MALCOLM PIRNIE

REPORT OF SITE INVESTIGATIONS

WESTCHESTER COLPROVIA CORPORATION
BEDFORD, NEW YORK

JULY 26, 1988
(THIRD)

MALCOLM PIRNIE, INC.

100 Eisenhower Drive
P.O. Box 36
Paramus, New Jersey 07653

2 Corporate Park Drive
P.O. Box 751
White Plains, New York 10602

1074-01-1104

MALCOLM PIRNIE

TABLE OF CONTENTS

LIST OF TABLES

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF APPENDICES

LIST OF PLATES

MALCOLM PIRNIE

1.0 INTRODUCTION

1.1 GENERAL

Westchester Colprovia Corporation formerly owned and operated an asphalt production plant in the Town of Bedford, Westchester County, New York. This facility is now owned and operated by O&G Colprovia Corporation. See Figure 1-1 for a map of the site. In December 1986 trichloroethylene (TCE) contamination was detected in a monitoring well (MW-3) on property of Colonial Sand & Gravel, located near the western boundary of Westchester Colprovia.

Earlier work was presented in two reports as discussed below. Field work described herein was conducted in early 1988.

1.2 PREVIOUS REPORTS

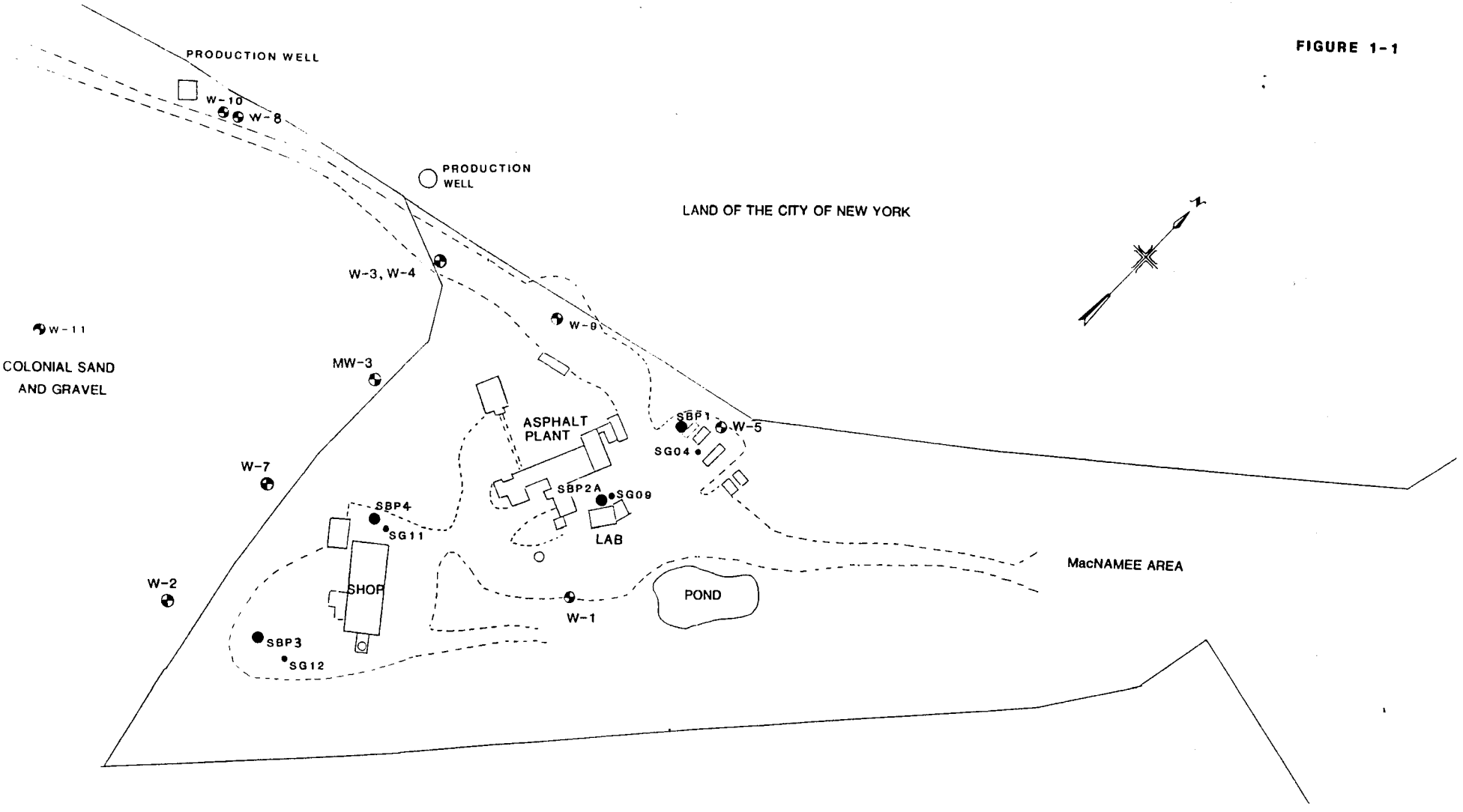
1.2.1 Report of Site Investigations (November 23, 1987)

In November 1987, Malcolm Pirnie issued a Report of Site Investigations at Westchester Colprovia Corporation. The results of phase I and II ground water investigations, the underground tank investigation, and the soil gas investigation were presented and interpreted. At that time it was proposed that ground water be collected and treated for VOC's in the area of MW-3, and certain soils on Westchester Colprovia property be remediated via a soil gas extraction system. Additional investigatory work was proposed to design these remedial measures.

1.2.2 Predesign Study Work Plan (December 4, 1987)

A Predesign Study Work Plan was issued in December 1987. This described the additional investigations necessary for the remedial design. Four soil borings/piezometers and a deep monitoring well were proposed. Additional soil samples and another round of ground water samples were to be collected to further define site conditions. Slug tests to determine aquifer characteristics were also proposed. These data were to be used for locating a ground water recovery system.

FIGURE 1-1



LEGEND

- MONITORING WELL LOCATION
- SOIL BORING LOCATION
- SOIL GAS SAMPLING LOCATION

0 100

SCALE IN FEET

WESTCHESTER COLPROVIA CORPORATION

BEDFORD, NEW YORK

SITE MAP

MALCOLM PIRNIE

2.0 FIELD INVESTIGATIONS

2.1 SOIL BORINGS AND MONITORING WELLS

Five soil borings and two monitoring wells were drilled with a hollow stem auger during January 1988. Originally, the borings were to be converted to piezometers in order to better define shallow ground water flow. No piezometers were installed because bedrock was encountered prior to ground water in four of the borings, and the fifth boring was installed in close proximity to an existing monitoring well, W-5.

Soil boring locations are indicated by "SBP" designations on Figure 1-1. The locations were chosen based on soil gas readings obtained by Tracer Research during their investigation in July 1987. The four corresponding gas sampling locations are also indicated on Figure 1-1.

2.1.1 Soil Sampling

Continuous split spoons were obtained from 1 to 11 feet in each borehole. Augering was continued below 11 feet in SBP2, SBP3, and SBP4 for installation of piezometers until refusal at rock. In boreholes SBP1, SBP3 and SBP4, soil was collected from the split spoon exhibiting the highest reading on an HNU photoionization detector. During augering deeper than 11 feet at SBP2, soil from the auger at 17 feet was noted to exhibit HNU readings higher than any of the soil from 1 to 11 feet, so an adjacent boring was done (SBP2A) and a split spoon sample was collected from the interval 17 to 19 feet. All soil samples collected were analyzed for volatile organic chemicals (VOCs) and petroleum hydrocarbons. Soil boring logs indicating depths of sample collection are provided in Appendix A.

2.1.2 Monitoring Well Construction

One deep monitoring well (W-10) and one shallow monitoring well (W-11) were installed on Colonial Sand and Gravel property. Their locations are indicated on Figure 1-1. Both wells are constructed of 4-inch PVC. Typical monitoring well construction is provided in Appendix B. Drilling logs for the monitoring wells are provided in Appendix A. The two newly installed wells were developed on January 15, 1988.

W-10 was installed adjacent to W-8 to monitor for migration of contamination deeper in the water table aquifer. W-8 is screened from 7 to 17 feet below grade and W-10 is screened from 20 to 30 feet below grade. Shallow

monitoring well, W-11, was installed near the concrete plant to provide an additional ground water elevation point and to determine the lateral extent of the shallow ground water plume.

2.2 GROUND WATER SAMPLING

On March 2, 1988 ground water levels were measured in all monitoring wells and both production wells at the Westchester Colprovia and Colonial Sand and Gravel sites, except the deep and shallow test wells installed by Geraghty and Miller. These two wells, which had flush mounted covers, could not be located. Ground water samples were collected from wells W-1, W-3, W-4, W-5, W-8, W-9, and W-10 on March 2, 1988 and from wells W-2, W-7, W-11, MW-2, MW-3, the Colonial Sand and Gravel production well and Westchester Colprovia's production well on March 3, 1988. Sampling protocol described in the Pre-design Study Work Plan was followed. All samples were submitted to Envirotest Labs for volatile organic and petroleum hydrocarbon analyses. Field measurements included pH, specific conductivity, and temperature.

2.3 SLUG TESTS

Slug tests to determine aquifer characteristics were conducted on wells W-8 through W-11 and MW-3 on March 7, 1988. A known volume of water was displaced in the wells and the time-drawndown of the water level was monitored. The data were collected to estimate the hydraulic conductivity by the Hvorslev (1951) method which has been expanded to include a variety of field situations by NAVFAC (19;71), Cedergren (1977) and Bonwer and Rice (1976).

2.4 WATER LEVEL MEASUREMENT

On July 11, 1988 water level measurements were taken in the same wells sampled on March 2, 1988.

MALCOLM PIRNIE

3.0 FINDINGS

3.1 GEOLOGY

3.1.1 Bedrock Geology

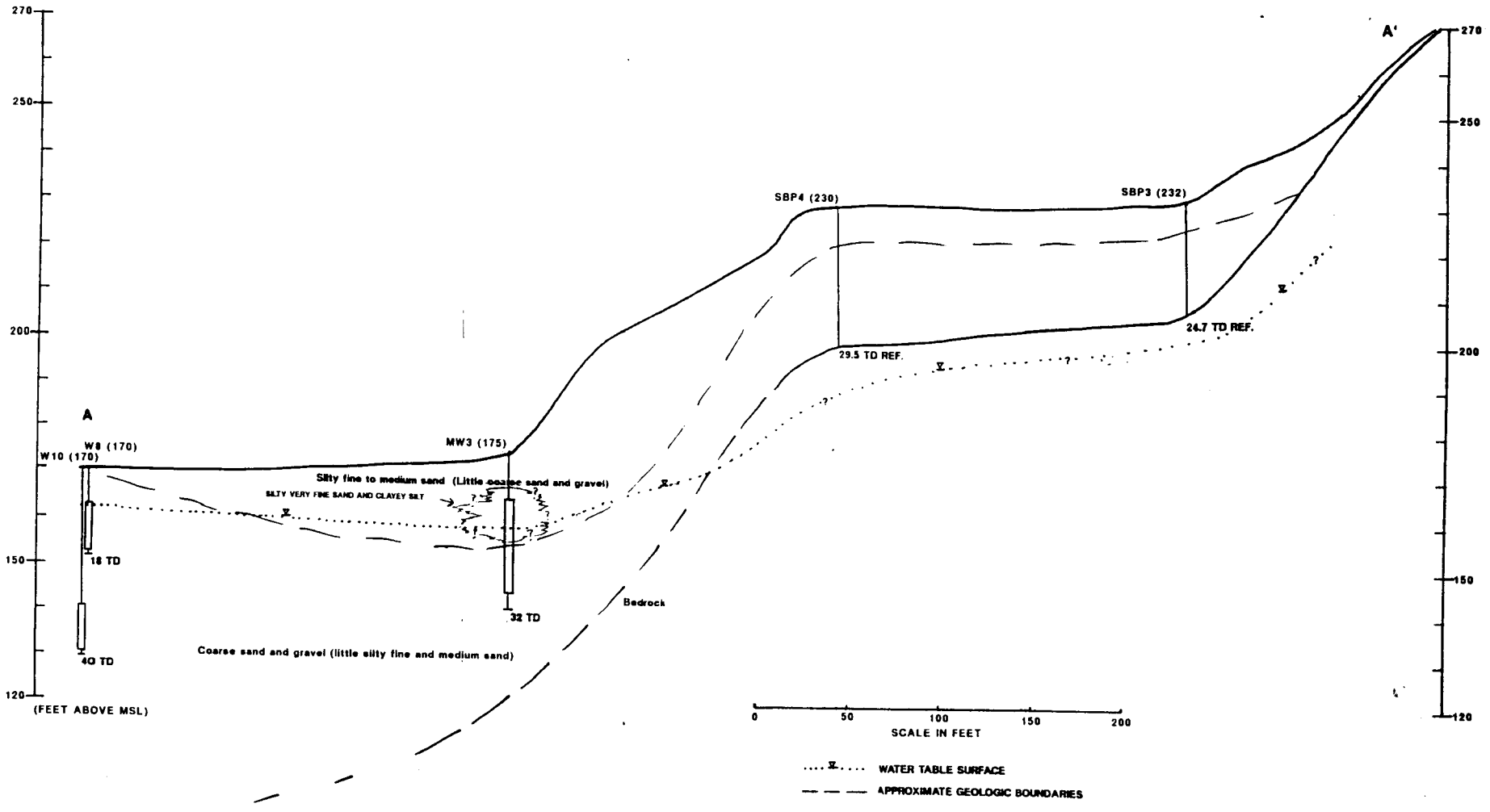
The Westchester Colprovia Corporation site is located within the Manhattan Prong region of the New England Physiographic region, an area of faulted metamorphic rock highlands and valleys typically filled with glacial deposits. The Manhattan Prong is principally made up of the Manhattan Formation, a banded granitic gneiss which grades to a schist, the Inwood Marble, a low grade course grained marble, and the Fordham Gneiss, a massive granitic gneiss. The bedrock at the site is a gneissic schist and forms a shelf below a relatively thin layer of unconsolidated deposits. The bedrock drops rapidly in elevation in all directions except towards the southeast where it outcrops in the vicinity of the Bedford Correctional Facility. Figures 3-1 and 3-2 present cross sections of the site.

3.1.2 Unconsolidated Geology

Unconsolidated deposits in the vicinity of the Westchester Colprovia site range from the fine-grained silts and sands to highly transmissive gravels located in the valley to the west of the site, where Colonial Sand has its operations. There is a sharp drop in topography of about 40 feet from Colprovia to Colonial. At the base of the sharp drop, lenses of clay and silt were encountered in wells MW-3, W-2 and W-7. The extent of these lenses to the west is not completely defined, but they were not encountered in W-11, W-8 or W-10. These unconsolidated materials were deposited by glacial meltwaters during the recessional stages of the last period of glaciation.

The nature of the unconsolidated deposits is dependent on the velocities of the meltwater streams, with the coarsest materials being deposited by rapidly moving streams and the finer materials being deposited during periods of glacial stagnation or when the meltwater streams are blocked by natural dams forming temporary glacial lakes. The coarse-grained materials are typically confined to channels determined by the course of the depositing stream. The fine grained materials are more widespread and are deposited in lens-shaped bodies the size of which depend on the size of the lakes or ponds during the quiescent periods of glaciation.

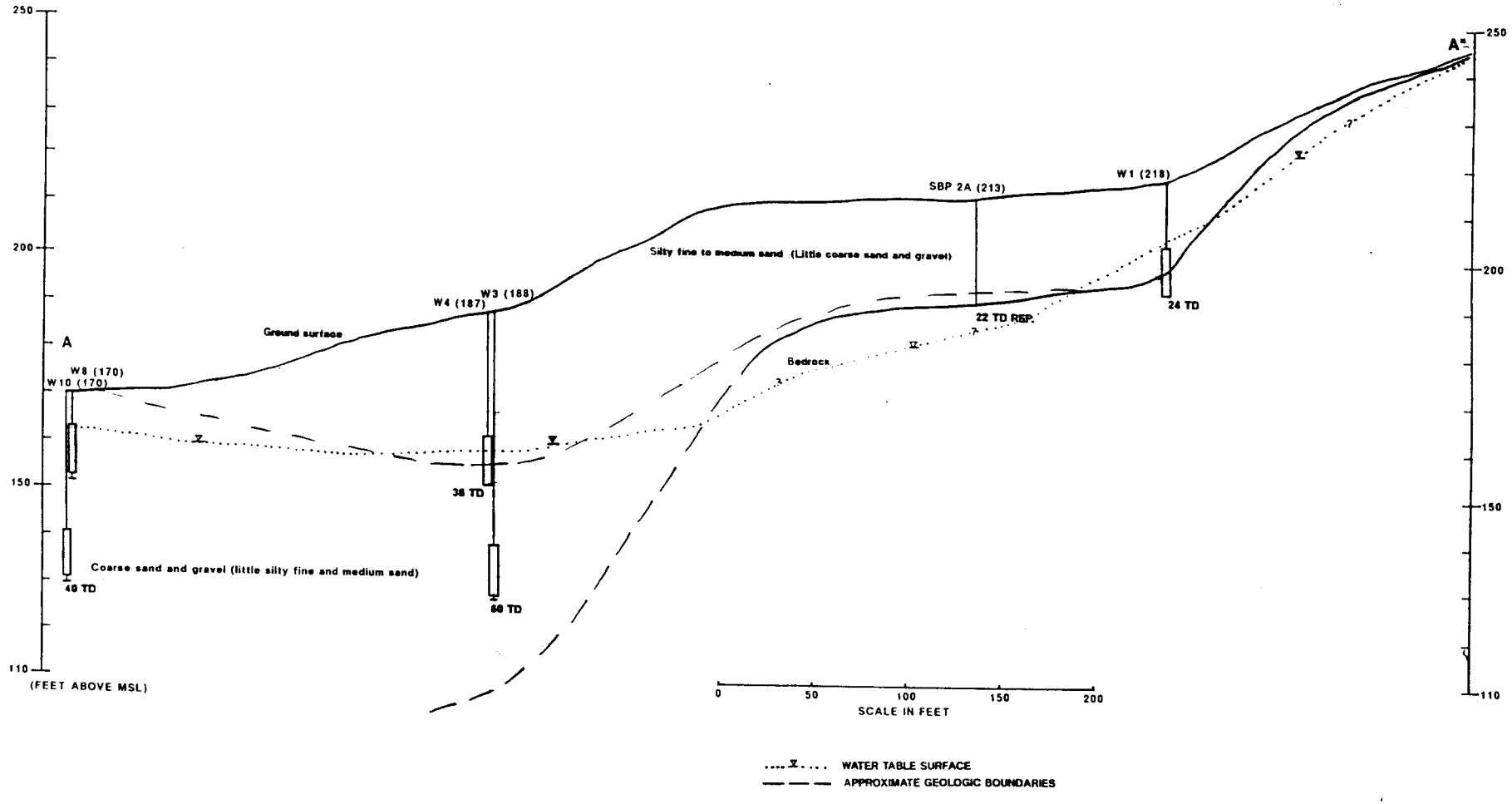
FIGURE 3-1



VERTICAL EXAGGERATION 2.5 TIMES
BORING AND MONITORING WELL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL
TD VALUES ARE DEPTHS BELOW LAND SURFACE

GEOLOGIC CROSS SECTION A-A'

FIGURE 3-2



VERTICAL EXAGGERATION 2.5 TIMES
BORING AND MONITORING WELL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL
TD VALUES ARE DEPTHS BELOW LAND SURFACE.

GEOLOGIC CROSS SECTION A-A"

3.2 HYDROGEOLOGY

3.2.1 Bedrock Hydrogeology

The majority of homes in the Bedford area rely on domestic wells which tap water-transmitting fractures in the bedrock units that exist in the area. Well yields from the bedrock unit are generally adequate to supply domestic needs, averaging about 12 gallons per minute with yields reported to be as high as 30 gallons per minute, in the vicinity of the site (Ground Water Assessment, Town of Bedford, NY, LBG 1985).

3.2.2 Water Level Measurements

Water level measurements are used to determine the direction of ground water movement, to assess the effect of periodic fluctuations in precipitation and other climatic factors, and to assess water level declines due to pumping. These measurements are made synoptically and often enough to establish the general characteristics of ground water flow and variation in water levels.

Three complete rounds and two partial rounds of water level measurement have been completed during the course of this study over a period of over one year. Although these data do not cover all seasonal variations which are possible, and additional monitoring wells were installed during this past year and were not available for all water level measurements, certain conclusions can be made. Water level data are summarized in Table 3-1.

Ground water flow through a permeable medium occurs from an area of relatively high head to an area of lower head. Ground water flow direction can be estimated by plotting and contouring the collected water level data and by interpreting the resulting ground water contour map. This map is an interpretative tool, the accuracy of which depends on the number and quality of data points used to create the map. If the system is isotropic, the lateral component of movement will be normal to the contours; if the system is anisotropic the flow may be oblique to the contours. In either case there may be a vertical component to flow that is not shown on the map.

Plate 1 is a contour map prepared from the March 7, 1988 water level data from 15 wells. This map indicates that ground water flows towards the northwest from the Colprovia property until it enters the more permeable sand and gravel deposits in the valley on the Colonial Sand and Gravel property, where the ground water contours indicate that ground water flow is towards the

MALCOLM PIRNIE

TABLE 3-1

GROUND WATER LEVELS

Well	May 22, 1987	March 7, 1988	July 11, 1988
		Water Level (Elevation in feet above MSL)	
Malcolm Pirnie Monitoring Wells			
W1	205.60	206.15	203.29
W2	183.97	180.81	179.87
W3 (D)	163.17	160.90	160.34
W4 (S)	163.05	159.28	158.38
W5	181.22	174.62	175.12
W7	169.71	164.62	163.93
W8	NI	162.76	161.79
W9	NI	164.53	164.05
W10	NI	162.76	161.79
W11	NI	163.40	162.36
Geraghty & Miller Monitoring Wells			
MW1	179.65	175.80	175.60
MW2	165.78	163.93	162.49
MW3	163.78	159.43	158.61
Production Wells			
Westchester Colprovia Production Well	NA	159.32	158.53
Colonial Sand and Gravel Production Well	NA	162.23	161.26

UPWARD GRADIENTS

Notes:

NI indicates the monitoring well was not installed.
NA indicates the data is not available.

northeast. Plate 2 shows the ground water contours on July 11, 1988. Water levels have declined, but flow patterns remain the same. Plate 3 shows the water table contours on May 22, 1987. Water levels, on the average, were four feet higher than the 1988 data. Also, water table contours plotted closer together when the 1987 data were obtained. The spacing of the water level contours is indicative of the water table gradient which is the change in water level elevation with respect to distance. Along the common site boundary, the gradient was about twice as steep in May 1987 as the gradient in March and July 1988.

Ground water movement is directly proportional to the hydraulic gradient where no changes in permeability exist. When ground water flows from a low permeability formation to a higher permeability formation, as occurs on this site, the resulting gradient change is not necessarily representative of a change in ground water velocities.

Vertical components vary across the site. On the east, dry overburden over bedrock indicates a downward component of flow into the rock. However, well cluster W3/W4 showed an upward gradient of 1.6 feet on March 7, 1988 and 2 feet on July 11, 1988 in the overburden where the bedrock slopes downward near the property line (See Figure 3-2 for the cross section). Further to the west, well cluster W8/W10, in the overburden, showed no vertical gradient in that deposit both times the water levels were measured. In May 1987, cluster W-3/W-4 still showed an upward head, but only 0.12 feet.

Interpretation of the water table maps, geologic cross sections (Figures 3-1 and 3-2), and the upward gradient in well cluster W3/W4 indicates that a portion of the water table, on the Colprovia site, is in the bedrock beneath the unsaturated unconsolidated deposits. This means that some of the ground water enters the bedrock through fractures in the higher elevation areas of the site and moves out of the rock and upward into the unconsolidated deposits at the lower portions of the property. However, the ground water system seems to be quite variable, as evidenced by changes in water levels between sampling events, and may fluctuate significantly due to seasonal variations in recharge. It appears that the upward head in well cluster W3/W4 becomes more pronounced during dry periods, when little surface infiltration occurs.

3.2.3 Slug Test Data and Interpretation

Permeability values were calculated with slug test data collected on June 8, 1987, and March 7-8, 1988, as described in Section 2.3. Permeability values obtained by this method are only estimates, as the method assumes a 100 percent efficient well and a homogeneous and isotropic aquifer. Permeability test data are presented in Appendix C and are summarized in Table 3-2. Values range from 1.4 to 4.0 gpd/ft^2 which are indicative of a silty, fine to medium sand, which is consistent with the geologic logs from wells drilled on the site. Recovery times for permeability tests on monitoring wells W-8, W-10, W-11, and MW-3 ranged from seven seconds to 50 seconds which are too short for analysis by the method. These recovery times indicate higher permeabilities which are consistent with the descriptions of the geologic materials penetrated by these wells.

3.3 SOIL BORINGS

Similar to previous geologic findings, sandy soils were encountered in the boreholes. SPB2, SPB3, and SPB4 have served to further define the extent of the shallow bedrock ledge encountered during installation of monitoring well W-1. Bedrock ledge is present beneath the shop building at approximately 20 to 30 feet and beneath the asphalt plant at approximately 20 feet. It is not present beneath the office trailers at this shallow depth. Figures 3-1 and 3-2 show the approximate bedrock location in relation to ground surface. Boring logs are provided in Appendix A.

3.3.1 Analytical Data

Table 3-3 provides the results of the laboratory analyses for volatile organic compounds (VOCs). Also provided are sample depths and corresponding soil gas sample data. VOCs were detected in all four samples; however, laboratory analyses for total petroleum hydrocarbons were negative. VOC concentrations were generally low and ranged from below detection limits to over 1,000 ug/kg (1 mg/kg) in sample SBP-1. Sample SBP-1A, a sample from the same split spoon, showed concurrence only with acetone and this compound was estimated at 210 ug/kg in SBP-1A in lieu of 820 ug/kg in SBP-1. The highest soil gas readings were found near the office area (SG-04) as were the highest volatiles in the soil (SBP-1).

MALCOLM PIRNIE

TABLE 3-2

PERMEABILITY TEST RESULTS

W-1	=	0.7×10^{-4}	cm/sec_2
	=	1.4	gpd/ft^2
	=	0.2×10^{-5}	ft/sec
	=	0.17	ft/day
W-2	=	0.8×10^{-4}	cm/sec_2
	=	1.8	gpd/ft^2
	=	0.3×10^{-5}	ft/sec
	=	0.26	ft/day
W-3	=	0.2×10^{-3}	cm/sec_2
	=	4.0	gpd/ft^2
	=	0.6×10^{-5}	ft/sec
	=	0.52	ft/day
W-4	=	0.8×10^{-4}	cm/sec_2
	=	1.6	gpd/ft^2
	=	0.3×10^{-5}	ft/sec
	=	0.26	ft/day
W-7	=	0.1×10^{-3}	cm/sec_2
	=	2.3	gpd/ft^2
	=	0.4×1^{-5}	ft/sec
	=	0.34	ft/day
W-9	=	0.2×10^{-3}	cm/sec_2
	=	3.9	gpd/ft^2
	=	0.6×10^{-5}	ft/sec
	=	0.5	ft/day

.5 x 365 x 24 hrs = 365 ft

MALCOLM PIRNIE

TABLE 3-3

WESTCHESTER COLPROVIA CORPORATION
VOLATILE ORGANICS DETECTED IN SOIL BORINGS(1)

Parameter	January 7, 1988					January 13, 1988		
	SBP-1 (ug/kg)	SBP-1A (ug/kg)	SBP-2A (ug/kg)	Field Blank (ug/l)	Trip Blank (ug/l)	SBP-3 (ug/kg)	SBP-4 (ug/kg)	Field Blank (ug/l)
Acetone	820	210J	390J	-	-	340	45J	-
2-Butanone	180	-	-	-	-	-	-	-
Carbon Disulfide	-	-	-	-	-	-	7.8J	-
Ethylbenzene	750B	29B	-	1.95	-	6.6J	-	-
Methylene Chloride	-	-	31JB	2.0B(4)	-	340JB	-	3.75
4-Methyl-2-Pentanone	-	-	-	13	-		-	-
2-Hexanone	-	-	-	47B(4)	-	-	-	-
1,1,2,2-Tetrachlorethane	-	-	-	2.65	1.35	-	-	1.35
Chlorobenzene	-	-	-	2.15	-	-	-	-
Styrene	-	-	-	1.55	-	-	-	-
1,1,1-Trichloroethane	1,100	-	-	-	-	-	-	-
Trichloroethylene	170	-	-	-	-	-	-	-
Xylenes	1,400B	-	110	1.95	-	-	-	-
Toluene	-	12JB	-	2.45	-	8.2J	-	-
Sampling Interval (depth in feet)	3'-5'	3'-5'	17-'19'	NA	NA	1'-3'	2.5'-4.5'	NA
Nearby Soil Gas Location(2)	SG-04	SG-04	SG-09	NA	NA	SG-12	SG-11	NA
1,1,1-Trichloroethane(3)	3,100	3,100	320	NA	NA	0.1	0.6	NA
Trichloroethylene(3)	370	370	90	NA	NA	3	60	NA
Tetrachloroethylene(3)	0.6	0.6	6	NA	NA	2	3	NA

Notes:

1. Soil samples were analyzed for all priority pollutant volatiles. Subscript "J" indicates an estimated value. Subscript "B" indicates analyte found in a blank as well as the sample. No trip blank results are provided for the January 13, 1988 sampling because the sample broke in transit.
2. From Tracer Research Corp. report of July 1987. For locations see Figure 1-1.
3. Soil gas concentrations in ug/l.
4. The B on these values refers to the lab's method blank in which 4.4 ug/l of methylene chloride and 13 ug/l of 2-hexanone were detected.

NA - Not Applicable

- indicates the parameter was not detected.

3.3.2 Interpretation

Only in SBP-1 are the concentrations of volatile organics high enough to consider action. Even though these levels were not reproduced in the same split spoon, the results of SBP-1 are considered significant because they are supported incidentally by the earlier soil gas findings and by analysis of ground water from nearby well W5. Also, soil samples, due to their heterogeneous nature, can show variability over small distances. Concentrations of volatiles at other sampling locations are not considered to be of concern nor warrant remedial action.

3.4 GROUND WATER QUALITY

3.4.1 Analytical Data

Temperature, conductivity, and pH were measured in the field and these results are presented in Table 3-4. Results of volatile organic chemical (VOC) analyses for the monitoring wells sampled in March 1988 are presented in Table 3-5. No VOCs were detected in the two production wells, therefore these wells are not listed on the table. The results of the May 1987 ground water sampling for VOCs are provided in Table 3-6 for comparison.

Consistent with past sampling events, MW-3 exhibited the highest concentration of TCE. Duplicate samples collected showed levels of 880 ug/l and 670 ug/l; however; this is about half the previously reported level (1570 ug/l). TCE was detected in W-7 at 270 ug/l and in W-2 at 68 ug/l. This agrees with the previous pattern of TCE contamination found in these two wells.

Ground water samples collected in May 1987 had not indicated any TCE contamination in W-3 or W-4. Both the deep (W-3) and shallow (W-4) well had significant levels of TCE (350 ug/l and 160 ug/l, respectively) when sampled in March 1988. W-4 also contained 200 ug/l of trans-1,2-dichloroethene, which was not detected previously.

Less significant concentrations of other VOCs were detected in all the monitoring wells except W-8. Wells MW-2 and W-11 were reported as only having methylene chloride. Methylene chloride, which was detected in most of the samples, is probably not representative of the ground water since it was also detected in the field blanks and trip blanks. This compound is a common laboratory contaminant. The 28 ug/l concentration of methylene chloride found

MALCOLM PIRNIE

TABLE 3-4

GROUND WATER PARAMETERS MEASURED IN THE FIELD
(MARCH 2, 1988)

Sampling Point	Temperature (C)	Conductivity (umhos/cm)	pH
Malcolm Pirnie Monitoring Wells			
W1	9.0	262	5.95
W2	8.0	390	7.5
W3	11.2	440	7.15
W4	11.2	590	7.1
W5	13.5	510	6.25
W7	9.0	405	6.8
W8	11.0	330	7.3
W9	13.5	340	6.35
W10	11.0	280	7.1
W11	8.5	210	6.98
Geraghty & Miller Monitoring Wells			
MW2	8.5	240	7.27
MW3	11.3	490	6.2
Production Well			
Westchester Colprovia	11.2	365	6.35
Colonial Sand and Gravel's	8.0	160	6.65

MALCOLM PIRNIE

TABLE 3-5

WESTCHESTER COLPROVIA
GROUND WATER SAMPLING RESULTS
MARCH 1988

VOLATILE ORGANIC ANALYSES
(ug/l)

Volatile Organic Compound	W-1 14-24	W-2 5-15	MW-2	W-3 49-59	MW-3 9.4-29.4	MW-3 Dup.	W-4 26-36	W-5 24-44	W-7 13-23	W-8 7-17	W-9 48-58	W-9 Dup.	W-10 29-39	W-11 9-19	Field Blanks	Trip Blanks
Chloromethane																
Bromomethane																
Vinyl Chloride																
Chloroethane																
Methylene Chloride	4.1JB	2.6JB	2.9JB	4.1JB	2.6JB			28B	1.5JB			4.8JB	1.8JB	1.6JB	5.4, 3.4J	4.0, 4.6J
Acetone																
Carbon Disulfide																
1,1-Dichloroethene																
1,1-Dichloroethane								7.2								
Trans-1,2-Dichloroethene				7.3			200		4.1J							
Chloroform				2.6J												
1,2-Dichloroethane																
2-Butanone																
1,1,1-Trichloroethane				6.1		1.8J		1.9	1.4J		6.0	6.2				
Carbon Tetrachloride																
Vinyl Acetate																
Bromodichloromethane																
1,2-Dichloropropane																
Trans-1,3-Dichloropropene																
Trichloroethene		68		350	880	670	160		270				1.4J			
Dibromochloromethane																
1,1,2-Trichloroethane																
Benzene	2.9J															
cis-1,3-Dichloropropene																
2-Chloroethylvinylether																
Bromoform																

TABLE 3-5

WESTCHESTER COLPROVIA
GROUND WATER SAMPLING RESULTS
MARCH 1988 (Continued)

VOLATILE ORGANIC ANALYSES
(ug/l)

Volatile Organic Compound	W-1	W-2	MW-2	W-3	MW-3	MW-3 Dup.	W-4	W-5	W-7	W-8	W-9	W-9 Dup.	W-10	W-11	Field Blanks	Trip Blanks
4-Methyl-2-Pentanone																
2-Hexanone																
Tetrachloroethene		2.8J		7.5	9.9	11			11				1.1J			
1,1,2,2-Tetrachloroethane																
Toluene																
Chlorobenzene																
Ethylbenzene																
Styrene																
Total Xylenes																

Notes:

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

Trichloroethene is synonymous with trichloroethylene.

J - Indicates an estimated value.

B - Indicates possible/probable blank contamination.

MALCOLM PIRNIE

TABLE 3-6

WESTCHESTER COLPROVIA
GROUND WATER SAMPLING RESULTS
MAY 21, 1987

VOLATILE ORGANIC ANALYSES
(ug/l)

Volatile Organic Compound	W-1	W-2	MW-2	W-3	MW-3	W-4	W-7	Field Blanks	Trip Blanks
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									
Benzene			13		5.2				
cis-1,3-Dichloropropene									
2-Chloroethylvinylether									
Bromoform									

TABLE 3-6

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

VOLATILE ORGANIC ANALYSES
(ug/l)

Volatile Organic Compound	W-1	W-2	W-3	MW-3	W-4	W-7	Field Blanks	Trip Blanks
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					

Notes:

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

Trichloroethene is synonymous with trichloroethylene.

in W-5 may be significant since it is almost an order of magnitude higher than the concentrations detected in the blanks. However, previous sampling by Geraghty and Miller, Inc. in June 1987 did not detect methylene chloride in W-5, nor was methylene chloride detected in the soil boring near W-5. (SPB-1, SPB-1A).

3.4.2 Interpretation

Wells W-8, W-10 and W-11 have helped define the extent of the TCE plume at Colonial Sand and Gravel. VOC contamination remains concentrated at MW-3, with no evidence of contamination downgradient at W-11 or W-8 and values of TCE and PCE below detection limits at W-10. However, some migration of VOCs has occurred downgradient towards wells W-3 and W-4. The levels of TCE detected in the W-3/W-4 cluster show little or no stratification between the depths monitored. This is no surprise given the upward gradient generally present.

MALCOLM PIRNIE

4.0 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.

5. Legette, Brashears and Graham, 1985. Ground Water Assessment, Town of Bedford, New York.

MALCOLM PIRNIE

APPENDIX A

MONITORING WELL AND SOIL BORING LOGS

MALCOLM PIRNIE 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 No.	Blows per 6"	Depth (ft.)	SOIL DESCRIPTION: 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 19 14 15	5-7	REC.24",Brown dense medium SAND, some Gravel and cobbles		4" sch. 40 Riser surface to 14' Bentonite pellets 11 to 13'
		8	GRAVEL and coarse SAND		
S-2	34 23 33 21	10-12	REC.0", Split spoon pushed a cobble - no sample		Ottawa filter sand 13 to 24' 4"I.D.-.010"slot Sch.40 PVC screen 14 to 24'
		10	Coarse GRAVEL		
S-3	31 51 95 56	15-17	REC.23",Brown very dense coarse SAND and GRAVEL, pieces decomposed schist		Bentonite & grout mixture from surface to 11'
			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 No.	Blows per 6"	Depth (ft.)	SOIL DESCRIPTION: Density, color, SOIL, admixtures moisture, other notes, ORIGIN	Well Const	Remarks
		0-2	Coarse roadway gravel		
S-1	13 9 10 18	2-4	REC.16",Gray medium dense CLAY, some medium Sand, trace Gravel		Protective casing with key lock 4" sch. 40 Riser surface to 5'
S-2	100/1	4-6	REC.0", Coarse GRAVEL		Bentonite pellets 3 to 4'
S-3	17 21 25 42	6-8	REC.16",Gray brown dense CLAY and SAND,7" decomposed Schist in end of sample		Ottawa filter sand 4 to 15'
S-4	20 22 60 30	10-12	REC. 4", decomposed schist and medium SAND		4"I.D.-.010"slot Sch.40 PVC screen 5 to 15'
			End of boring 15' Well set at 15'		Bentonite & grout mixture from surface to 4'

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

BORING NUMBER :W-3

SAMPLE No.	Blows per 6"	Depth (ft.)	SOIL DESCRIPTION: 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 PVC~~ screen 29 to 44'

End of boring 60'
Well set at 59'

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

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

BORING NUMBER :W-5

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

End of boring 45'
Well set at 44'

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

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

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 No.	Blows/6" Rec.	Depth (ft)	SOIL DESCRIPTION Density, Color, Soil, Admixtures Moisture, other notes, Origin	WELL CONSTRUCTION Remarks
			1.5' road pack, into gravelly sand	
1	5/5/5/5 1.0' rec.	1.5-3	Gravel and m-vc sand, silty poorly sorted, brown, dry	Protective casing with key lock
HNu readings	0/0/0/0			
2	7/8//8/8 0.8' rec.	4.5-6	same as above	4" sch. 40 PVC Riser surface to 7'
HNu readings	0/0/0/0			cement seal, surface to 3'
3	7/9/8/8 0.8' rec.	7-8.5	same as above, bottom slighty damp	bentonite powder seal 3'-5'
HNu readings	0/0/0/0			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.	9-10.5	same as above, Gravel and m-vc sand, silty,
HNu readings	0/0/0/0		brown, some roots, bottom 2" wet and grey
5	9/12/12/11 0.7' rec.	11-12.5	same as above, but grey and wet water in auger string ≈ 9' below surface augered to 18' well set at 17'
HNu readings	0/0/0/0		

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

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 No.	Blows Rec.	Depth (ft)	SOIL DESCRIPTION Density, Color, Soil, Admixtures Moisture, other notes, Origin	WELL CONSTRUCTION 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'	

MONITORING WELL CONSTRUCTION DATA SHEET

PROJECT # 1074-01

PROJECT W. COLPROVIA

DRILLING CO. MARINE POLLUTION CONTROL

DRILLER JOE KAUFMAN

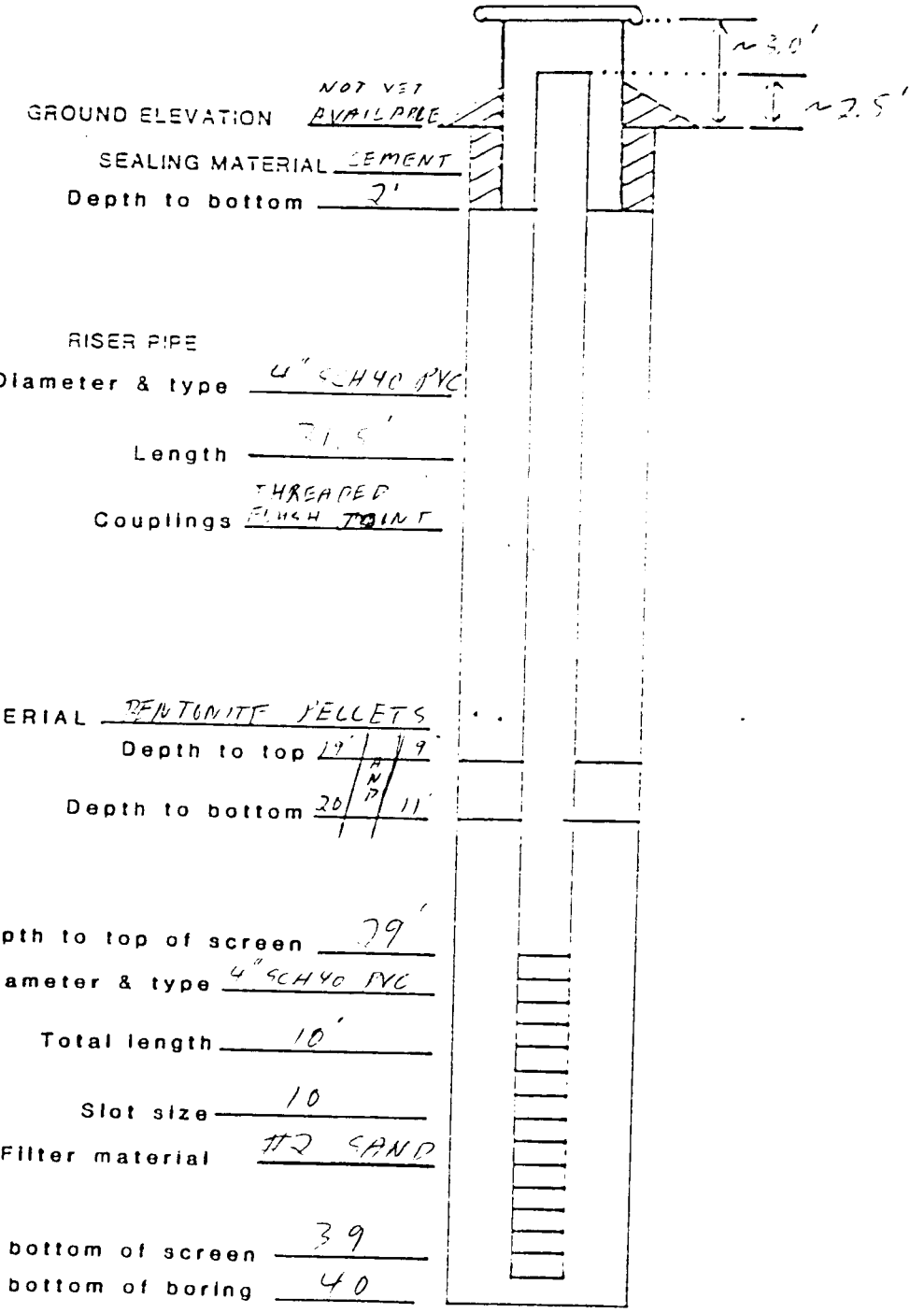
DATE OF INSTALLATION JANUARY 8 1988

MALCOLM PIRNIE PERSONEL PAUL SCIAN

WELL (AND/OR) W-12

BORING DESIGNATION

ELEV. (0.01) NOT YET AVAILABLE



GROUND ELEVATION NOT YET AVAILABLE

SEALING MATERIAL CEMENT

Depth to bottom 2'

RISER PIPE

Diameter & type 4" SCH 40 PVC

Length 31.5'

Couplings THREADED FLUSH JOINT

SEALING MATERIAL BENTONITE PELLETS

Depth to top 19' AND 9'

Depth to bottom 20' AND 11'

Depth to top of screen 29'

Screen Diameter & type 4" SCH 40 PVC

Total length 10'

Slot size 10

Filter material #2 SAND

Depth to bottom of screen 39

Depth to bottom of boring 40

MALCOLM PIRNIE

MONITORING WELL CONSTRUCTION DATA SHEET

PROJECT # 1074-01

PROJECT W. COLPROVIA

WELL (AND/OR) W-11

DATE OF INSTALLATION JANUARY 8, 1988

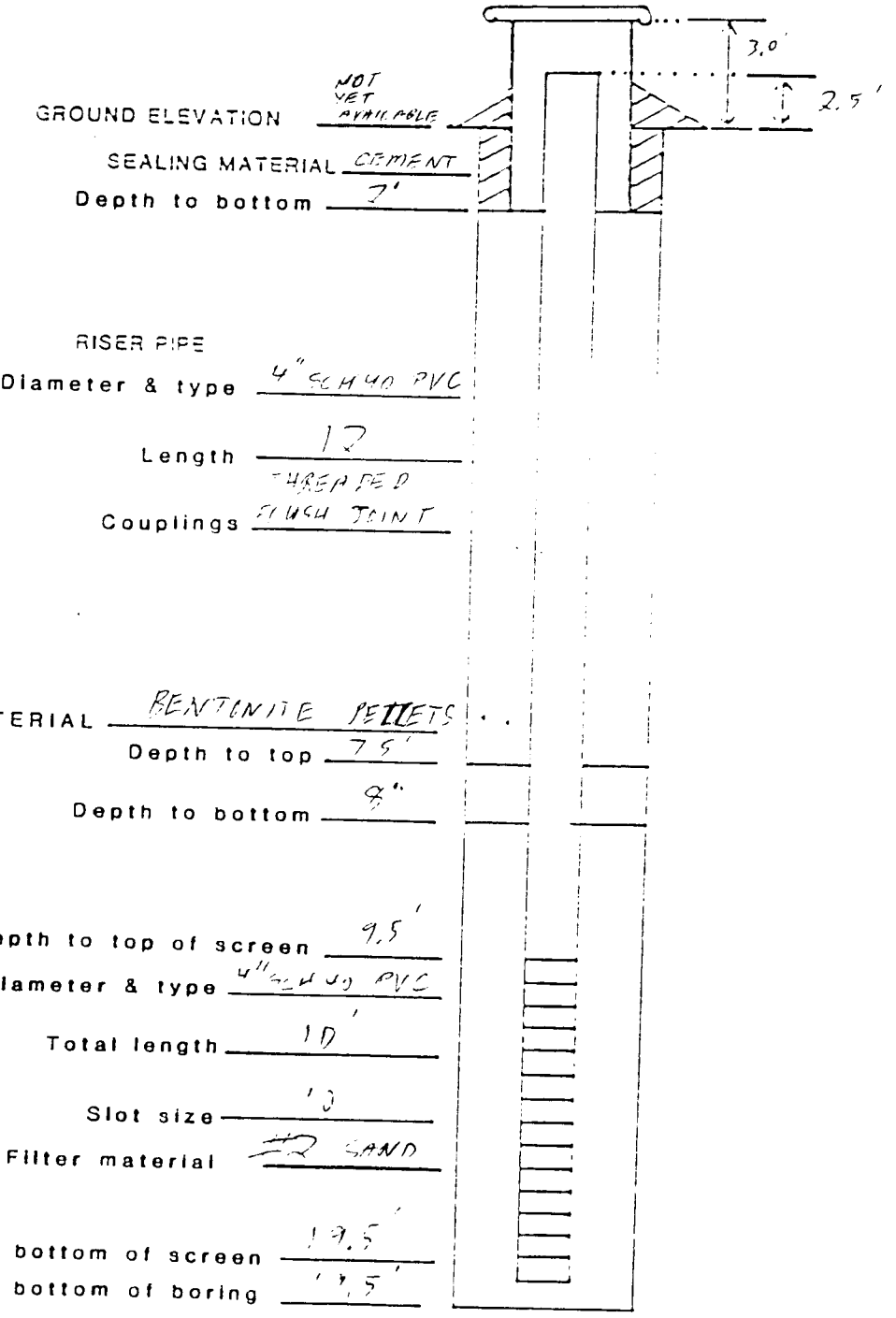
BORING DESIGNATION

DRILLING CO. MARINE POLLUTION CONTROL

MALCOLM PIRNIE PERSONEL PAUL SCIAN

ELEV. (0.01) NOT YET AVAILABLE

DRILLER JOE KAUFFMAN



GROUND ELEVATION NOT YET AVAILABLE

SEALING MATERIAL CEMENT

Depth to bottom 2'

RISER PIPE

Diameter & type 4" SCH 40 PVC

Length 12

THREADED

Couplings FLUSH JOINT

SEALING MATERIAL BENTONITE PELLETS

Depth to top 7.5'

Depth to bottom 8"

Depth to top of screen 9.5'

Screen Diameter & type 4" SCH 40 PVC

Total length 10'

Slot size 10

Filter material #2 SAND

Depth to bottom of screen 19.5'

Depth to bottom of boring 19.5'

MALCOLM PIRNIE

PROJECT :WESTCHESTER COLPROVIA PROJECT NO. :1074-01-1104
LOCATION :BEDFORD HILLS, N.Y.

BORING NUMBER :SBP 1 DATE :JANUARY 7, 1988
CONTRACTOR :MARINE POLLUTION CONTROL INSPECTOR :P. SCIAN
DRILL. METHOD :3 1/2 INCH ID HOLLOW- STEM AUGER (≈6 INCH OD)
SAMPLE METHOD:2" SPLIT SPOON

SAMPLE			SOIL DESCRIPTION	HNu READING
No.	Blows/2" Recovery	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	
		0-1	Asphalt and road base, ≈ 5" than 6" of f-m sd., frost zone	0
1	42 1.8'	1-3	F. sd., some m-c sd. and silt, trace pebbles and granules, brown, dry	0
2	30 1.5'	3-5	saa with zones of black discoloration and what appears to be small solidified tar balls, dry (Sampled)	0 on brown sd. 20 on black material
3	11 1.35'	5-7	v. f. sd., little m. sd. and silt, light brown to tan, dry	0
4	12 0.3	7-9	saa with trace pebbles, dry	0
5	9 0.3	9-11	saa with trace granules, dry	0.2

No well installed.

PROJECT :WESTCHESTER COLPROVIA PROJECT NO. :1074-01-1104
LOCATION :BEDFORD HILLS, N.Y.

BORING NUMBER :SBP 2 and SBP 2A DATE :JANUARY 7, 1988
CONTRACTOR :MARINE POLLUTION CONTROL INSPECTOR :P. SCIAN
DRILL. METHOD :3 1/2 INCH ID HOLLOW- STEM AUGER (≈6 INCH OD)
SAMPLE METHOD:2" SPLIT SPOON

SAMPLE			SOIL DESCRIPTION	HNu READING
No.	Blows/2" Recovery	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	
		0-1	Asphalt and road base, ≈ 6" than 6" of m-c sd., frost zone	0
1	35 0.4'	1-3	f-m sd., some c-vc sd. and silt, trace granules and pebbles, brown, dry	0
2	25 1.5	3-5	saa with some silty layers, brown, dry	0
			one black zone from ≈ 3' down with chunks of asphalt	1
3	48 1.6	5-7	layered silty vf sd., tan, dry and sandy silt, brown, dry	0
4	30 2.0	7-9	vf-f sd., very well sorted, tan, dry	0
5	30 2.0	9-11	saa	0
6A	39 0.6'	11-13	f-m sd., silty, some c sd., trace pebble, brown, dry	0
			c sd. and pebble probably slough from redrilled hole	

BORING NUMBER :SBP 2 and SBP 2A DATE JANUARY 7, 1988
continue

SAMPLE			SOIL DESCRIPTION	HNu READING
No.	Blows/2' Recovery	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	
7A	25 2.0'	13-15	f sd. with some silty layers, tan and brown, dry	0
8A	29 2.0'	15-17	saa, dry but bottom 6" grey, dry	0 1.5
9A	30 2.0'	17-19	saa bottom 6", all grey, dry one 3" silty section (Sampled)	2 10
10	80 1.2'	19-21	f-c sd., grey, dry, piece of bedrock? in tip of SS, most of the 80 blows were from the last six inches. Auger refusal at 22' below grade.	0

No well installed. Split spoon (SS) samples 1-5 and 10 were drilled in SBP2. Contamination picked up in auger cuttings resulted in SPB2A being drilled adjacent to SBP2 with SS samples 6A-9A.

PROJECT :WESTCHESTER COLPROVIA PROJECT NO. :1074-01-1104
LOCATION :BEDFORD HILLS, N.Y.

BORING NUMBER :SBP 3 DATE :JANUARY 13, 1988
CONTRACTOR :MARINE POLLUTION CONTROL INSPECTOR :P. SCIAN
DRILL. METHOD :3 1/2 INCH ID HOLLOW- STEM AUGER (≈6 INCH OD)
SAMPLE METHOD:2" SPLIT SPOON

SAMPLE			SOIL DESCRIPTION	HNu READING
No.	Blows/6" Recovery	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	
		0-1	Frost zone, unpaved granular road pack, dry, grey	6
1	20/21/23/34 1.2'	1-3	uppermost is a grey silty sand changing to brown silty sand, poorly sorted, cobbles at bottom of sample (Sampled)	6
2	13/16/20 0.5'	3-4.5	sd., silty, cobble stuck in SS opening tannish brown, dry	2
3	7/15/13 0.4'	4.5-6	f-m sd., brown, large cobbles coming up outside of auger	0
4	5/4/6/8 1.0'	6-8	c sd., cobble-silt, very poorly sorted, brownish tan, dry	2
5	6/8/7 0.3'	8-9.5	saa, dry	0
6	3/4/6 0.6'	9.5-11	saa, dry	0
7	9/18/33 0.9'	20-21.5	saa, dry,	0
8	40/100for2" 0.25'	24-24.7	Refusal. Sd. with pulverized rock pieces, dry	0

No well installed. Large cobbles coming up outside of augers, some > 6".

PROJECT :WESTCHESTER COLPROVIA PROJECT NO. :1074-01-1104
LOCATION :BEDFORD HILLS, N.Y.

BORING NUMBER :SBP 4 DATE :JANUARY 13-14, 1988
CONTRACTOR :MARINE POLLUTION CONTROL INSPECTOR :P. SCIAN
DRILL. METHOD :6 1/4 INCH ID HOLLOW- STEM AUGER (10 INCH OD)
SAMPLE METHOD:2" SPLIT SPOON
ELEVATION :NOT YET AVAILABLE

SAMPLE			SOIL DESCRIPTION	HNu READING
No.	Blows/6" Recovery	Depth (ft)	Density, Color, Soil, Admixtures Moisture, other notes, Origin	
			6"-8" Frost zone. 0-3" of granular road pack, 3"-12" m sd., brown	0
1	19/8/10 1.2'	1-2.5	f-m sd., trace pebbles and silt, tan, dry	1.0
2	3/4/4/5 1.5'	2.5-4.5	saa, dry (Sampled)	1.5
3	4/4/6 1.0'	4.5-6	f sd., some m sd. and silt, dry	0
4	5/5/8 1.0'	6-7.5	top 6" saa, dry bottom 6" m-c sd., some f sd., tan dry	0
5	3/4/10 1.0'	7.5-9	saa bottom, dry	0.5
6	6/9/6/9 1.3'	9-11	saa, dry	0
7	6/6/18 1.5	20-21.5	top 1.25' saa, dry, bottom 0.25' poorly sorted, vc sd. and gravel, v. light tan, dry	0
8	100for1.5"	29.5	zero recovery, auger refusal	-

Driller reports thatsfrom 24' on there was very large cobbles and very little sand. Auger cuttings show 1"-4" cobbles with auger hole pushed open. No well.

GERAGHTY & MILLER, INC.

Geologic Log of Monitoring Well MW-3 at Quarry, Bedford, New York

Well No.	Description	Depth (ft.) From	To
MW-3	Fill. Sand, medium to coarse, with some fine sand. Tannish brown, moist, loose.	0	0.5
	Fill. Asphalt, topsoil, fine to medium gravel, fine to medium sand, trace of clay and silt.	0.5	2
	Sand, fine to medium, trace of fine to medium gravel. Tannish brown, moist, loose.	2	7
	Silt, trace of clay. Dark olive drab, moist, partly cohesive.	7	8
	Silt, very fine to fine sand, with some clay. Dark brown, moist, fairly cohesive.	8	12
	Silt, very fine to fine sand, with lenses of fine to medium sand and some clay, trace of fine to medium gravel. Dark brown, moist, fairly cohesive.	12	14
	Silt and clay. Dark brown, moist, cohesive.	14	15
	Silt, very fine to medium sand, with some clay. Dark brown, moist.	15	16
	Silt and clay, with trace of fine gravel. Dark brown, moist, cohesive.	16	16.7
	Sand, very fine to medium, with some silt and clay. Tannish brown, wet, fairly cohesive. Water table at 17 feet below land surface?.	16.7	18
	Silt and clay, with some sand and fine to medium gravel. Dark brown, wet. Petroleum? Odor and sheen.	18	19
	Sand, very fine to coarse, with fine to coarse gravel, trace of silt. Grayish brown, fairly loose, wet. Slight odor, stained?	19	24
	Sand, fine to coarse, with some fine to coarse gravel and silt, trace of clay and mica flakes. Brown, fairly loose, wet. Stained? Odor?	24	30

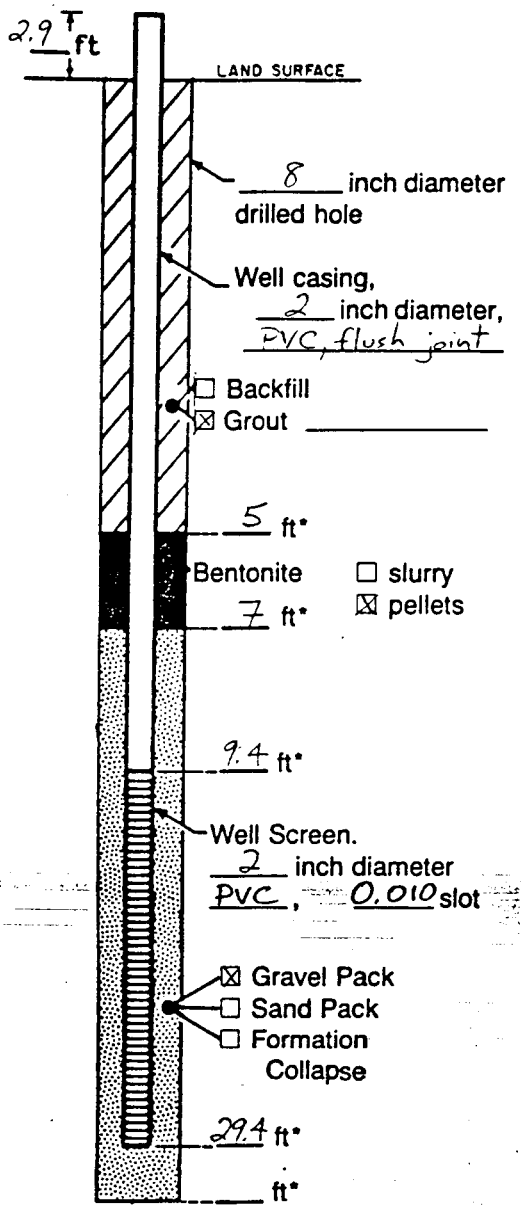
Geologic Log of Monitoring Well MW-3 at Quarry, Bedford, New York

Well No.	Description	Depth (ft.) From	To
MW-3 (Cont'd.)	Large cobble apparently. Refusal, no recovery.	30	- 32
	Sand, medium to coarse, with some fine sand and fine to medium gravel. Brown, wet, loose. Odor?	32	- 33

#J953BF1\122986.

GERAGHTY & MILLER, INC.
Ground-Water Consultants

WELL CONSTRUCTION LOG



Measuring Point is Top of Well Casing Unless Otherwise Noted.

*Depth Below Land Surface

Project J1171BD1 Well MW-3

Town/City Bedford

County Westchester State NY

Permit No. —

Land-Surface Elevation

and Datum _____ feet ☐ surveyed

_____ ☐ estimated

Installation Dates(s) 12/8/86

Drilling Method hollow stem auger

Drilling Contractor General Borings, Inc.

Drilling Fluid _____

Development Techniques(s) and Date(s)

Fluid Loss During Drilling _____ gallons

Water Removed During Development _____ gallons

Static Depth to Water _____ feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration _____ hours

Yield _____ gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose _____

Remarks _____

Prepared by Jeff Melby

MALCOLM PIRNIE

APPENDIX B

TYPICAL MONITORING WELL CONSTRUCTION

NEW YORK STATE

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

MONITORING WELL SPECIFICATIONS

Groundwater Monitoring Well Specifications. (See Figure 1)

(1) All wells to be nominal four (4) inch diameter

(2) Boring logs shall be recorded for each boring. Soil samples shall be taken from each soil layer encountered or at a maximum five (5) foot intervals to give a general description of the underlying soils at the facility.

(3) Wells must be installed plum and straight.

(4) Flush threaded joints must be used to avoid contamination of well by glued joints.

(5) Well screens are to be machine slotted and be of adequate length and placement to accommodate seasonal variations in water table. (Length will generally be 10' to 15' with the mean water table in the middle of the screen).

(6) Filter pack must be compatible with soil around screened portion of well and with the screen opening. It must extend approximately one foot below the screen and three to five feet above the screen.

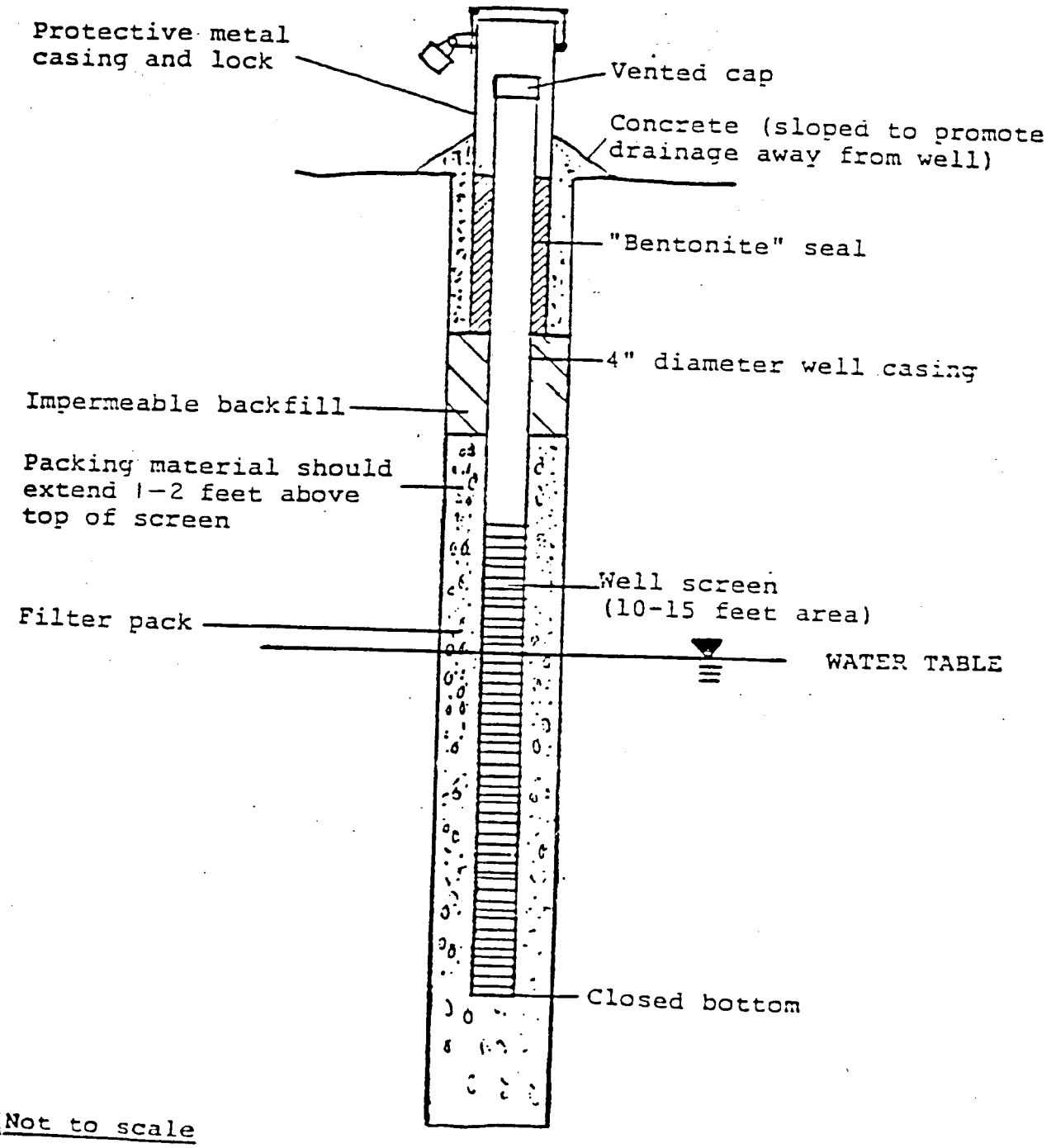
(7) The well must be sealed between the casing and the bore hole with an impermeable material and capped with concrete or other suitable material to prevent contamination from the surface.

(8) Wells must be sufficiently developed to ensure that samples will accurately represent the condition of the groundwater.

(9) Tops of wells must be enclosed by a protective metal casing and locked.

(10) All wells must be clearly marked as monitoring wells.

FIGURE 1



Not to scale

MALCOLM PIRNIE

MONITORING WELL

MALCOLM PIRNIE

APPENDIX C

SLUG TEST DATA

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

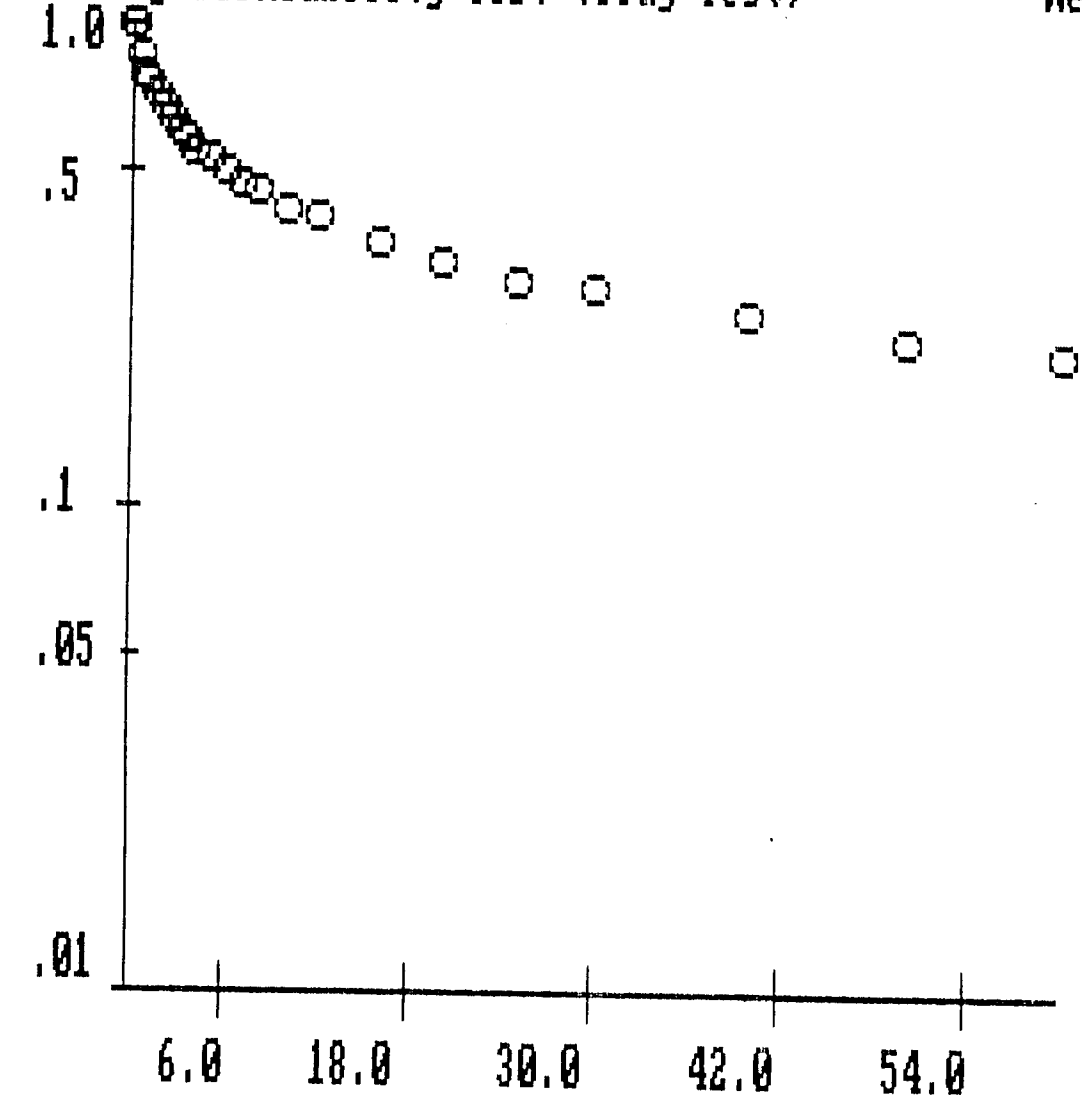
K = 0.7E-04 CM/SEC
= 1.4 GPD/FT2
= 0.2E-05 FT/SEC
= 0.2 FT/DAY

REGRESSION COEFFICENT = -.8955774

Malcolm Pirnie Inc.

Time-Lag Permeability Test (Slug Test)

Well No.: W-1



X AXIS:
TIME,MIN

Y AXIS:
LOG (H/HO)

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
480	2.9	-0.60	.6666666
600	2.9	-0.60	.6666666
720	2.95	-0.55	.611111
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

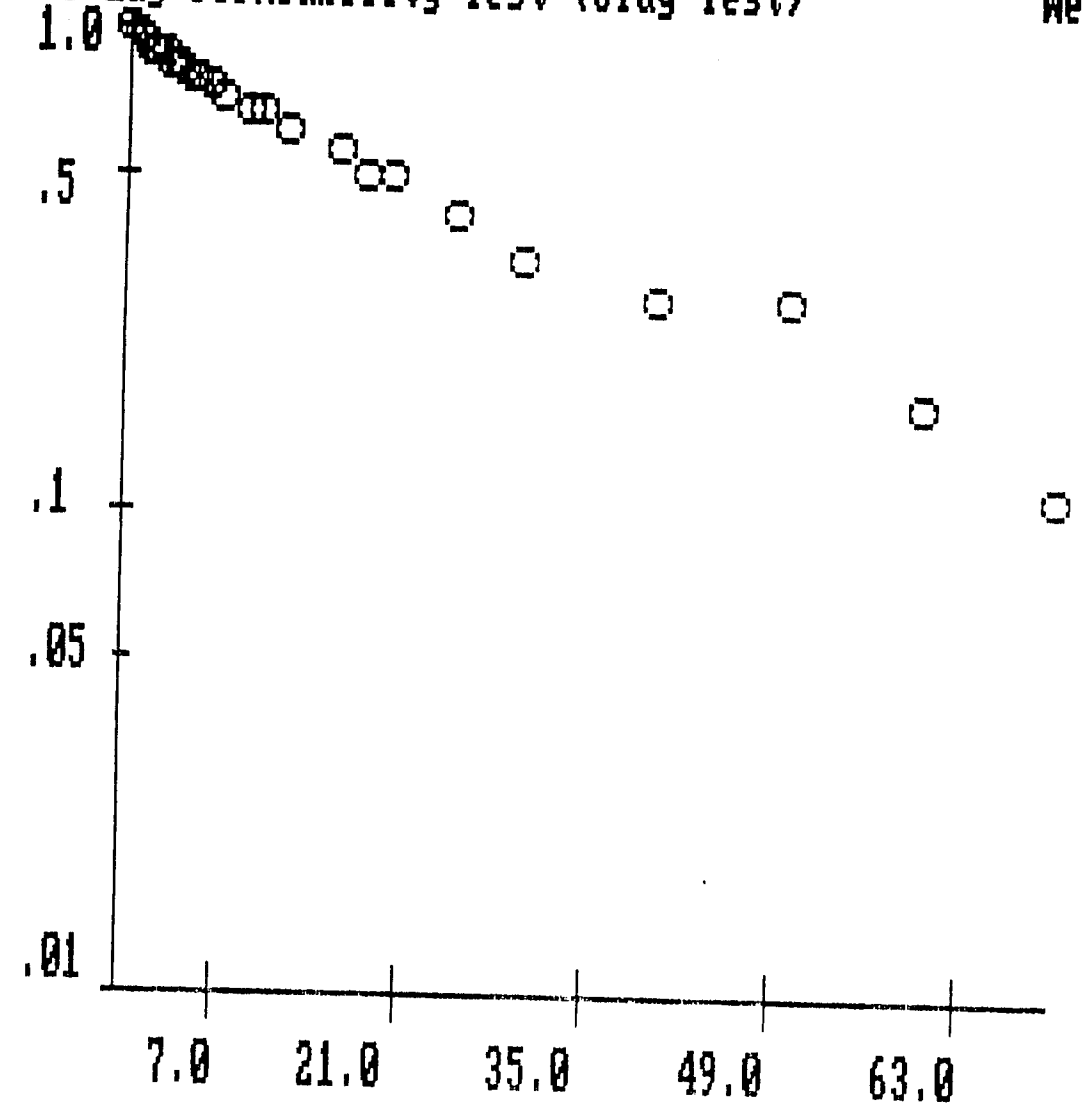
K = 0.8E-04 CM/SEC
= 1.8 GPD/FT2
= 0.3E-05 FT/SEC
= 0.2 FT/DAY

REGRESSION COEFFICENT = -.9912656

Malcolm Pirnie Inc.

Time-Lag Permeability Test (Slug Test)

Well No.: W-2



X AXIS:
TIME,MIN

Y AXIS:
LOG (H/HO)

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA INC.
WELL NO: W-3

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
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	.6153886
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

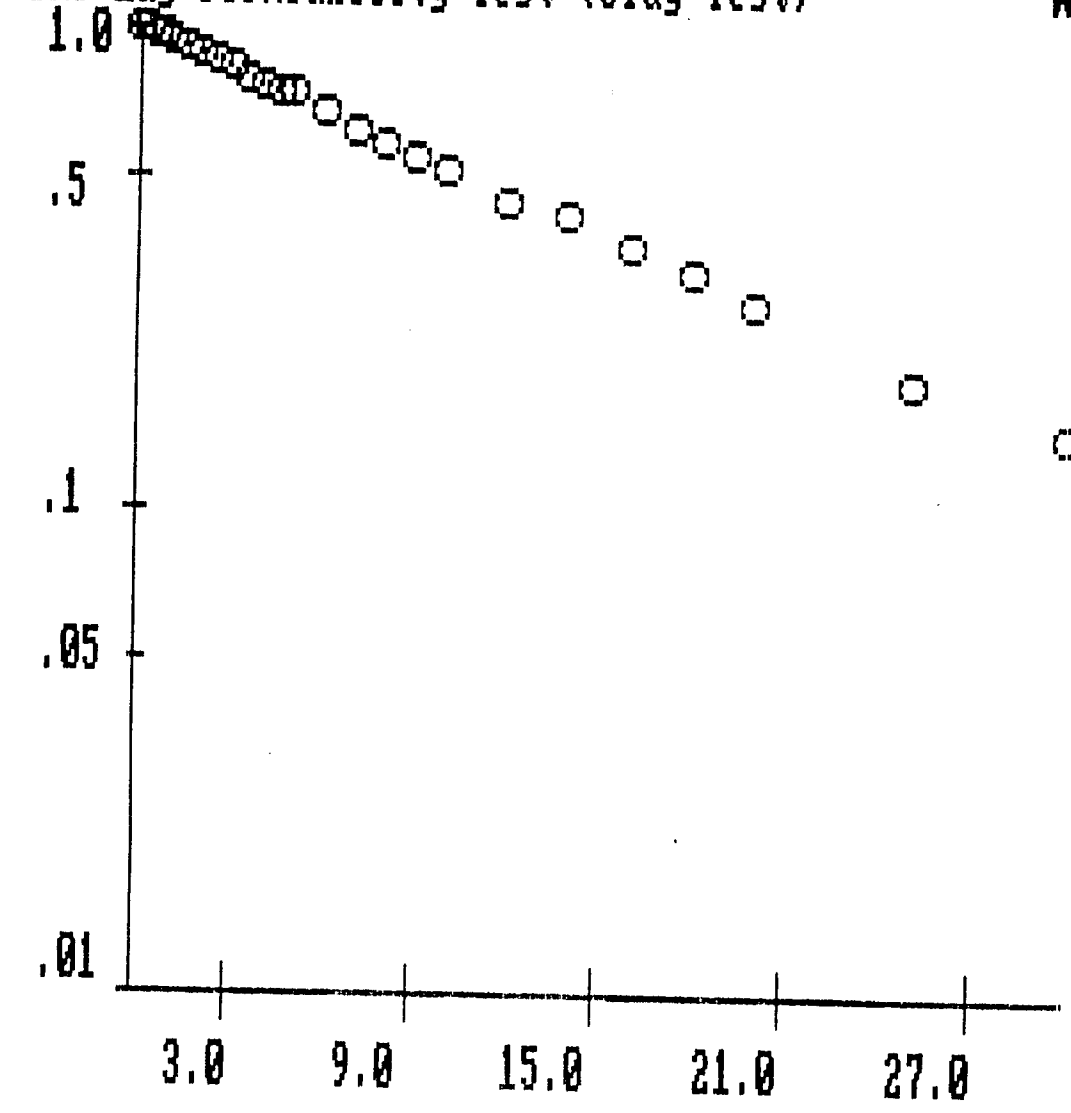
K = 0.2E-03 CM/SEC
= 4.0 GPD/FT2
= 0.6E-05 FT/SEC
= 0.5 FT/DAY

REGRESSION COEFFICENT = -.9997041

Malcolm Pirnie Inc.

Time-Lag Permeability Test (Slug Test)

Well No.: W-3



X AXIS:
TIME,MIN

Y AXIS:
LOG (H/HO)

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA INC.
WELL NO: W-4

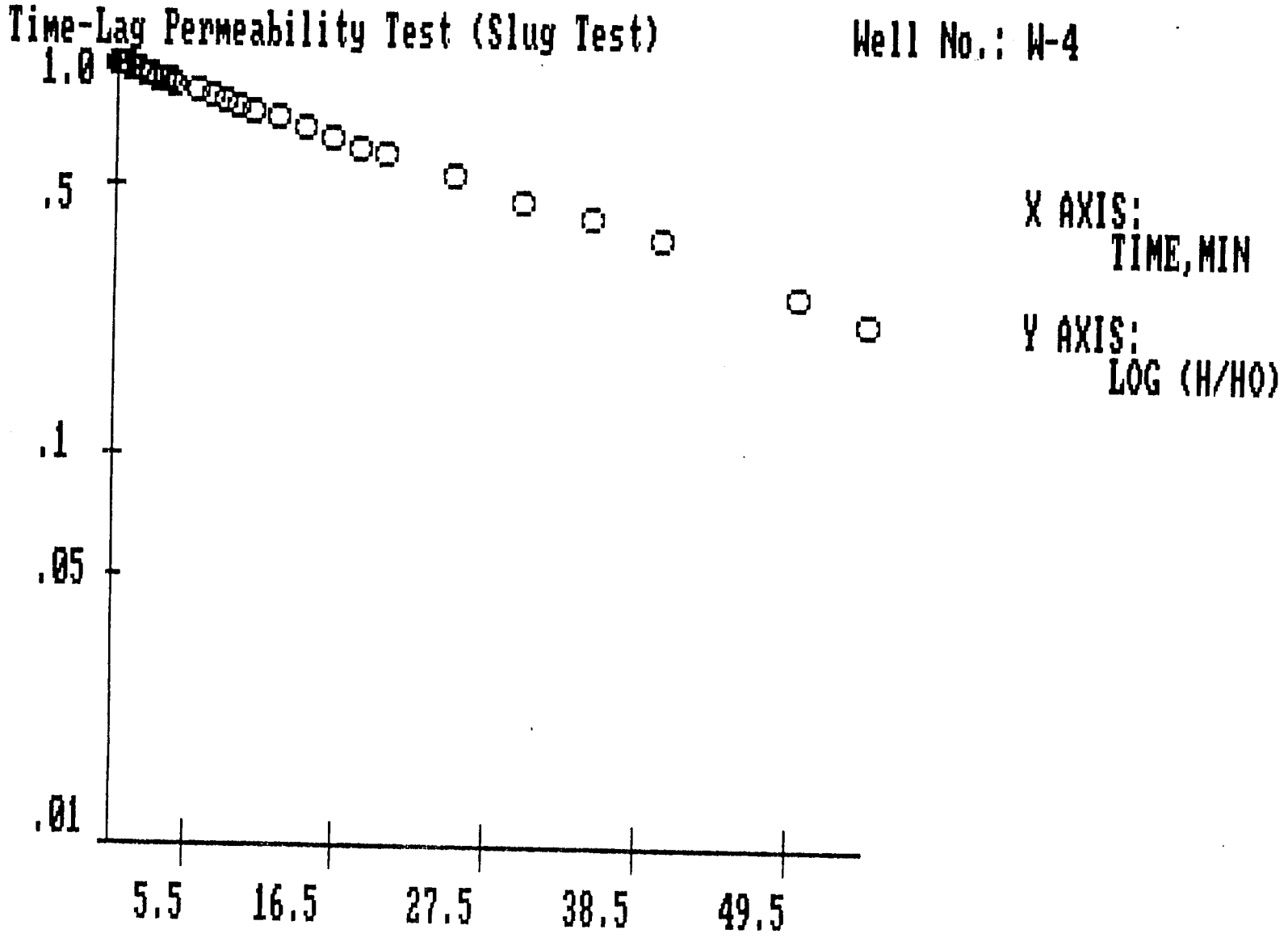
TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
0	29.66	-0.89	1
15	29.66	-0.89	1
30	29.67	-0.88	.9887642
45	29.67	-0.88	.9887642
60	29.68	-0.87	.9775285
90	29.7	-0.85	.9550534
120	29.71	-0.84	.9438212
150	29.71	-0.84	.9438212
180	29.73	-0.82	.9213497
210	29.74	-0.81	.9101139
240	29.75	-0.80	.8988746
270	29.76	-0.79	.8876389
300	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 COEFFICENT = -.9995673

Malcolm Pirnie Inc.


Time-Lag Permeability Test (Slug Test)
Well No.: W-4
1.0
.5
.1
.05
.01
5.5
16.5
27.5
38.5
49.5
X AXIS:
TIME,MIN
Y AXIS:
LOG (H/HO)

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA INC.
WELL NO: W-7

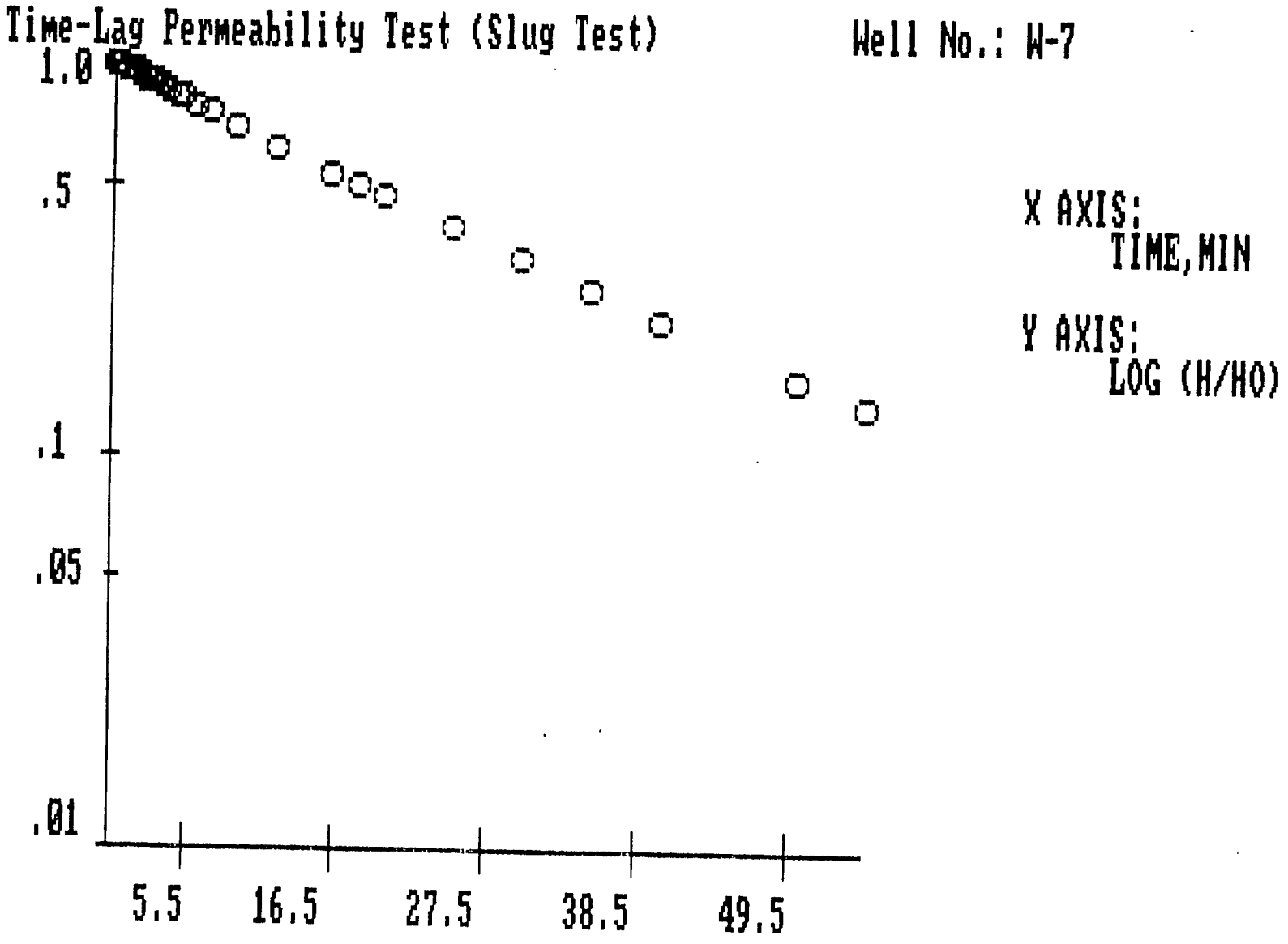
TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
0	15.1	-0.89	1
8.399999	15.1	-0.89	1
15	15.1	-0.89	1
30	15.1	-0.89	1
45	15.12	-0.87	.9775285
60	15.13	-0.86	.966291
90	15.14	-0.85	.9550553
105	15.15	-0.84	.9438213
120	15.16	-0.83	.9325838
135	15.17	-0.82	.9213481
150	15.18	-0.81	.9101123
165	15.18	-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 COEFFICENT = -.9994786

Malcolm Pirnie Inc.


Time-Lag Permeability Test (Slug Test)
Well No.: W-7
1.0
.5
.1
.05
.01
5.5
16.5
27.5
38.5
49.5
X AXIS:
TIME,MIN
Y AXIS:
LOG (H/HO)

Time-Lag Permeability Test (Slug Test)

WESTCHESTER COLPROVIA
WELL NO: W-9

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
9	38.48	-0.92	1
21	38.55	-0.85	.9239146
34.98	38.58	-0.82	.8913032
45	38.6	-0.80	.8695679
49.98	38.62	-0.78	.8478292
60	38.65	-0.75	.8152178
79.98	38.67	-0.73	.7934825
90	38.7	-0.70	.7608711
105	38.73	-0.67	.728263
135	38.77	-0.63	.6847823
150	38.79	-0.61	.6630436
180	38.83	-0.57	.6195662
210	38.87	-0.53	.5760888
270	38.93	-0.47	.5108727
360	39.02	-0.38	.4130453
480	39.1	-0.30	.3260905
600	39.16	-0.24	.2608711
780	39.22	-0.18	.195655
960	39.25	-0.15	.163047
1200	39.29	-0.11	.1195662
1500	39.3	-0.10	.1087002
1800	39.31	-0.09	9.782749E-02
2100	39.32	-0.08	8.696155E-02
2400	39.33	-0.07	7.608881E-02
2700	39.33	-0.07	7.608881E-02

UNCONFINED AQUIFER

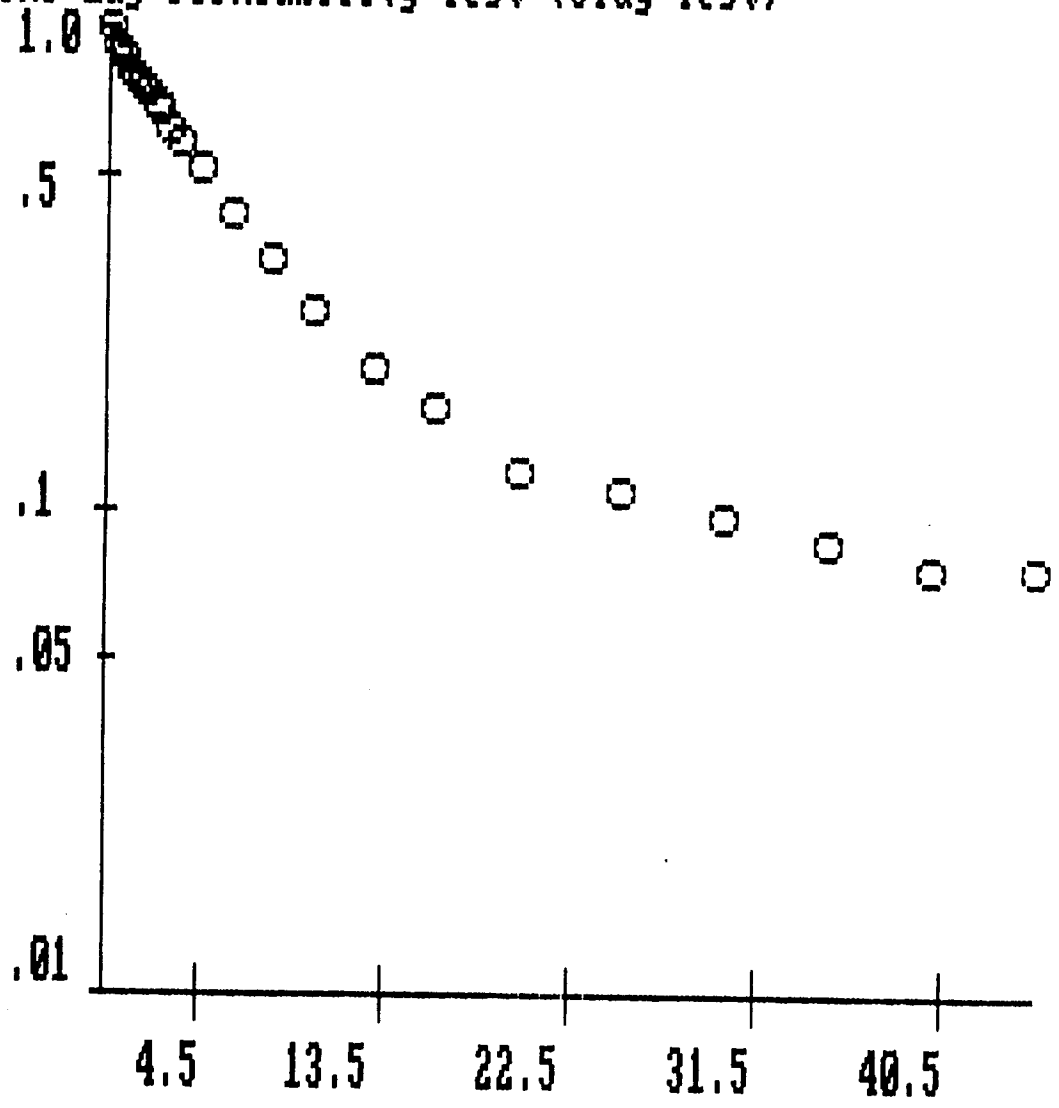
K = 0.2E-03 CM/SEC
= 3.9 GPD/FT2
= 0.6E-05 FT/SEC
= 0.5 FT/DAY

REGRESSION COEFFICENT = -.9490588

Malcolm Pirnie Inc.

Time-Lag Permeability Test (Slug Test)

WELL W-9



X AXIS:
TIME,MIN

Y AXIS:
LOG (H/HO)