branch Creek at three stations (LL, Pump Station & Wendover Rd.) for atrazine and purgeable halocarbon analyses. The sampling stations are shown in Figure 11. Some of the December stream samples were destroyed in the laboratory. Consequently, the three stream stations were resampled in March 1989. Atrazine analyses of the May 1988 and March 1989 stream samples are summarized in Table 4. The laboratory data sheets may be referenced in Appendices G and H.

The May 1988 analytical results, collected during wet weather conditions, are nearly identical to the August 1987 results, collected during dry weather conditions. All of the May 1988 stream samples show atrazine concentrations below the proposed EPA health advisory concentration of 3 ppb.

Analyses of stream samples collected in December 1988 showed apparently anomalous results. The atrazine concentrations were less than 1 ug/l at the CIBA-GEIGY property line (LL) and two miles downstream at the Wendover Road bridge. However, elevated atrazine concentrations were reported 3/4 mile downstream of the site at the "Pump Station". The duplicate samples collected for analysis by CIBA-GEIGY laboratories for quality control purposes were destroyed in the laboratory. Without the duplicate sample analyses, CIBA-GEIGY considers the unusual results of the December stream samples to be inconclusive. ERM-Southeast personnel resampled the three stream stations in duplicate on March 15 to provide verification of stream quality. The duplicate samples were sent to IEA Labs, Inc. and CIBA-GEIGY labs.

The March stream analyses (Table 4) indicate slightly elevated atrazine concentrations at "LL" (6 & 13) ug/l which decrease downstream at the Pump Station (3 & 2 ug/l) and at Wendover Road (<1 & <1 ug/l). There is sufficient correlation between the results from the two laboratories to provide data verification.

All of the May and December 1988 stream samples indicate purgeable halocarbon concentrations below quantitation limits (Appendices I and J).

The stream flow measured at the LL weir at the time of sampling was approximately 651 gallons per minute on May 18, 1988 and 70 gallons per minute on March 15, 1989.

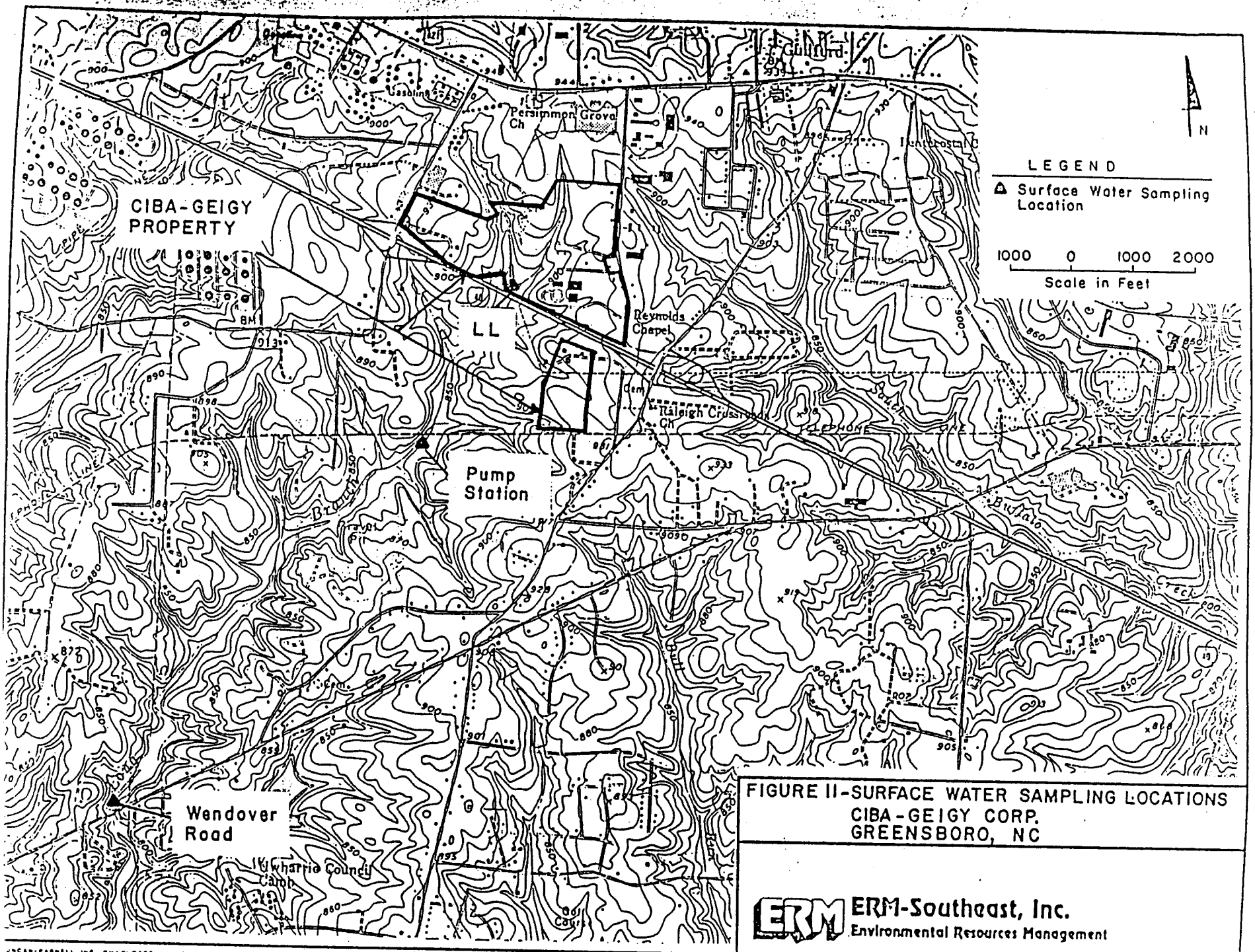


FIGURE II-SURFACE WATER SAMPLING LOCATIONS
CIBA-GEIGY CORP.
GREENSBORO, NC

ERM-Southeast, Inc.
Environmental Resources Management

TABLE 4 - RESULTS OF ATRAZINE ANALYSES (ug/l) OF SURFACE WATER AT LONG BRANCH CREEK

CIBA-GEIGY GREENSBORO FACILITY

SAMPLE STATION	July 24, 1986 (1)	October 30, 1986 (2)	January 18, 1987 (3)	August 6, 1987 (4)	May 18, 1988 (3)
"UU" - Weir Upstream of Bldg. R in Creek	-	-	<1/<1	-	-
'GG" - Discharge from 48" Conc. Culvert to Creek	11/7	-	7/6	-	-
'RR" - Discharge from 42" Conc. Culvert to Creek	2/2	-	1/<1	-	-
'BB" - Discharge from 24" Concrete Culvert to Creek	14/9	-	22/28	-	-
XX" - Culvert under Jogging Track in Creek	15/6	9/16	13/15	-	-
LL" - Weir at I-40 Culvert in Creek	1/2	1/2	6/7	<1/<1 (<1)	<1/1.2
'ump Station" - In Creek at Sewage Pump Station (3/4 mile dowstream of "LL")	-	-	-	<1/1.4(1.5)	<1(<1)/1.6
lendover" - In Creek at lendover Rd. Bridge (2 miles downstream of "LL")	-	-	-	<1/<1 (<1)	<1/<1

NOTES:
(1) Dry weather conditions. Split samples analysed by Radian and CIBA-GEIGY Labs (Radian/C-G).
(2) Dry weather conditions. Split samples analysed by Radian and CIBA-GEIGY Labs (Radian/C-G).
(3) Wet weather conditions. Split samples analysed by IEA and CIBA-GEIGY Labs (IEA/C-G).
(4) Dry weather conditions. Split samples analysed by IEA and CIBA-GEIGY Labs (IEA/C-G).
(5) Dash denotes sample was not collected or not analyzed.
(6) Results of repeat analyses shown in parentheses.

Con't

TABLE 4 - RESULTS OF ATRAZINE ANALYSES (ug/l) OF SURFACE WATER AT LONG BRANCH CREEK

CIBA-GEIGY GREENSBORO FACILITY

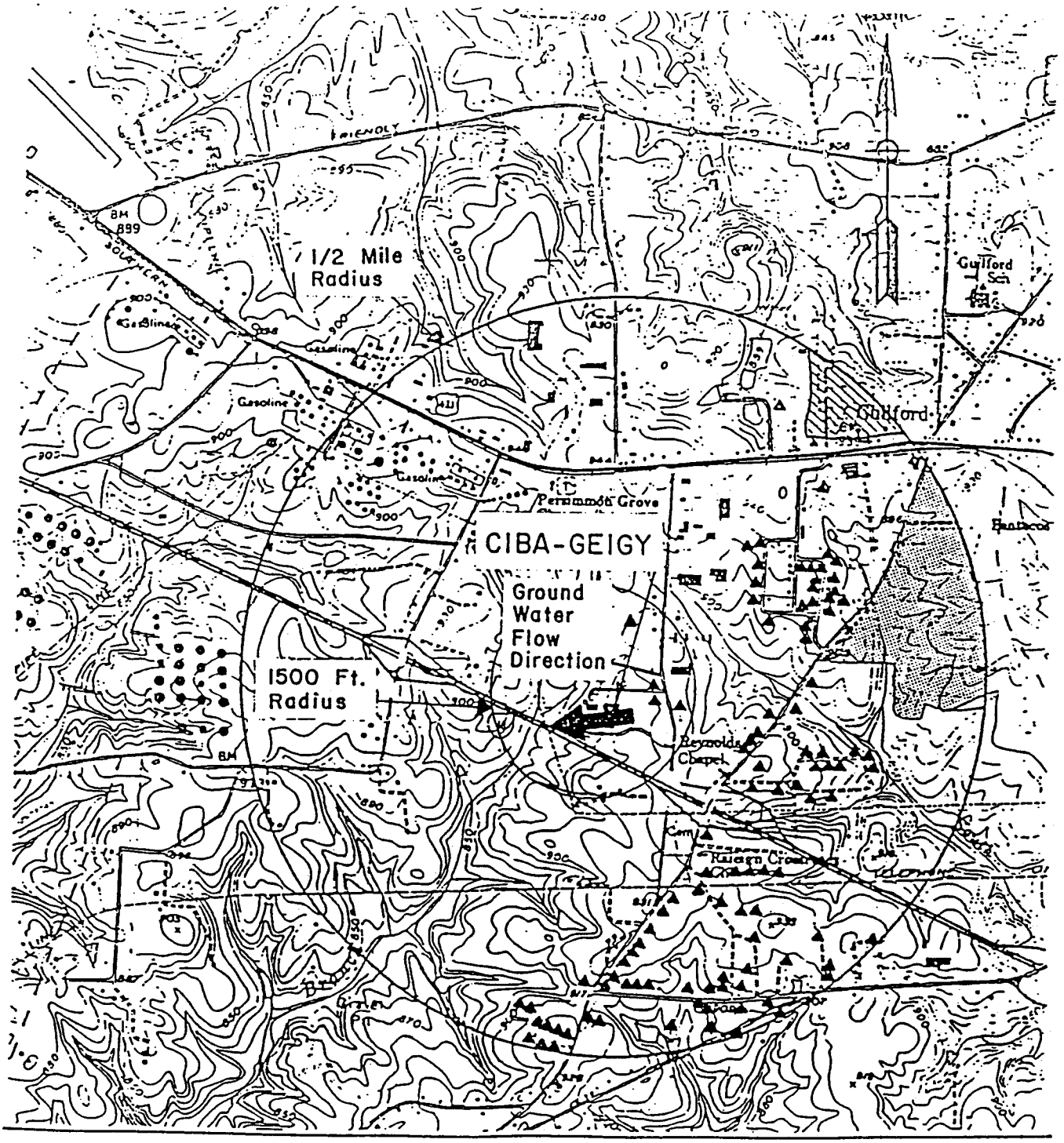
SAMPLE STATION	March 15, 1989 (3)
"UU" - Weir Upstream of Bldg. R in Creek	-
"GG" - Discharge from 48" Conc. Culvert to Creek	-
"RR" - Discharge from 42" Conc. Culvert to Creek	-
"BB" - Discharge from 24" Concrete Culvert to Creek	-
"XX" - Culvert under Jogging Track in Creek	-
"LL" - Weir at I-40 Culvert in Creek	13/6
"Pump Station" - In Creek at Sewage Pump Station (3/4 mile downstream of "LL")	1.0(2.0)(1.4)/3(3)
"Wendover" - In Creek at Wendover Rd. Bridge (2 miles downstream of "LL")	<1 / <1

NOTES: (1) Dry weather conditions. Split samples analysed by Radian and CIBA-GEIGY Labs (Radian/C-G).
(2) Dry weather conditions. Split samples analysed by Radian and CIBA-GEIGY Labs (Radian/C-G).
(3) Wet weather conditions. Split samples analysed by IEA and CIBA-GEIGY Labs (IEA/C-G).
(4) Dry weather conditions. Split samples analysed by IEA and CIBA-GEIGY Labs (IEA/C-G).
(5) Dash denotes sample was not collected or not analyzed.
(6) Results of repeat analyses shown in parentheses.

Section 6

WATER WELL SURVEY

In accordance with the Special Order by Consent, a field reconnaissance survey to locate the additional ground water supply wells within a 1500 foot radius of the CIBA-GEIGY property was conducted by ERM-Southeast personnel on March 30, 1989. The survey was conducted to verify information obtained from a previous well inventory conducted as part of a RCRA Part B permit application. The identified water well locations are shown in Figure 12. One previously unidentified well was located at the Salem Truck Leasing Corporation on Burnt Poplar Road. An interview with an employee of the company revealed that the facility had switched from using well water to the city water supply during 1988. All of the water wells within a 1500 foot radius of the CIBA-GEIGY source areas are located upgradient of the site.



- residential area containing approx. 17 water wells

- residential area containing approx. 155 water wells

△ - water wells

1000 0 1000 2000

Approximate Scale in Feet

Adapted from map in CIBA-GEIGY's RCRA Part B Permit application, 1988.

WELL LOCATION MAP

CIBA-GEIGY CORP.

GREENSBORO, N.C.

FIGURE 12

ERM-Southeast, Inc.

Environmental Resources Management

Section 7

CONCLUSIONS

The investigative activities conducted in 1988 at the CIBA-GEIGY Greensboro facility have resulted in the following conclusions:

(1) The results of the soil vapor survey indicate that the source of the elevated volatile organics in the MW-1 ground water is not due to an adjacent surface release. No substantial levels of volatile organics were observed in the unsaturated soils within the soil vapor survey area. If a surface release had occurred outside the survey area and upgradient (east) of MW-1, then it would be reasonable to expect PCE, TCE and TCA to be found at MW-12 and MW-13, which is not the case. The evidence indicates the nature of the source to be a subsurface release at the depth of the water table in an area near MW-1. Such a release could have resulted from a leaky sewerline. The sanitary sewer line near MW-1 was replaced in 1987. Remediation of surface soils in the vicinity of MW-1 is considered unwarranted.

(2) The water level elevation data from the monitor well network shows that ground water flow is westward toward Long Branch Creek. The water levels were generally lower in December than in May. At Long Branch Creek in the area of piezometer wells PW-1 and PW-2, a downward vertical flow potential was measured in March between the shallow and intermediate depth zones of the uppermost aquifer. The vertical hydraulic gradient appears to exceed the horizontal hydraulic gradient. The piezometric data indicates that, during the early spring season, Long Branch Creek recharges the shallow aquifer. Quarterly monitoring of ground water elevations during the next year will be conducted to verify this conclusion.

(3) The ground water analyses indicate a volatile organic plume extending along a centerline from MW-1 to MW-5 to MW-21. The primary plume constituents are PCE, DCE and TCA. The leading edge of the plume has reached MW-19, as indicated by the first appearance of PCE at that location. An overall trend of gradually increasing concentrations of volatile organics is observed at MW-1, MW-5, MW-6, and MW-18. However, the concentrations decreased substantially at MW-21 between May and December.

The levels of volatile organic contaminants in MW-18, (an intermediate depth well) were found to be lower for those same compounds in MW-6, (the adjacent shallow well). However, the volatile concentrations are increasing in MW-18 at a greater rate than in MW-6.

We interpret these data to indicate that the plume has migrated laterally at a greater rate within the upper zone of the saprolite aquifer than in the lower zone. The vertical plume front has reached the lower zone of the saprolite at MW-18 after the passage of the lateral plume front at MW-6.

Relatively low levels of t,1,2-DCE are observed in MW-20, which is located downgradient of the concrete wastewater tank at Building R. However, no t,1,2-DCE was observed at the same shallow depth in MW-15 located immediately adjacent to the concrete wastewater tank. Thus, the source of t,1,2-DCE does not appear to be the concrete wastewater tank. The wastewater tank is scheduled for removal in the summer of 1989.

(4) Two separate atrazine plumes occur at the site. Elevated atrazine levels were observed in MW-21, located immediately downgradient of the wastewater sump in Building D. Only trace levels of atrazine are found in monitor wells located upgradient of the sump. The atrazine distribution pattern indicates that the Building D sump and/or its associated piping is an apparent source of one atrazine ground water plume. The elevated levels of atrazine observed at MW-6 are also believed to be attributable to releases from the Building D sump. The intermediate-depth well, MW-18, located adjacent to MW-6 shows only trace levels of atrazine. It was concluded that the atrazine plume migrates preferentially along a horizontal path through the upper zone of the saprolite aquifer and vertical migration to the lower zone is at a slower rate.

The second occurrence of elevated atrazine was observed at MW-15 which is located within the same excavation as the concrete tank at Building R. It is apparent that the observed atrazine was the result of releases from the concrete tank. However, no quantifiable levels of atrazine were observed immediately downgradient at MW-20. Therefore, the atrazine ground water contamination in this area appears to be localized.

(5) The stream samples from Long Branch Creek continue to indicate no quantifiable levels of volatile organic compounds. Thus, there are no apparent impacts to the stream quality resulting from the volatile organic plume.

(6) The May 1988 atrazine concentrations in Long Branch Creek were below the proposed EPA health advisory limit of 3 ppb for all three sampling stations. In March 1989, atrazine concentrations ranged from 6 to 13 ug/l in Long Branch Creek at the CIBA-GEIGY property line. The March atrazine concentrations decrease downstream to levels which do not exceed the proposed Environmental Protection Agency maximum contaminant level for drinking water of 3 ug/l. Thus, there are no significant impacts to the stream quality resulting from the two atrazine plumes.

(7) A survey of water wells within a 1500 foot radius of the contaminant sources identified four wells. All four wells are located upgradient (north and east) of the source areas. There are no identified downgradient ground water receptors within 1500 feet of the site.

A Remedial Action System (RAS) report will be prepared describing the design and operational characteristics of a proposed ground water remediation system. Negotiations are currently underway with City of Greensboro officials to obtain a permit to discharge the pre-treated effluent to the POTW. The RAS report will be submitted in accordance with the schedule described in the Special Order of Consent.