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REPORT OF SITE INVESTIGATIONS
WESTCHESTER COLPROVIA CORPORATION
BEDFORD, NEW YORK

NOVEMBER 23, 1987

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1.0 BACKGROUND

Westchester Colprovia Corporation operates an asphalt production plant located in the Town of Bedford, Westchester County, New York. The asphalt production area is limited to the western portion of the property. This area is bordered on the southeast by a New York State correctional facility, on the southwest by Colonial Sand and Gravel and on the north by watershed property owned by New York City. Figure 1-1 provides a site map.

In December 1986, Geraghty & Miller, Inc. installed monitoring wells at Colonial Sand and Gravel. The monitoring wells and Westchester Colprovia's production well were sampled and analyzed for volatile organics, chlorides, nitrate, sulfate, alkalinity, petroleum hydrocarbons and priority pollutant metals. Of concern was the 1400 ug/l level of trichloroethylene (TCE) detected in monitoring well MW-3, near the Westchester Colprovia property line. While TCE was not detected in the other samples on Colonial's property, other organics were. Water level data gathered by Geraghty & Miller indicated ground water flow on the Colonial Sand and Gravel property generally to be to the north.

In anticipation of the sale of its property, Westchester Colprovia retained Malcolm Pirnie to explore the relationship of the TCE contamination to its property. Ground water flow and quality were to be studied to determine hydrogeological conditions in this regard.

201
2
320 elwiler
415
5
7

2.0 INVESTIGATIONS

2.1 PHASE I GROUND WATER INVESTIGATION

After review of available data, Malcolm Pirnie installed six ground water monitoring wells to further define the hydrogeological conditions at Westchester Colprovia and Colonial Sand and Gravel. Wells W-1, W-3, W-4 and W-5 were installed on Westchester Colprovia property and W-2 and W-7 on Colonial Sand and Gravel property. Well W-3 and W-4 constitute a cluster with W-3 being the deeper well. Well logs are provided in Appendix A. Approximate locations of the monitoring wells are shown on the site map (Figure 1-1). A survey of the wells on both properties was conducted so ground water contours could be estimated.

During installation of monitoring wells W-1, W-3, W-5 and W-7, soil samples were collected and analyzed for priority pollutant volatile organics. On May 21, 1987, ground water sampling was conducted and water level measurements were taken for monitoring wells at both sites. Ground water samples were collected from W-1, W-2, W-3, W-4, W-7, and MW-3 and analyzed by Enviro-^{not} test Labs for priority pollutant volatile organic compounds (VOCs), priority pollutant metals, total petroleum hydrocarbons, chloride, sodium, and calcium. Samples for metal analysis were filtered in the field. Temperature, pH, and conductivity measurements were made in the field. Results of ground water analyses and soil analyses are provided in Tables 2-1 and 2-2. Based on the ground water elevations and site topography, water table contours were interpolated. These are shown on Plate 1, at the end of this report. ^{not W5}

Slug testing of monitoring wells was conducted on June 8, 1987. Slug testing refers to a specific type of in-situ permeability test where a known volume of water is either added or removed from a monitoring well and the time drawdown or recovery of the water level is monitored. The time drawdown data acquired from the slug tests are provided in Appendix B. Estimates of hydraulic conductivity were derived from the time drawdown data using the Hvorslev (1951) method which has been expanded to include a variety of field situations by NAVFAC (1971), Cedergren (1977) and Bouwer and Rice (1976). These estimates are listed in Table 2-3.

FIGURE 1-1

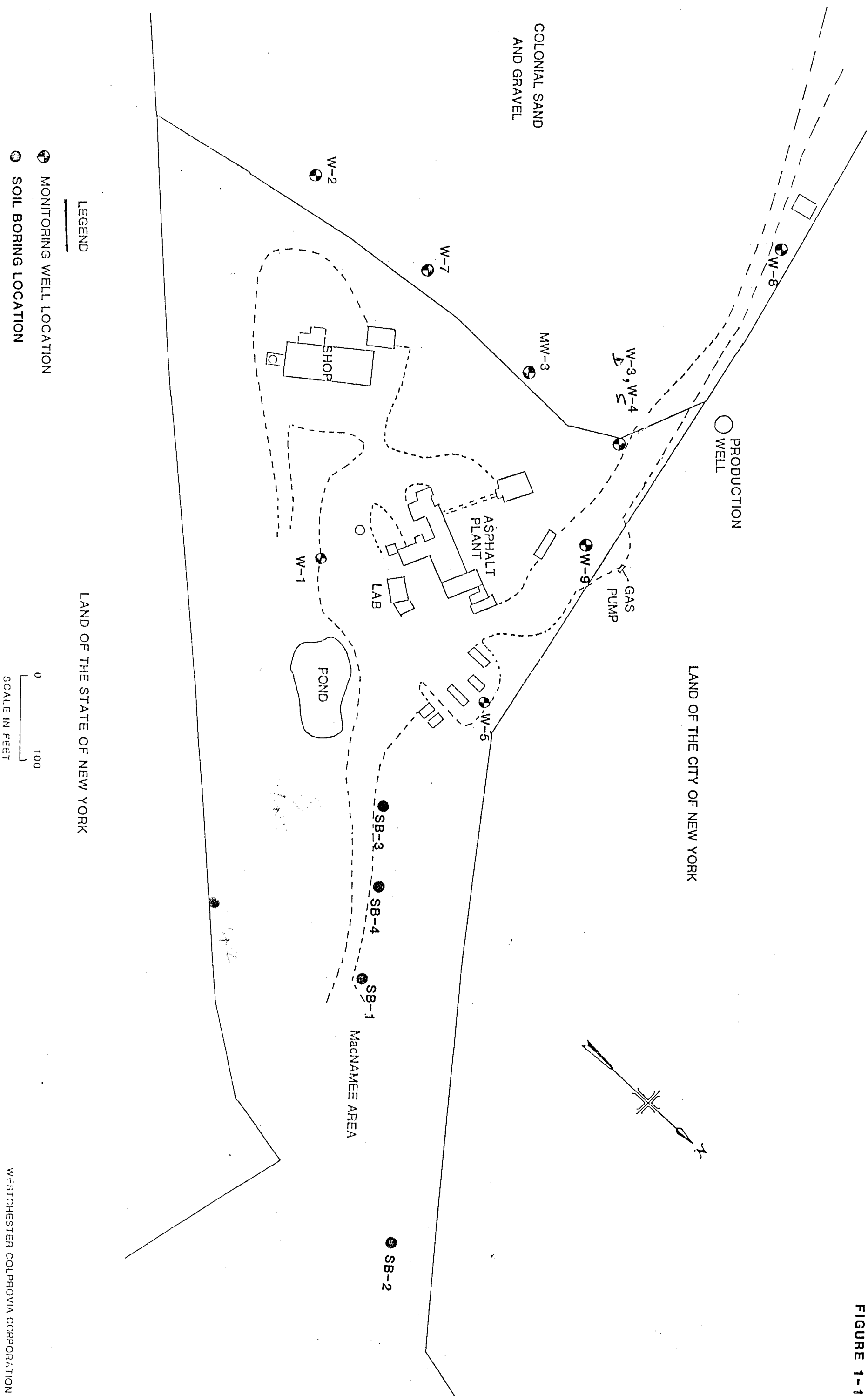


TABLE 2-1

WESTCHESTER COLPROVIA
GROUND WATER SAMPLING RESULTS
MAY 21, 1987Volatile Organic Analyses
(ug/l)

<u>Volatile Organic Compound</u>	<u>Sample ID</u>						<u>Field</u>	<u>Trip</u>
	<u>W-1</u>	<u>W-2</u>	<u>W-3</u>	<u>MW-3</u>	<u>W-4</u>	<u>W-7</u>	<u>Blank</u>	<u>Blank</u>
Chloromethane								
Bromomethane								
Vinyl Chloride								
Chloroethane								
Methylene Chloride								
Acetone								
Carbon Disulfide		4.0		5.7				
1,1-Dichloroethene								
1,1-Dichloroethane								
Trans-1,2-Dichloroethene								
Chloroform								
1,2-Dichloroethane								
2-Butanone								
1,1,1-Trichloroethane				3.8				
Carbon Tetrachloride								
Vinyl Acetate								
Bromodichloromethane								
1,2-Dichloropropane								
Trans-1,3-Dichloropropene								
Trichloroethene		34		1570		220		
Dibromochloromethane								
1,1,2-Trichloroethane			13	5.2				
Benzene								
cis-1,3-Dichloropropene								
2-Chloroethylvinylether								
Bromoform								
4-Methyl-2-Pentanone								
2-Hexanone		5.7						
Tetrachloroethene				7.6		4.5		
1,1,2,2-Tetrachloroethane								
Toluene								
Chlorobenzene								
Ethylbenzene			2.7	1.7				
Styrene								
Total Xylenes			5.5					

Note:

A blank space indicates the compound was analyzed for but not detected.
Trichloroethene is synonymous with trichloroethylene.



TABLE 2-1

WESTCHESTER COLPROVIA
GROUND WATER SAMPLING RESULTS
MAY 21, 1987 (Continued)

Total Petroleum Hydrocarbons
(ug/l)

Sample ID	<u>W-1</u>	<u>W-2</u>	<u>W-3</u>	<u>MW-3</u>	<u>W-4</u>	<u>W-7</u>	<u>Field Blank</u>
				93			

Inorganic Analyses
(ug/l)

	<u>W-1</u>	<u>W-2</u>	<u>W-3</u>	<u>MW-3</u>	<u>W-4</u>	<u>W-7</u>	<u>Field Blank</u>
Antimony							
Arsenic							
Beryllium							
Cadmium							
Calcium	46,000	82,000	74,000	162,000	126,000	83,000	
Chlorides	84	42	34	15	46	41	(2
Chromium							
Copper		50			51		
Lead	37			59			
Mercury							
Nickel							
Selenium							
Silver							
Sodium	48,000	22,000	20,000	70,000	113,000	20,000	
Thallium							
Zinc	119	109	88	114	254	95	

Note:

A blank space indicates the compound was analyzed for but not detected.

Parameters Measured in the Field

	<u>W-1</u>	<u>W-2</u>	<u>W-3</u>	<u>MW-3</u>	<u>W-4</u>	<u>W-7</u>
Temperature (C)	12	12	15	13.5	14	13
Conductivity (umhos/cm)	320	290	370	480	800	390
pH (standard units)	6.0	7.5	6.8	6.0	6.6	7.2

TABLE 2-2

WESTCHESTER COLPROVIA
SOIL SAMPLING RESULTS
MAY 1987

Volatile Organic Analyses
(ug/l)

<u>Sample Depth</u>	<u>Sample ID</u>			
	<u>W-1</u> 16'-17'	<u>W-3</u> 22'-23'	<u>W-5</u> 26'-28'	<u>W-7</u> 10'-11'
<u>Volatile Organic Compound</u>				
Chloromethane				
Bromomethane				
Vinyl Chloride				
Chloroethane				
Methylene Chloride				
Acetone				
Carbon Disulfide				
1,1-Dichloroethene				
1,1-Dichloroethane				
Trans-1,2-Dichloroethene				
Chloroform				
1,2-Dichloroethane				
2-Butanone				
1,1,1-Trichloroethane				
Carbon Tetrachloride				
Vinyl Acetate				
Bromodichloromethane				
1,2-Dichloropropane				
Trans-1,3-Dichloropropene				
Trichloroethene				
Dibromochloromethane				
1,1,2-Trichloroethane				
Benzene				
cis-1,3-Dichloropropene				
2-Chloroethylvinylether				
Bromoform				
4-Methyl-2-Pentanone				
2-Hexanone	11			
Tetrachloroethene				
1,1,2,2-Tetrachloroethane				
Toluene				
Chlorobenzene				
Ethylbenzene	6.9			
Styrene				
Total Xylenes	15			

Note:

A blank space indicates the compound was analyzed for but not detected.

TABLE 2-3

WESTCHESTER COLPROVIA
HYDRAULIC CONDUCTIVITY ESTIMATES

Monitoring Well	Hydraulic Conductivity (K)	
	(cm/sec)	(ft/day)
W-1	7.0×10^{-5}	0.2
W-2	8.0×10^{-5}	0.2
W-3	2.0×10^{-4}	0.5
W-4	8.0×10^{-5}	0.2
W-7	1.0×10^{-4}	0.3

2.2 UNDERGROUND TANK INVESTIGATION

On April 2, 1987, Malcolm Pirnie collected 10 soil samples from the Westchester Colprovia property from three areas where underground storage tanks had been recently removed. A summary description of the samples collected is provided in Table 2-4. The results of the analyses performed are provided in Table 2-5. A map (Figure 2-1) provides sample locations.

Results indicate no residual contamination remains under the motor oil tank (Sample WC-8), 1,000 gallon gasoline tank (Sample WC-9) or 2,000 gallon gasoline tank (Sample WC-10). The other two tank excavation areas show evidence of petroleum hydrocarbons being present. Hydrocarbons in Samples WC-1 through WC-5 were obviously associated with the earlier burial of three crushed tanks in this area. This soil had an oily odor and positive HNU readings were found in the areas of Samples WC-1 and WC-2.

The soil directly under where the gasoline tank had been on the north (WC-6) appeared clean. HNU readings there were negative and there was no odor. A small spill of gasoline was reported to have occurred off the eastern corner of the tank during its emptying. This small area had a strong gasoline odor and positive HNU readings. After further excavation of this area, HNU readings dropped and a sample was taken (WC-7). Since no petroleum hydrocarbons were found in Sample WC-7 and no VOCs -- which would be expected with any gasoline leakage -- were found in either WC-6 or WC-7, overall it does not appear that there is a problem at this area.

2.3 SOIL GAS INVESTIGATION

A shallow soil gas investigation was conducted by Tracer Research Corporation at the Westchester Colprovia Corporation facility on July 13 and 14, 1987. The main purpose was to define better the areal distribution and extent of VOC contamination in the subsurface at the facility and on portions of Colonial Sand and Gravel's property.

For this survey, soil gas samples were taken and analyzed for the following compounds:

- 1,1,1-Trichloroethane (TCA)
- Trichloroethylene (TCE)
- Tetrachloroethene (PCE)

TABLE 2-4
WESTCHESTER COLPROVIA
TANK REMOVAL SAMPLING SUMMARY
April 2, 1987

<u>Sample ID</u>	<u>Area</u>	<u>HNU Readings (ppm)</u>	<u>Description</u>
WC-1	Side of Shop	5-10	Crushed diesel fuel tanks excavation - soil from pile near southern end of hole.
WC-2	Side of Shop	5-10	Crushed diesel fuel tanks excavation - soil from pile near northern end of hole.
WC-3	Side of Shop	BKGD	Crushed diesel fuel tanks excavation - soil removed from the southeast corner of the hole, approximately 12 feet deep.
WC-4	Side of Shop	BKGD	Crushed diesel fuel tanks excavation soil removed from the southwest corner of the hole, approximately 12 feet deep.
WC-5	Side of Shop	BKGD	Crushed diesel fuel tanks excavation - composite of soil removed from the northeast and northwest corners of the hole, approximately 12 feet deep.
WC-6	Entrance Road	BKGD	4,000 gallon gas tank excavation - composite from ten locations of soil that had been in contact with the bottom of the tank, approximately 10 feet deep.
WC-7	Entrance Road	10	4,000 gallon gas tank excavation - composite from eastern portion of excavation, after further excavation to approximately 15 feet deep.

TABLE 2-4
WESTCHESTER COLPROVIA
TANK REMOVAL SAMPLING SUMMARY (Continued)
April 2, 1987

<u>Sample ID</u>	<u>Area</u>	<u>HNU Readings (ppm)</u>	<u>Location/Description</u>
WC-8	Front of Shop	BKGD	Excavation north of shop - composite from five locations under the motor oil tank.
WC-9	Front of Shop	BKGD	Excavation north of shop - composite from five locations under the 1,000 gallon gasoline tank.
WC-10	Front of Shop	2-5	Excavation north of shop - composite from five locations under the 2,000 gallon gasoline tank.

Note:

BKGD = Background

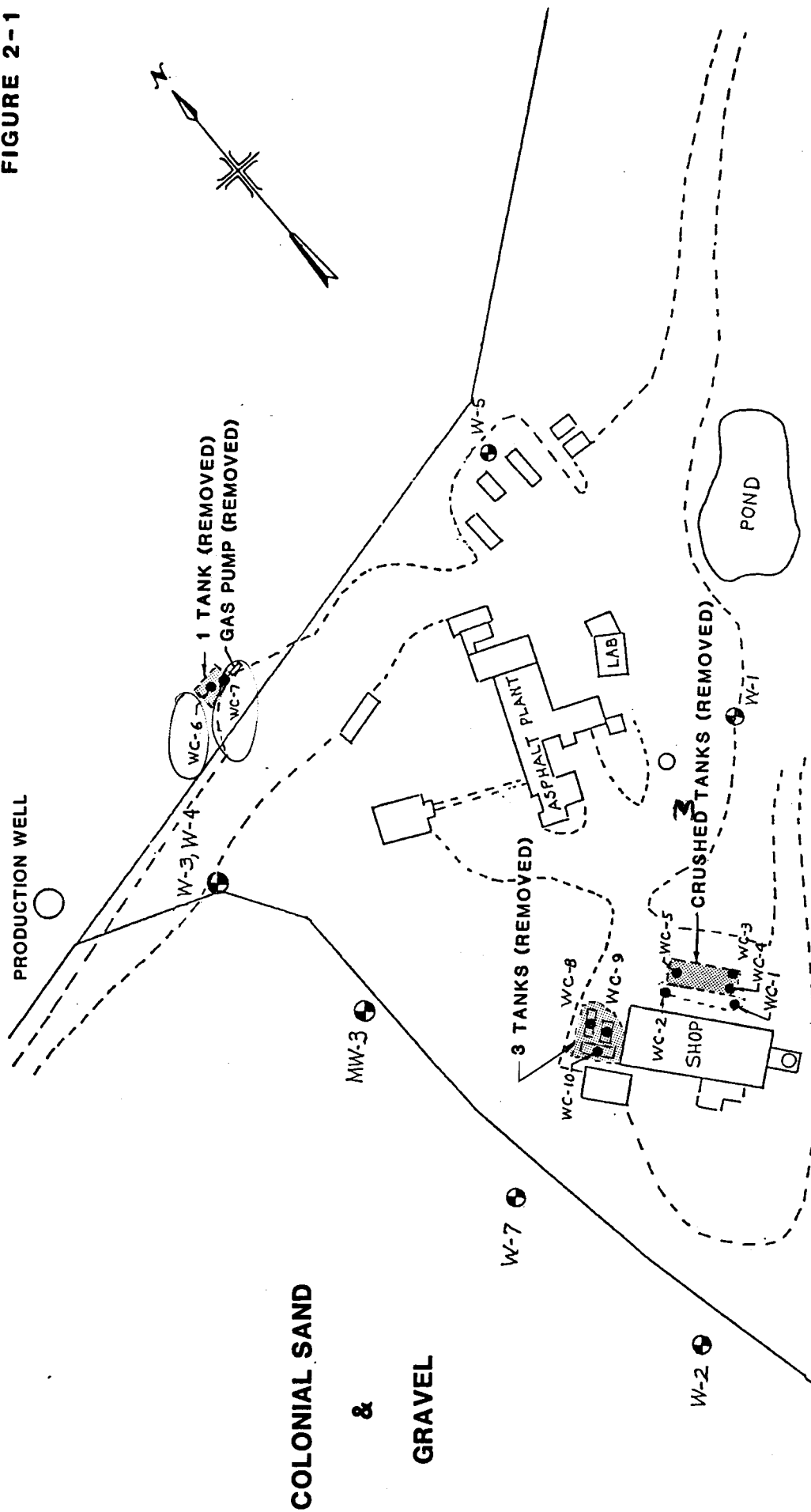
TABLE 2-5

WESTCHESTER COLPROVIA
TANK SOIL SAMPLING RESULTS
APRIL 2, 1987

	<u>WC-1</u>	<u>WC-2</u>	<u>WC-3</u>	<u>WC-4</u>	<u>WC-5</u>	<u>WC-6</u>	<u>WC-7</u>	<u>WC-8</u>	<u>WC-9</u>	<u>WC-10</u>
Polychlorinated Biphenyls (mg/kg)	22	18	31	<10	21	22	<10	<10	<10	<10
pH (pH Units)	7.2	7.1	7.3	7.2	7.5	7.5	7.2	7.3	7.3	7.3
Lead (mg/kg)	0.44	1.0	0.38	0.44	0.19	0.71	0.19	0.06	0.25	0.06
Petroleum Hydrocarbons (mg/kg)	425	1,580	676	4,760	878	1,200	<50	<50	<50	<50
Volatile Organic Compounds (mg/kg)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

*Butene-2, 3-ds
of xylene*

FIGURE 2-1



LEGEND

- SOIL SAMPLE LOCATION
- ⊙ MONITORING WELL LOCATION
- LIMIT OF ROADWAYS AND PAVING

WESTCHESTER COLPROVIA CORP.
BEDFORD, NEW YORK

TANK SAMPLE LOCATION MAP
(not to scale)

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A total of 38 soil gas and one water sample were taken and analyzed during the investigation. Analytical results are condensed in Appendix C. Maps showing the sampling locations and interpolated isoconcentration contours for TCA, TCE, and PCE are provided as Figures 2-2 through 2-4.

2.4 PHASE II GROUND WATER INVESTIGATION

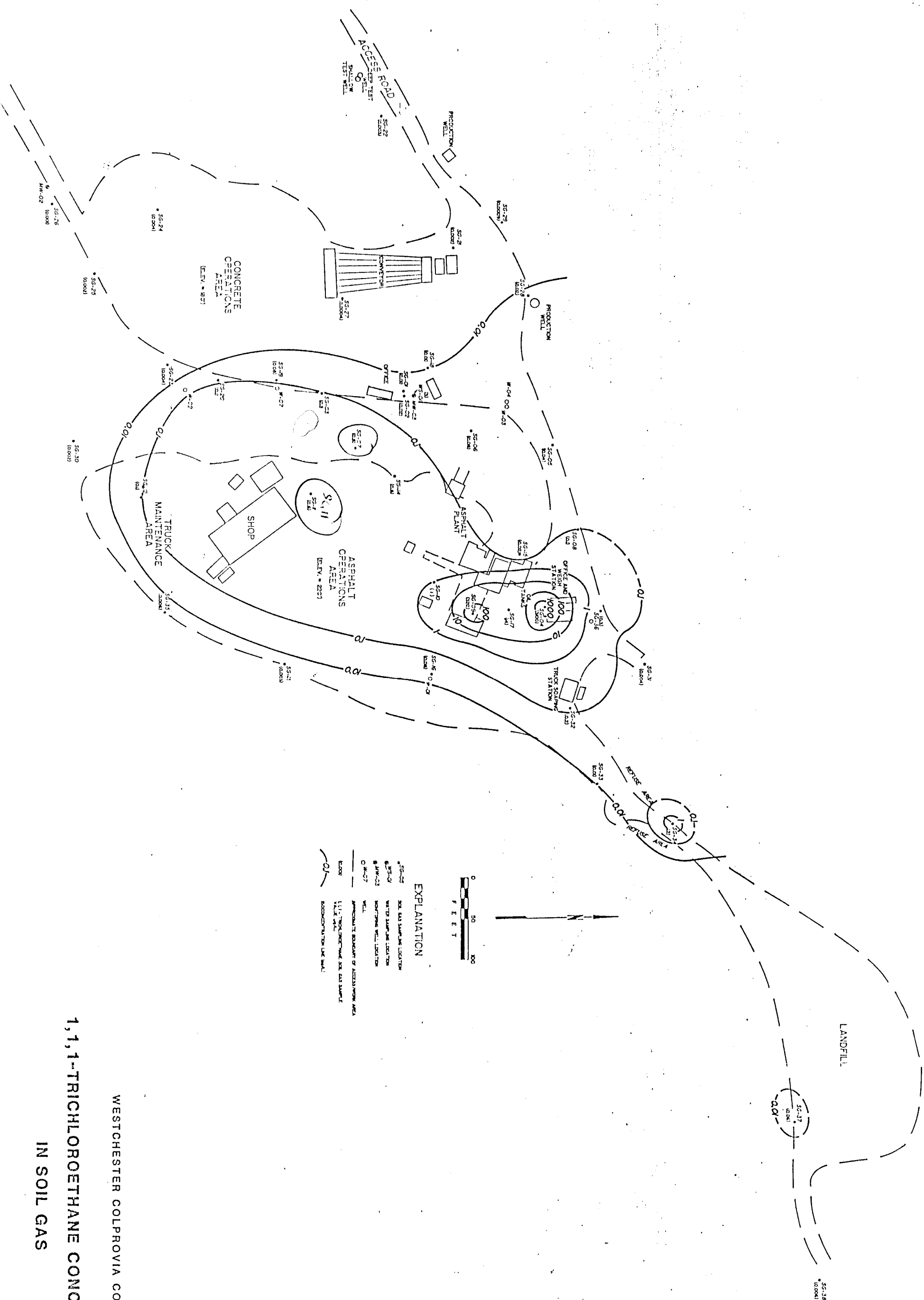
After reviewing the soil gas data gathered by Tracer, it was decided to further investigate the eastern area of the site and areas between downgradient monitoring wells. On August 3 through August 5, 1987, six soil borings were done. In two of these, monitoring wells W-8 and W-9, were installed and developed. W-8 was installed on Colonial Sand and Gravel property. Four soil borings were made in the eastern area of Westchester Colprovia. One of the borings was to be a monitoring well, but bedrock was encountered before ground water, preventing installation of a well. Well logs and soil boring logs are provided in Appendix A. Figure 1-1, the site map, indicates approximate locations of the monitoring wells and borings.

One soil sample was collected from each of the six soil borings. They were analyzed for VOCs at Malcolm Pirnie's laboratory in White Plains. No VOCs were detected in these soil samples at a detection limit of 2 mg/kg.

On August 10, 1987, monitoring wells W-8 and W-9 were sampled for VOCs. Results of analyses performed at Malcolm Pirnie's White Plains laboratory are shown in Table 2-6. No volatile organics were detected in well W-9. Well W-8 was found to have single-digit ppb levels of 1,1,1-trichloroethane; 1,1,2-trichloroethane; bromoform; and 1,1,2,2-tetrachloroethane.

Water level measurements were taken in wells W-4, W-5, W-8, and W-9. These data are provided in Table 2-7 along with previous water levels taken in W-4 and W-5. Water levels in W-4 and W-5 had fallen 5 to 8 feet between May and August. This large change indicates that the ground water levels on the property are quite sensitive to precipitation and is consistent with a small recharge area and relatively high ground water flow rates.

FIGURE 2-2

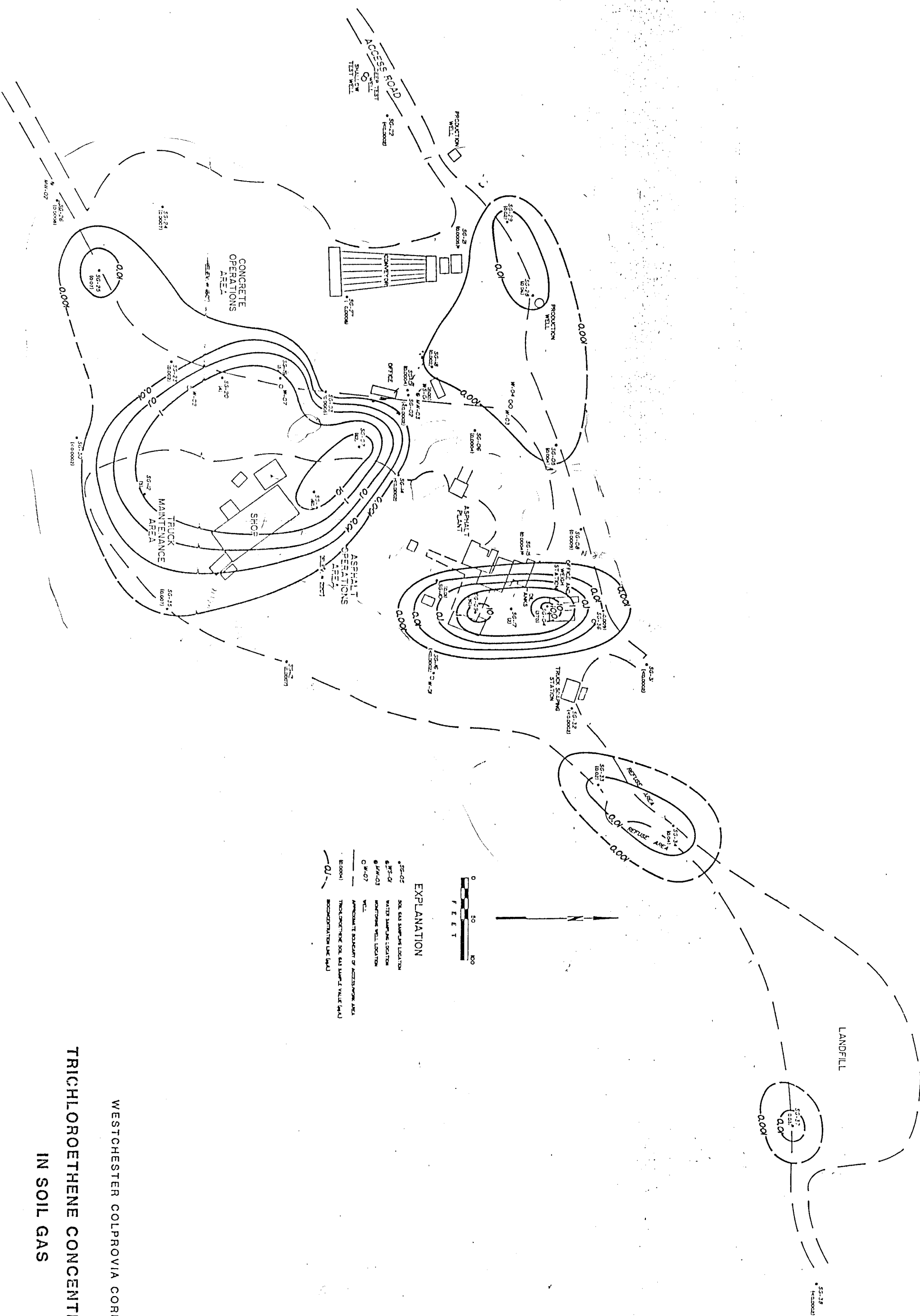


WESTCHESTER COLPROVIA CORP

1,1,1-TRICHLOROETHANE CONCENTRATION

IN SOIL GAS

FIGURE 2-3

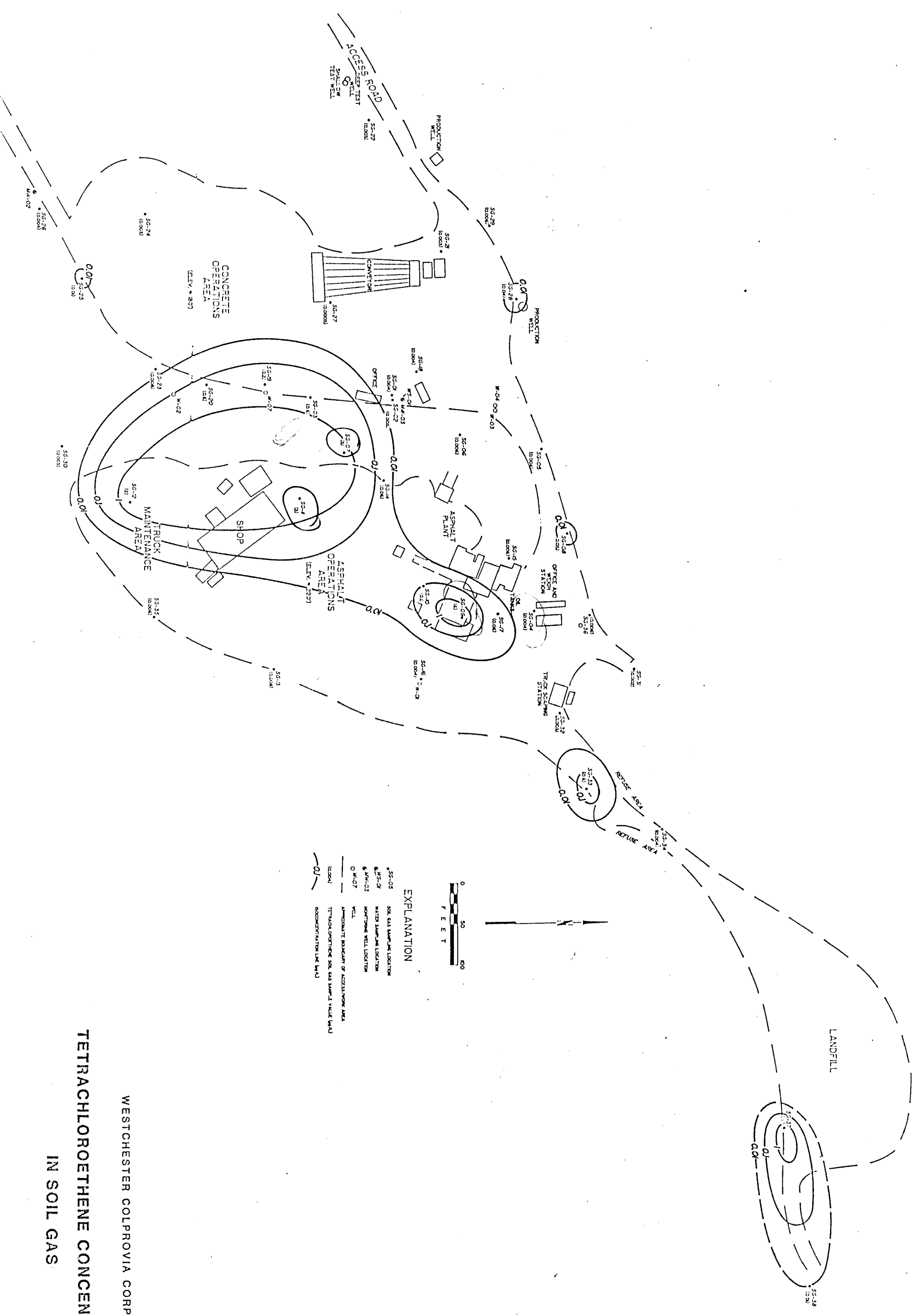


WESTCHESTER COLPROVIA CORP

TRICHLOROETHENE CONCENTRATIONS

IN SOIL GAS

FIGURE 2-4



WESTCHESTER COLPROVIA CORP
TETRACHLOROETHENE CONCENTRATIONS
IN SOIL GAS

TABLE 2-6

WESTCHESTER COLPROVIA
GROUND WATER SAMPLING RESULTS
AUGUST 10, 1987Volatile Organic Analyses (Method 624)
(ug/l)

<u>Volatile Organic Compound</u>	<u>Sample ID</u>			
	<u>W-8</u>	<u>W-9</u>	<u>Field Blank</u>	<u>Trip Blank</u>
Chloromethane				
Bromomethane				
Vinyl Chloride				
Chloroethane				
Methylene Chloride				
Acetone				
Carbon Disulfide				
1,1-Dichloroethene				
1,1-Dichloroethane				
Trans-1,2-Dichloroethene				
Chloroform			7.4	7.6
1,2-Dichloroethane				
2-Butanone				
1,1,1-Trichloroethane	2.3			
Carbon Tetrachloride				
Vinyl Acetate				
Bromodichloromethane				
1,2-Dichloropropane				
Trans-1,3-Dichloropropene				
Trichloroethene				
Dibromochloromethane				
1,1,2-Trichloroethane	3.9			
Benzene				
cis-1,3-Dichloropropene				
2-Chloroethylvinylether				
Bromoform	7.3			
4-Methyl-2-Pentanone				
2-Hexanone				
Tetrachloroethene				
1,1,2,2-Tetrachloroethane	9.2			
Toluene			1.6	2.2
Chlorobenzene				
Ethylbenzene				
Styrene				
Total Xylenes				

Note:

A blank space indicates the compound was analyzed for but not detected.
Trichloroethene is synonymous with trichloroethylene.

TABLE 2-7
WESTCHESTER COLPROVIA CORP.
GROUND WATER ELEVATIONS

<u>Well</u>	<u>August 10, 1987</u>		<u>May 22, 1987</u>
	<u>Depth to Water (Feet)</u>	<u>Water Level Elevation</u>	<u>Water Level Elevation</u>
W-4	32.30	157.80	163.05
W-5	40.20	173.17	181.22
W-8	11.55	-	-
W-9	40.40	-	-

3.0 INTERPRETATION OF FINDINGS

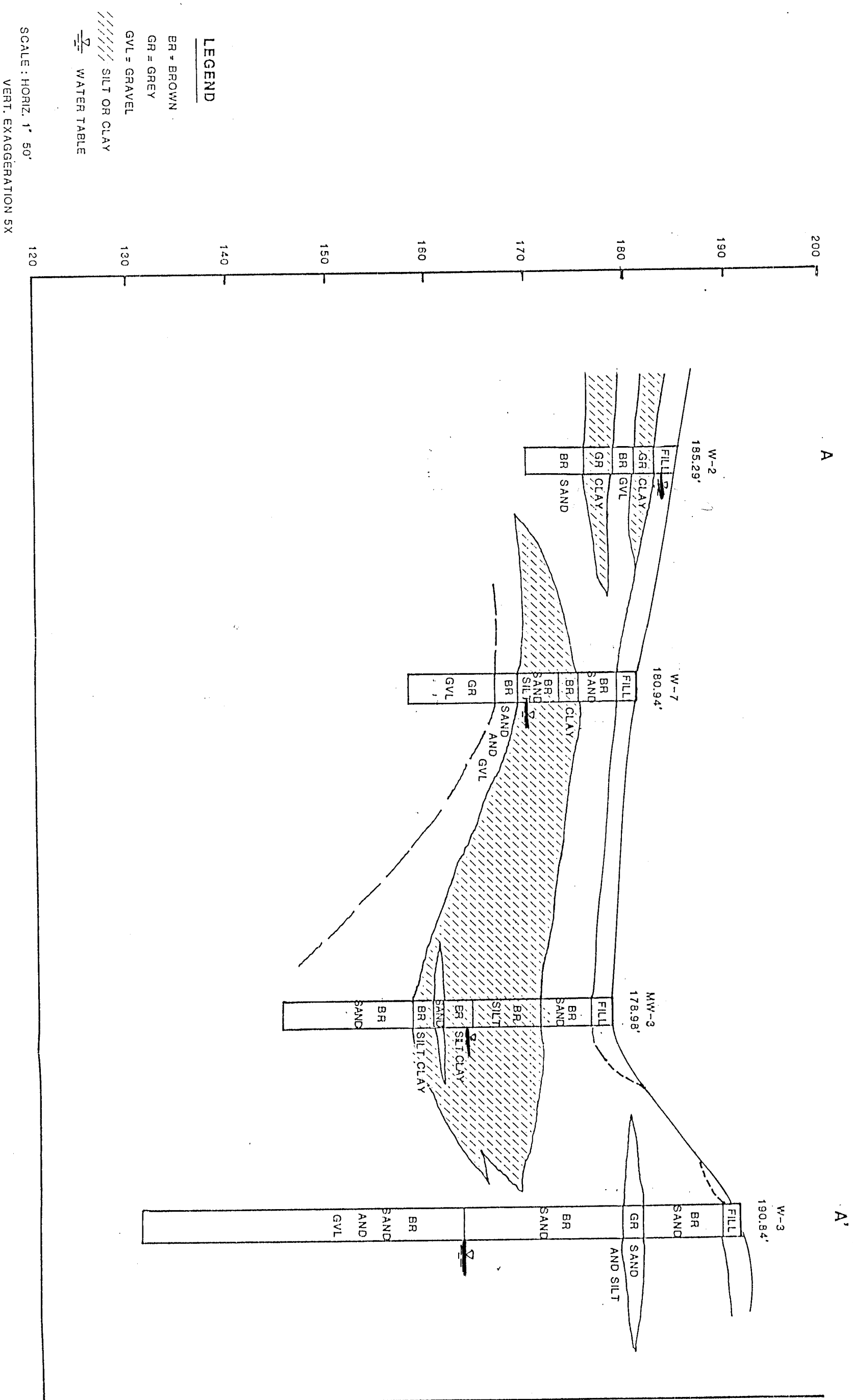
3.1 GROUND WATER FLOW

Sand and gravel were found to make up the majority of the unconsolidated deposits present at Westchester Colprovia. A shallow bedrock ledge was encountered near the base of the embankment leading to the correctional facility. While installing W-1, sand and gravel were found to a depth of 19.5 feet, where rock was encountered. Sand and gravel were present to 28 feet in W-5 and then a sandy silt layer was found to 45 feet, the end of the boring. A fuel oil odor and sheen were evident at approximately 35 feet in W-5. W-3 and W-4 revealed sand and gravel to 60 feet, with traces of silt and clay. The two test wells installed earlier at Colonial Sand and Gravel by Geraghty & Miller encountered similar sand and gravel strata for 71 feet. W-9, installed during Phase II, revealed silty sand to 35 feet and sand and gravel from 35 to 51.5 feet of depth.

Wells installed at Colonial Sand and Gravel, near the Westchester Colprovia property line, revealed some clay and silt deposits in addition to sand and gravel. A geological profile in the area of W-2, W-7, MW-3, W-3 and W-4 is provided on Figure 3-1. Geraghty & Miller recorded silt and clay at MW-3 for approximately ten feet above the water table, which they estimated to occur at 17 feet below the surface. Thinner bands of clay, about two feet thick, were encountered within six feet of the surface while installing W-2 and W-7. Well W-8, installed during Phase II, showed silty gravel and sand to 18 feet.

Hydraulic conductivity estimates for the monitoring wells that were tested are of the order expected for fine sand to silty sand materials. This is consistent with the geological findings of the monitoring well installations.

Ground water elevation patterns were found to be similar to surface topography. Generally, flow is to the north, but along the property line between Westchester Colprovia and Colonial Sand and Gravel, flow follows the steep embankment which slopes down to the west.



3.2 GROUND WATER QUALITY

Results of ground water sample analyses are provided in Tables 2-1 and 2-6. In general, the levels of volatile organics found were low. However, TCE was detected at significant levels in MW-3 (1,570 ug/l), W-2 (34 ug/l), and W-7 (220 ug/l). The value in MW-3 was consistent with that found by Geraghty & Miller in December 1986 (1,400 ug/l). Of the metals analyzed for in ground water, only lead was detected in a significant concentration. The maximum contaminant level for lead in drinking water (USEPA National Interim Primary Drinking Water Regulations) is 50 ug/l. Lead was detected in two of the six wells sampled. It was found in MW-3 at 59 ug/l and in W-1 at 37 ug/l. Geraghty & Miller previously reported lead in MW-3 to be less than the detection limit of 50 ug/l.

The levels of TCE detected in W-2 and W-7 and direction of ground water flow at the two sites do not indicate the principal source of TCE contamination in MW-3 to be on Colonial Sand and Gravel's property. W-1, located upgradient on Westchester Colprovia's property, showed no contamination that might be attributed to the corrections facility. During Geraghty & Miller's sampling, no TCE was detected in Westchester Colprovia's production well which is downgradient of MW-3. During the May 22, 1987 sampling, no TCE was detected in W-3 or W-4, which are also downgradient of MW-3, though they are not directly in the anticipated line of flow, as the production well is. TCE was not detected in W-8 or W-9. It appears that significant contamination has not migrated past the area of investigation towards the east, south, or west.

The results from the shallow soil gas investigation conducted indicate that there are two areas that are possible sources contributing to the ground water contamination underlying the site. The area between the office and the asphalt plant (soil gas sampling locations SG-04 and SG-09) and the area in front of the shop (SG-07 and SG-11) are possible sources of contamination. These locations are shown on Figures 2-2, 2-3, and 2-4.

4.0 PROPOSED PLAN

4.1 INTRODUCTION

Based on the investigatory findings described above it is recommended that actions be taken to remediate ground water contamination on the Colonial Sand and Gravel property in the vicinity of MW-3 and to remediate soil contamination on the Westchester Colprovia property. Additional field investigations are necessary before a complete remedy can be detailed. Proposed remedial measures and investigations are discussed below.

4.2 PROPOSED REMEDIAL MEASURES

Ground water should be collected in the area of MW-3 and treated by air stripping to remove volatile organics. Recovery of this ground water may be accomplished by installation of one or more recovery wells or possibly an intercepting trench. We believe that flows of 5 to 10 gpm can be developed.

Treatment for removal of the volatile organics found in the ground water can be best accomplished by use of packed column air stripping. With this technique water is pumped to the top of the column and allowed to trickle downward over packing material which has great surface area. Air is blown upward through the column and volatiles leave the water and enter the air stream, exiting at the top of the column. We estimate that a column with a diameter of one foot and a packing height of over 33 feet will be required to reduce TCE concentrations below the USEPA drinking water maximum contaminant level (MCL) of 5 ppb.

Air leaving the column will contain volatile organics. However, emissions will be quite low. For example, at a water flow rate of 10 gpm and a water VOC concentration of 1,500 ppb, emissions to the air would be less than 0.2 pounds per day. The treated water should be recharged to the ground in the area previously used as a scrubber water recharge pond on the Westchester Colprovia property.

Volatile contamination of soils in the area of the Westchester Colprovia office and plant can best be remediated by use of a soil gas extraction system. With this technique an 8-inch diameter perforated pipe is installed as a soil gas vent and a vacuum is induced by a blower attached to the vent.

Air moves through the pore spaces in the soil in the unsaturated zone and takes volatile organics with it. The almost complete paving of the Westchester Colprovia plant and the sandy nature of the soils will tend to increase the effectiveness of this method.

The soil vent is expected to have a radius of influence of at least 100 feet. An air flow rate of about 1,200 cfm (200 m³/hr) would be utilized. At this flow rate and an average initial soil gas VOC concentration of 50 ug/l, a total of 5 pounds per day would be emitted. This concentration is expected to decrease rapidly with time.

4.3 PROPOSED INVESTIGATIONS

In order to complete design of remedial measures additional field investigations are required. Investigations recommended include four additional soil borings to be converted to piezometers; additional sampling of monitoring wells; conduct of additional slug tests; installation of a recovery well(s); and pump tests of the recovery well(s).

Soil borings are proposed at four locations, corresponding to soil gas sampling locations SG-04 (office), SG-09 (asphalt plant), SG-11 (shop front), and SG-12 (shop rear). These locations are chosen to obtain information on areas where soil gas extraction is being considered and to correlate soil gas data with actual soil concentrations of VOCs. Split spoon samples will be taken in the depth intervals of 1 to 3 feet, 3 to 5 feet, 5 to 7 feet, and 7 to 9 feet. Samples will be screened for volatile organic compounds (VOCs) with an HNU photoionization detector. Based on this screening, the sample with the highest HNU reading from each borehole will be sent to a laboratory for analyses of petroleum hydrocarbons and VOCs. If no HNU readings above background occur in a borehole, a sample of soil from the deepest sample will be analyzed.

Each borehole will be converted into a piezometer by advancing the auger about 5 feet past the water table and installing 2-inch PVC casing and screen. This may not be possible behind the shop due to shallow bedrock in that area.

Due to the evolving nature of investigations relative to sale of the Westchester Colprovia property and the related investigations of the adjacent Colonial Sand and Gravel property, there has not been full synoptic sampling of ground water quality nor ground water elevations on both properties. A

MALCOLM PIRNIE

single sampling event is proposed to determine VOC concentrations and elevations at significant monitoring points at a single point in time utilizing consistent sampling and analytic protocols. Sampling points include:

- Malcolm Pirnie Wells W-1, W-2, W-3, W-4, W-7, W-8, and W-9
- Geraghty & Miller Wells MW-2, MW-3, and the shallow test well
- The concrete plant production well and the asphalt plant production well

Slug tests to determine aquifer characteristics will be conducted on wells W-8, W-9, MW-3 and the four piezometers installed in the borings described above.

After completion of the above investigations, a location for a recovery well or wells will be selected and construction details finalized. The alternative of a recovery trench in lieu of wells will also be considered at this time. The recovery system will be installed so as to intercept the plume of VOCs found at well MW-3 and is likely to be in the vicinity of that monitoring well.

After installation of the recovery system, a pump test will be conducted to determine the appropriate pumping rate to recover contaminated ground water without pumping excess clean water. Pumping will be carried on at various rates for 24 to 72 hours while water levels are measured in monitoring wells and piezometers. Based on the area of influence found during pumping, an appropriate pumping rate will be identified. This pumping rate, as well as water quality information gathered earlier, will be used in finalizing design of the ground water treatment system.

REFERENCES

1. Bouwer, H. and R. C. Rice. 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research. V. 12, No. 3.
2. Cedergren, H. R. 1977. Seepage, Drainage, and Flow Nets, 2nd ed. John Wiley & Sons. p. 534.
3. Hvorslev, M. J. 1951. Time Lag and Soil Permeability in Ground Water Observations. U.S. Army Corps of Engineers Waterways Experiment Station Bulletin 36. Vicksburg, Mississippi.
4. Naval Facilities Engineering Command (NAVFAC). 1971. Chapter 4. Field tests and measurements. Design Manual - Soil Mechanics, Foundations, and Earth Structures. Dept. of the Navy, Alexandria, Virginia.

APPENDIX A

MALCOLM
PIRNIE

MALCOLM FIRNIE INC.

PROJECT :Westchester Colprovia
 DATE :May 4,1987
 CONTRACTOR :New England Boring
 DRILL. METHOD:6 5/8" I.D. H.S.A.

BORING NUMBER:W-1

PROJECT NO. :1074-1-1101
 LOCATION :Bedford Hills,N.Y.
 INSPECTOR :Gregory Burchette
 SAMP. METHOD :1 3/8" Split spoon
 and cuttings

GRD.SURFACE ELEVATION:218.46'

SAMPLE		SOIL DESCRIPTION		
No.	Blows per 6"(ft.)	Depth	Density, color, SOIL, admixtures moisture, other notes, ORIGIN	Well Const Remarks
		0-2	5" Black top underlain with gravel	
		2-5	Brown medium SAND , little Gravel, trace Silt, pieces of brick	Protective casing with key lock
S-1	13	5-7	REC.24",Brown dense medium SAND, some Gravel and cobbles	4" sch. 40 Riser surface to 14'
	19			
	14			Bentonite pellets
	15			11 to 13'
		8	GRAVEL and coarse SAND	
S-2	34	10-12	REC.0", Split spoon pushed a cobble - no sample	Ottawa filter sand 13 to 24'
	23			
	33			4" I.D.-.010" slot
	21			Sch.40 PVC screen 14 to 24'
		10	Coarse GRAVEL	
S-3	31	15-17	REC.23",Brown very dense coarse SAND and GRAVEL, pieces decomposed schist	Bentonite & grout mixture from surface to 11'
	51			
	95			
	56			
			Auger refusal at 19.5'	
			6" roller bit from 19.5 to 24'	
			End of boring 24'	
			Well set at 24'	

Driller: Steve Ramsdell of New England Boring
 Contractors, Glastonbury,CT.

MALCOLM PIRNIE INC.
 PROJECT : Westchester Colprovia
 DATE : May 8, 1987
 CONTRACTOR : New England Boring
 DRILL. METHOD: 6 5/8" I.D. H.S.A.

BORING NUMBER: W-2
 PROJECT NO. : 1074-1-1101
 LOCATION : Bedford Hills, N.Y.
 INSPECTOR : Gregory Burchette
 SAMP. METHOD : 1 3/8" Split spoon
 and cuttings

GRD. SURFACE ELEVATION: 185.29'

SAMPLE		SOIL DESCRIPTION			
No.	Blows per 6" (ft.)	Depth	Density, color, SOIL, admixtures, moisture, other notes, ORIGIN	Well Const	Remarks
		0-2	Coarse roadway gravel		
S-1	13	2-4	REC. 16", Gray medium dense CLAY, some medium Sand, trace Gravel		Protective casing with key lock
	9				
	10				4" sch. 40 Riser
	18				surface to 5'
S-2	100/1	4-6	REC. 0", Coarse GRAVEL		Bentonite pellets 3 to 4'
S-3	17	6-8	REC. 16", Gray brown dense CLAY and SAND, 7" decomposed Schist in end of sample		Ottawa filter sand 4 to 15'
	21				
	25				
	42				
S-4	20	10-12	REC. 4", decomposed schist and medium SAND		4" I.D. -.010" slot Sch. 40 PVC screen 5 to 15'
	22				
	60				
	30				
			End of boring 15'		Bentonite & grout mixture from surface to 4'
			Well set at 15'		

Driller: Steve Ramsdell of New England Boring Contractors, Glastonbury, CT.

MALCOLM PIRNIE INC.
 PROJECT : Westchester Colprovia
 DATE : May 6, 1987
 CONTRACTOR : New England Boring
 DRILL. METHOD: 6 5/8" I.D. H.S.A.
 BORING NUMBER: W-3
 PROJECT NO. : 1074-1-1101
 LOCATION : Bedford Hills, N.Y.
 INSPECTOR : Gregory Burchette
 SAMP. METHOD : 1 3/8" Split spoon
 and cuttings
 GRD. SURFACE ELEVATION: 190.84'

SAMPLE		SOIL DESCRIPTION		
No.	Blows per 6" (ft.)	Depth	Density, color, SOIL, admixtures moisture, other notes, ORIGIN	Well Const Remarks
		0-2	7" Black top underlain with gravel	
S-1	8	2-4	REC. 13", Brown medium dense medium SAND, trace Clay, trace Silt, trace Gravel	Protective casing with key lock
	6			
	6			4" sch. 40 Riser surface to 49'
S-2	7	4-6	REC. 13", same as above	
	9			Bentonite pellets 46 to 48'
	13			
	12			
S-3	2	10-12	REC. 17", Gray brown very loose fine SAND, little Silt, trace Clay	Ottawa filter sand 48 to 59'
	1			
	1			
	2			4" I.D. -.010" slot Sch. 40 PVC screen 49 to 59' ?
S-4	5	15-17	fine to medium SAND, little Gravel, trace Silt, occasional cobbles	
	3			
	2			Bentonite & grout mixture from surface to 46'
	2			
S-5	3	17-19	REC. 12", same as above	
	3			
	4			
	4			
S-6	1	19-21	REC. 18", same as above	
	3			
	3			
	4			
S-7	2	21-23	REC. 24", same as above	
	3			
	3			
	5			
S-8	48	30-32	REC. 24", Brown medium to coarse GRAVEL and SAND	
	46			
	30			
	22			

BORING NUMBER :W-3

SAMPLE		SOIL DESCRIPTION			
	Blows No. per 6" (ft.)	Depth	Density, color, SOIL, admixtures moisture, other notes, ORIGIN	Well Const	Remarks
S-9	10 5 4 30	35-37	REC. 8", same as above		
S-10	31 15 11 11	39-41	REC. 10", Brown medium dense Gravel and coarse Sand, trace Silt		Bentonite pellets 26 to 28'
S-11	10 14 17 21	44-46	REC. 24", same as above		Ottawa filter sand 28 to 44'
S-12	10 8 7 9	49-51	REC. 12", same as above		

4" I.D. - .010" slot
Sch. 40 PVD screen
29 to 44'

End of boring 60'
Well set at 59'

Driller: Steve Ramsdell of New England Boring
Contractors, Glastonberry, Ct.

190.84
57
137.84

MALCOLM PIRNIE INC.
PROJECT :Westchester Colprovia
DATE :May 7,1987
CONTRACTOR :New England Boring
DRILL. METHOD:6 5/8" I.D. H.S.A.

BORING NUMBER:W-4
PROJECT NO. :1074-1-1101
LOCATION :Bedford Hills,N.Y.
INSPECTOR :Gregory Burchette
SAMP. METHOD :1 3/8" Split spoon
and cuttings

GRD.SURFACE ELEVATION:190.10'

=====

SAMPLE	SOIL DESCRIPTION
Blows Depth No. per 6"(ft.)	Density, color, SOIL, admixtures moisture, other notes, ORIGIN
Well Const	Remarks

Same Soil as W-3

Protective casing
with key lock

4" sch. 40 riser
surface to 26'

Bentonite pellets
23' to 25'

Ottawa filter sand
25' to 36'

4" I.D.-.010" slot
sch. 40 PVC screen
26' to 36'

Bentonite & grout
mixture from
surface to 23'

End of boring 36'
Well set at 36'

Driller: Steve Ramsdell of New England Boring
Contractors, Glastonbury,CT.

MALCOLM PIRNIE INC.

PROJECT :Westchester Colprovia
DATE :May 5,1987
CONTRACTOR :New England Boring
DRILL. METHOD:6 5/8" I.D. H.S.A.

BORING NUMBER:W-5

PROJECT NO. :1074-1-1101
LOCATION :Bedford Hills,N.Y.
INSPECTOR :Gregory Burchette
SAMP. METHOD :1 3/8" Split spoon
and cuttings

GRD.SURFACE ELEVATION:213.37'

SAMPLE		SOIL DESCRIPTION		
No.	Blows per 6"(ft.)	Depth	Density, color, SOIL, admixtures moisture, other notes, ORIGIN	Well Const Remarks
S-1		0-2	Black top and underlain with gravel	Roadway type protective casing
	14	2-4	REC.6",brown medium dense fine to coarse SAND, some Gravel, little Silt	
	13			
	6			
S-2	6			
	1	4-6	REC.8",brown very loose brown SAND, trace Silt	
	2			
	2			
S-3	2	6-8	REC.12",same as above	4" sch. 40 Riser surface to 29'
	2			
	3			
	7			
S-4	2	8-10	REC.18",brown loose fine to medium SAND, little Gravel, trace Silt	
	3			
	3			
	2			
S-5	4	10-12	REC.2",light brown medium dense fine SAND, trace Gravel, trace Silt	
	6			
	7			
	9			
S-6	6	12-14	REC.16",same as above	Bentonite & grout mixture is in annulus from surface to 26'
	12			
	11			
	11			
S-7	4	14-16	REC.20",same as above	
	3			
	4			
	10			
S-8	9	16-18	REC.20",same as above	
	9			
	10			
	10			
S-9	6	18-20	REC.24",same as above	
	7			
	9			
	11			

BORING NUMBER :W-5

SAMPLE		SOIL DESCRIPTION			
No.	Blows per 6"(ft.)	Depth	Density, color, SOIL, admixtures moisture, other notes, ORIGIN	Well Const	Remarks
S-10	4	20-22	REC.22",same as above		
	6				
	6				
	10				
S-11	10	22-24	REC.18",brown dense fine SAND and GRAVEL, little Silt, ocassional cobbles		Bentonite pellets 26 to 28'
	15				
	16				
	13				
S-12	6	24-26	REC.20",same as above		
	11				
	11				Ottawa filter sand 28 to 44'
	11				
	11				
S-13	21	26-28	REC.4",same as above		
	20				
	16				
	18				
S-14	16	28-30	REC.24", Gray brown dense Silt and fine SAND, some Gravel, trace Clay		
	13				
	12				4"I.D.- .010" slot Sch.40 PVC screen 29 to 44'
	14				
S-15	14	35-37	REC.24", same as above		
	12		Sample smells of diesel fuel		
	13		or fuel oil		
	40				

End of boring 45'
Well set at 44'

Driller:Steve Ramsdell of New England Boring
Contractors, Glastonbury,CT.

213.37
44

169.37
15

184

MALCOLM FIRNIE INC.

PROJECT : Westchester Colprovia
 DATE : May 7, 1987
 CONTRACTOR : New England Boring
 DRILL. METHOD: 6 5/8" I.D. H.S.A.

BORING NUMBER: W-7

PROJECT NO. : 1074-1-1101
 LOCATION : Bedford Hills, N.Y.
 INSPECTOR : Gregory Burchette
 SAMP. METHOD : 1 3/8" Split spoon
 and cuttings

GRD. SURFACE ELEVATION: 180.94'

SAMPLE		SOIL DESCRIPTION		
No.	Blows per 6" (ft.)	Depth	Density, color, SOIL, admixtures moisture, other notes, ORIGIN	Well Const Remarks
		0-2	Large GRAVEL with pieces of concrete	
S-1	8	2-4	REC. 13", Brown dense fine SAND, little Silt	Protective casing with key lock
	15			
	16			4" sch. 40 Riser surface to 13'
	18			
S-2	21	4-6	REC. 22", same as above	
	12			Bentonite pellets 9 TO 11'
	9			
	8			
S-3	3	6-8	REC. 12", Brown loose CLAY, trace Sand	
	3			Ottawa filter sand 12 TO 23'
	3			
	2			
S-4	2	8-10	REC. 22", Brown medium dense fine SAND, little Silt	4" I.D. -.010" slot Sch. 40 PVC screen 13 TO 23'
	5			
	6			
	7			
S-5	8	10-12	REC. 18", same as above	
	7			Bentonite & grout mixture from surface to 9'
	12			
	14			
S-6	49	12-14	REC. 6", Brown very dense coarse SAND and GRAVEL, little Silt	
	50/0			
S-7	49	15-17	REC. 12", Gray very dense coarse GRAVEL, few cobbles, little Silt	
	56			
	54			
	49			
S-8	100	20-22	REC. 20", same as above	
	33			
	30			
	22			

180.94
 22
 158.94

End of boring 23'

Well set at 22'

Driller: Steve Ramsdell of New England Boring Contractors, Glastonbury, CT.

PROJECT :Westchester Colprovia BORING/WELL NUMBER W-8
 DATE :August 3, 1987 PROJECT NO. :1074-011-101
 CONTRACTOR :Marine Pollution Control LOCATION :Katonah
 DRILL METHOD :6 5/8" ID HSA 8" OD INSPECTOR :Paul Scian
 SAMPLE METHOD: 1 3/8" Split spoon and cuttings

SAMPLE		SOIL DESCRIPTION		WELL CONSTRUCTION
No.	Blows/6" Rec.	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	Remarks
			1.5' road pack, into gravelly sand	
1	5/5/5/5 1.0' rec. HNu readings	1.5-3 0/0/0/0	Gravel and m-vc sand, silty poorly sorted, brown, dry	Protective casing with key lock
2	7/8//8/8 0.8' rec. HNu readings	4.5-6 0/0/0/0	same as above	4" sch. 40 PVC Riser surface to 7'
3	7/9/8/8 0.8' rec. HNu readings	7-8.5 0/0/0/0	same as above, bottom slightly damp	cement seal, surface to 3' bentonite powder seal 3'-5' pea gravel filter pack 5'-17'
obstruction at 9', rig moved to west approximately 30', material in first 0-9' cuttings same as first hole, HNu readings 0/0/0/0				
4	13/16/16/15 0.7' rec. HNu readings	9-10.5 0/0/0/0	same as above, Gravel and m-vc sand, silty, brown, some roots, bottom 2" wet and grey	
5	9/12/12/11 0.7' rec. HNu readings	11-12.5 0/0/0/0	same as above, but grey and wet water in auger string \approx 9' below surface augered to 18' well set at 17'	4" I.D. 10 slot sch. 40 PVC screen 7'-17'

Notes: HNu readings taken from Headspace/Stem/Cuttings/Sample

PROJECT :Westchester Colprovia BORING/WELL NUMBER W-9
 DATE :August 3, 1987 PROJECT NO. :1074-011-101
 CONTRACTOR :Marine Pollution Control LOCATION :Katonah
 DRILL. METHOD :6 5/8" ID HSA 8" OD INSPECTOR :Paul Scian
 SAMPLE METHOD: 1 3/8" Split spoon and cuttings

SAMPLE		SOIL DESCRIPTION		WELL CONSTRUCTION
No.	Blows Rec.	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	Remarks
			Asphalt rd. with gravel and sand base	flush mounted
1	50 1.0' rec. HNu readings 0/0/0/5	5-6.5	sand, f-m, some c-vc sand and silt, little gravel, brown, dry	4" sch 40 PVC riser surface to 47.5' cement seal surface to 2' cement grout 2'-15' natural pack 15'-37'
2	62 0.7' rec. HNu readings 0/0/0/5	10-11.5	sand, f, silty, some m sand and gravel, brown, dry	bentonite pellet seal 37'-41' pea gravel filter pack 41'-58'
3	70 1.0' rec. HNu readings 0/0/0/5	15-16.5	sand, f-m, some silt and gravel, brown, dry	
4	70 1.0' rec. HNu readings 0/0/0/5	20-21.5	same as above, dry	4" I.D. 10 slot sch. 40 PVC screen 47.5'-57.5'
5	32 1.0' rec. HNu readings 0/0/0/5	25-26.5	sand, f-m, little silt, trace gravel brown, dry	
6	60 1.1' rec. HNu readings 0/0/0/5	30-31.5	same as above, dry	

Notes: HNu readings taken from Headspace/Stem/Cuttings/Sample

PROJECT :Westchester Colprovia BORING/WELL NUMBER W-9
 DATE :August 3, 1987 PROJECT NO. :1074-011-101
 CONTRACTOR :Marine Pollution Control LOCATION :Katonah
 DRILL METHOD :6 5/8" ID HSA 8" OD INSPECTOR :Paul Scian
 SAMPLE METHOD: 1 3/8" Split spoon and cuttings

SAMPLE		SOIL DESCRIPTION	WELL CONSTRUCTION
No.	Blows Rec.	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin Remarks
7	60 0.9' rec.	35-36.5	sand, m-vc, some gravel, silt and f sand, piece of peat, brown, dry HNu readings 0/0/0/5
8	60 0.6' rec.	40-41.5	sand, m-vc, some gravel and f sand trace silt, brown, dry HNu readings 0/0/0/0
9	100 1.0' rec.	50-51.5	same as above, moist, outside of split spoon wet, some peat HNu readings 0/0/0/0 augered to 58' screen set at 57.5'

PROJECT :Westchester Colprovia BORING NUMBER :SB-1
 DATE :August 4, 1987 PROJECT NO. :1074-011-101
 CONTRACTOR :Marine Pollution Control LOCATION :Katonah
 DRILL METHOD :6 5/8" ID HSA 8" OD INSPECTOR :Paul Scian
 SAMPLE METHOD: 1 3/8" Split spoon and cuttings

SAMPLE		SOIL DESCRIPTION		
No.	Blows Rec.	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	Remarks
			0-5' fill, sand and pea gravel miw black, dry, (road material waste)	
1	30 0.5' rec.	5-7	sand, f-m, some silt and c sand, little gravel, brown, dry, FILL	
2	30 0.8' rec.	10-12	same as above, brown, dry, bottom 2" an asphalt plug, FILL	
3	30 1.0' rec.	15-17	same as above, with asphalt chucks and cobbles, brown, dry, FILL	
4	50 0.7' rec.	20-22	same as above, w/o cobbles, FILL	
5	70 0.5' rec.	25-27	same as above, w/ cobbles, FILL	
6	50 .25' rec.	30-32	same as above, w/o asphalt chucks Natural strata?	
7	100 .5' rec.	35-37	same as above, sampled	
			37' refusal, bedrock	

Notes: HNu readings on background, headspace, stem, cuttings and samples all
 equal to zero.

PROJECT :Westchester Colprovia BORING NUMBER :SB-2
DATE :August 4, 1987 PROJECT NO. :1074-011-101
CONTRACTOR :Marine Pollution Control LOCATION :Katonah
DRILL. METHOD :6 5/8" ID HSA 8" OD INSPECTOR :Paul Scian
SAMPLE METHOD: 1 3/8" Split spoon and cuttings

SAMPLE		SOIL DESCRIPTION		
No.	Blows Rec.	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	Remarks
1	1.0' rec.	2.5-4	sand, f-m, some silt, vc-c sd and gravel, wood chunks, brown, dry FILL	
2	0.8' rec.	7.5-9	same as above, FILL	
3	0.4' rec.	12.5-14	same as above, with a chunk of wire brush, FILL	
4	0.5' rec.	17.5-19	same as above, FILL, sampled auger refusal at 19'	

Notes: HNu readings on background, headspace, stem, cuttings and sample all equal to zero.

PROJECT :Westchester Colprovia BORING NUMBER :SB-3
 DATE :August 5, 1987 PROJECT NO. :1074-011-101
 CONTRACTOR :Marine Pollution Control LOCATION :Katonah
 DRILL METHOD :6 5/8" ID HSA 8" OD INSPECTOR :Paul Scian
 SAMPLE METHOD: 1 3/8" Split spoon and cuttings

SAMPLE		SOIL DESCRIPTION		
No.	Blows/6" Rec.	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	Remarks
1	48 1.5' rec. HNu readings 0/0/.5/2	7.5-9	top .75 surface slough, road gravel and sand, top 1" with oil sheen from road drips: bottom .75 sand, f-m, silty, trace gravel, brown, dry	
2	32 1.0' rec. HNu readings 0/0/0/0	12.5-14	sand, f-m, trace silt and c sand, lite brown, dry	
3	4/7/7 1.5' rec. HNu readings 0/.5/0/0	17.5-19	same as above w/ thin silty layers, lite brown, dry	
4	4/3/9 1.2' rec. HNu readings 0/0/0/0	22.5-24	same as above, sampled	
5	3/5/7 .3' rec. HNu readings 0/0/0/0	27.5-29	organic rich, humus and roots, very dark brown, grey and lite brown f sand and trace gravel, dry	
6	6/9/2 0.7' rec. HNu readings 0/0/.5/0	32.5-34	sand, m-c, some gravel and f sand, trace silt, lite brown, dry	
7	100 1.5" rec. HNu readings 0/0/0/0	37.5	bedrock, quartz and feldspar rich fragments	

Notes: HNu readings taken from headspace/stem/cuttings/sample

PROJECT :Westchester Colprovia BORING NUMBER :SB-4
 DATE :August 5, 1987 PROJECT NO. :1074-011-101
 CONTRACTOR :Marine Pollution Control LOCATION :Katonah
 DRILL METHOD :6 5/8" ID HSA 8" OD INSPECTOR :Paul Scian
 SAMPLE METHOD: 1 3/8" Split spoon and cuttings

SAMPLE		SOIL DESCRIPTION		
No.	Blows Rec.	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	Remarks
1	6/10/15 0.8' rec.	2.5-4	sand, f-vf, little silt and m sand, trace thin silty layers, lite brown dry	
	HNu readings 0/0/0/0			
2	9/6/5 1.4' rec.	7.5-9	same as above w/ one large root chunk dry	
	HNu readings 0/5/0/0			
3	6/5/4 1.3' rec.	12.5-14	same as above, sampled	
	HNu readings 0/0/0/0			
4	6/5/5 1.5' rec.	17.5-19	top .75' same as above bottom .75' silty f sand, with clayey silt layers	
	HNu readings 0/5/0/0			
			augered down to 20'	
			bottom of boring	

Notes: HNu readings taken from headspace/stem/cuttings/sample

APPENDIX B

MALCOLM
PIRNIE

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA INC.

WELL NO: W-1

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
0	15.81	-0.71	1
15	15.81	-0.71	1
30	15.91	-0.61	.8591556
45	15.96	-0.56	.7887344
60	15.98	-0.54	.760566
90	16.02	-0.50	.7042246
120	16.05	-0.47	.6619741
150	16.07	-0.45	.6338035
180	16.1	-0.42	.5915508
210	16.11	-0.41	.5774643
240	16.13	-0.39	.5492981
300	16.15	-0.37	.5211297
360	16.17	-0.35	.492959
420	16.19	-0.33	.4647883
480	16.2	-0.32	.4507041
600	16.23	-0.29	.4084536
720	16.24	-0.28	.3943672
960	16.27	-0.25	.3521145
1200	16.29	-0.23	.3239439
1500	16.31	-0.21	.2957776
1800	16.32	-0.20	.2816934
2400	16.34	-0.18	.2535227
3000	16.36	-0.16	.2253521
3600	16.37	-0.15	.2112678
3600	16.37	-0.15	.2112678

UNCONFINED AQUIFER

K = 0.7E-04 CM/SEC
= 1.4 GPD/FT2
= 0.2E-05 FT/SEC
= 0.2 FT/DAY

REGRESSION COEFFICIENT = -.8955774

Malcolm Pirnie Inc.

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA INC.

WELL NO: W-2

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
0	2.6	-0.90	1
30	2.625	-0.88	.9722221
60	2.65	-0.85	.9444442
90	2.7	-0.80	.8888888
120	2.7	-0.80	.8888888
150	2.7	-0.80	.8888888
180	2.75	-0.75	.8333332
210	2.75	-0.75	.8333332
240	2.775	-0.72	.8055553
270	2.8	-0.70	.7777778
300	2.8	-0.70	.7777778
360	2.825	-0.67	.7499999
420	2.85	-0.65	.7222222
540	2.9	-0.60	.6666666
600	2.9	-0.60	.6666666
720	2.95	-0.55	.6111111
960	3	-0.50	.5555556
1080	3.05	-0.45	.5
1200	3.05	-0.45	.5
1500	3.125	-0.38	.4166667
1800	3.2	-0.30	.3333332
2400	3.25	-0.25	.2777778
3000	3.25	-0.25	.2777778
3600	3.35	-0.15	.1666666
4200	3.4	-0.10	.1111112

UNCONFINED AQUIFER

K = 0.8E-04 CM/SEC
= 1.8 GPD/FT2
= 0.3E-05 FT/SEC
= 0.2 FT/DAY

REGRESSION COEFFICIENT = -.9912656

Malcolm Pirnie Inc.

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA INC.

WELL NO: W-3

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/H0
0	28.68	-0.91	1
15	28.68	-0.91	1
30	28.7	-0.89	.978019
45	28.72	-0.87	.9560449
60	28.73	-0.86	.9450561
90	28.76	-0.83	.9120863
120	28.79	-0.80	.8791199
150	28.82	-0.77	.8461536
180	28.84	-0.75	.824176
210	28.87	-0.72	.7912096
240	28.89	-0.70	.7692321
270	28.92	-0.67	.7362623
300	28.93	-0.66	.7252735
360	28.98	-0.61	.6703296
420	29.03	-0.56	.6153856
480	29.07	-0.52	.5714306
540	29.1	-0.49	.5384608
600	29.12	-0.47	.5164832
720	29.19	-0.40	.4395617
840	29.22	-0.37	.4065953
960	29.27	-0.32	.351648
1080	29.31	-0.28	.3076928
1200	29.35	-0.24	.2637377
1500	29.42	-0.17	.1868128
1800	29.46	-0.13	.1428576
1800	29.46	-0.13	.1428576
1800	29.46	-0.13	.1428576
1800	29.46	-0.13	.1428576
1800	29.46	-0.13	.1428576
1800	29.46	-0.13	.1428576

UNCONFINED AQUIFER

K = 0.2E-03 CM/SEC
 = 4.0 GPD/FT2
 = 0.6E-05 FT/SEC
 = 0.5 FT/DAY

REGRESSION COEFFICIENT = -.9997041

Malcolm Pirnie Inc.

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA INC.

WELL NO: W-4

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/H0
0	29.66	-0.89	1
15	29.66	-0.89	1
30	29.67	-0.88	.9887642
45	29.67	-0.88	.9887642
60	29.68	-0.87	.9775285
90	29.7	-0.85	.9550534
120	29.71	-0.84	.9438212
150	29.71	-0.84	.9438212
180	29.73	-0.82	.9213497
210	29.74	-0.81	.9101139
240	29.75	-0.80	.8988746
258	29.76	-0.79	.8876389
360	29.79	-0.76	.8539317
420	29.81	-0.74	.8314601
480	29.83	-0.72	.8089886
540	29.85	-0.70	.7865171
600	29.87	-0.68	.7640456
720	29.9	-0.65	.7303383
840	29.94	-0.61	.6853918
960	29.97	-0.58	.6516845
1080	30	-0.55	.6179772
1200	30.02	-0.53	.5955057
1500	30.08	-0.47	.5280876
1800	30.15	-0.40	.4494373
2100	30.19	-0.36	.4044943
2400	30.23	-0.32	.3595513
3000	30.32	-0.23	.258426
3300	30.35	-0.20	.2247187
3300	30.35	-0.20	.2247187
3300	30.35	-0.20	.2247187

UNCONFINED AQUIFER

K = 0.8E-04 CM/SEC
= 1.6 GPD/FT2
= 0.3E-05 FT/SEC
= 0.2 FT/DAY

REGRESSION COEFFICIENT = -.9995673

Malcolm Pirnie Inc.

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA INC.

WELL NO: W-7

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/H0
0	15.1	-0.89	1
8.399999	15.1	-0.89	1
15	15.1	-0.89	1
30	15.1	-0.89	1
45	15.12	-0.87	.9775285
60	15.13	-0.86	.966291
90	15.14	-0.85	.9550553
105	15.15	-0.84	.9438213
120	15.16	-0.83	.9325838
135	15.17	-0.82	.9213481
150	15.18	-0.81	.9101123
165	15.18	-0.81	.9101123
180	15.19	-0.80	.8988766
210	15.21	-0.78	.8764034
240	15.22	-0.77	.8651676
270	15.24	-0.75	.8426961
300	15.25	-0.74	.8314605
360	15.29	-0.70	.7865175
420	15.32	-0.67	.7528085
540	15.37	-0.62	.6966298
720	15.44	-0.55	.6179779
960	15.52	-0.47	.5280885
1080	15.55	-0.44	.4943813
1200	15.58	-0.41	.4606741
1500	15.65	-0.34	.3820239
1800	15.7	-0.29	.3258434
2100	15.75	-0.24	.269663
2400	15.79	-0.20	.22472
3000	15.85	-0.14	.1573038
3300	15.87	-0.12	.1348324

UNCONFINED AQUIFER

K = 0.1E-03 CM/SEC
 = 2.3 GPD/FT2
 = 0.4E-05 FT/SEC
 = 0.3 FT/DAY

REGRESSION COEFFICIENT = -.9994786

Malcolm Pirnie Inc.



DRAFT

APPENDIX C: CONDENSED DATA

Mg/kg

TCA TCE PCE
IN SOIL BORINGS (1 VGLUING)

Sample Depth Date TCA (ug/l) TCE (ug/l) PCE (ug/l)

S601	2'	07/13	0.01	0.0004	0.004
S602	6'	07/13	0.02	<0.0002	0.005
S603	5.5'	07/13	0.1	0.0005	0.04
S604	5'	07/13	3.100	370	0.6
S605	5.5'	07/13	0.04	0.0004	0.004
S606	5'	07/13	0.03	0.0004	0.006
S607	13'	07/13	0.8	62	3
S608	6'	07/13	0.1	0.0009	0.05
S609	5.5'	07/13	320	90	6
S610	6'	07/13	1	0.01	0.1
S611	6'	07/13	0.6	60	3
S612	5.5'	07/13	0.1	3	2
S613	2'	07/13	0.003	0.0007	0.008
S614	3'	07/13	0.8	<0.0002	0.00
S615	6'	07/13	0.02	0.0004	0.006
S616	6'	07/13	0.08	<0.0002	0.004
S617	5.5'	07/13	14	2	0.06
S618	2'	07/13	0.01	0.0002	0.004
S619	4'	07/13	0.08	5	0.2
S620	4'	07/13	0.1	4	0.6
S621	1.5'	07/13	0.002	0.0005	0.003
S622	4.5'	07/13	0.003	<0.0002	0.003
S623	6'	07/14	0.004	0.0002	0.008
S624	6'	07/14	0.004	0.0007	0.003
S625	4'	07/14	0.002	0.07	0.01
S626	2'	07/14	0.001	0.0008	0.004
S627	3'	07/14	0.0004	0.0008	0.0005
S628	4'	07/14	0.02	0.06	0.04
S629	4.5'	07/14	0.009	0.02	0.006
S630	2.5'	07/14	0.002	<0.0002	0.003
S631	3'	07/14	0.004	<0.0002	0.002
S632	5'	07/14	0.2	<0.0002	0.003
S633	4.5'	07/14	0.01	0.02	0.6
S634	2.5'	07/14	2	0.04	0.004
S635	4.5'	07/14	0.006	0.007	0.006
S636	2.5'	07/14	0.3	0.003	0.006

290' (12.19')

45'

355 (1-3')

2270 (3')

1,100 170

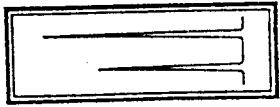
Notations:

I interference with adjacent peaks
NA not analyzed

Analyzed by M. Favero

Checked by S. Cherba

Proofed by L. Laplander



Tracer Research Corporation

MALCOLM PIERNEY/NESTCHESTER COLPROVIA CORP./BEDFORD HILLS, NEW YORK

Sample	Depth	Date	TCA (ug/l)	TCE (ug/l)	PCE (ug/l)
5837	2.5'	07/14	0.06	0.03	1
5838	3.5'	07/14	0.006	<0.0002	0.01
WSD1		07/14	3	1.500	20

WSD1
SAMPLING
LOCATION

Notations:
I interference with adjacent peaks
NA not analyzed

Analyzed by M. Favero
Checked by S. Cherba
Proofed by L. Laplander