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Area B
Hydrogeologic Report
for
Naval Air Warfare Center
Warminster, Pennsylvania

Northern Division
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Contract Task Order 0134

April 1995

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AREA B
HYDROGEOLOGIC REPORT
FOR
NAVAL AIR WARFARE CENTER
WARMINSTER, PENNSYLVANIA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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1.0 INTRODUCTION

In response to Contract Task Order No. 134 under Contract N62472-90-D-1298, Halliburton NUS Corporation (HNUS) is submitting this Area B Hydrogeologic Investigation Report for the Naval Air Warfare Center (NAWC) located in Warminster, Pennsylvania (Figure 1-1). This work is part of the Navy's Installation Restoration Program (IRP), which is designed to identify contamination of Navy and Marine Corps facilities resulting from past operations and to institute corrective measures as appropriate. IRP activities are typically performed in four distinct phases. The first phase consists of a Preliminary Assessment (PA) followed by a Site Inspection (SI). The third phase is a Remedial Investigation/Feasibility Study (RI/FS), which is intended to characterize physical and chemical parameters and risks associated with the facility. The last phase consists of remedial action designed to control and mitigate contamination. This report is prepared under Phase III IRP activities.

In addition to meeting the objectives of the Navy's IRP, the purpose of RI investigations is to meet the requirements of CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act of 1980), as amended by SARA (Superfund Amendments and Reauthorization Act of 1986). As such, RI investigations should address the nature and extent of contamination associated with hazardous substance releases at the facility that are not regulated and are not being investigated under the authority of the Clean Air Act, Clean Water Act, the Resource Conservation and Recovery Act (RCRA), and other Federal laws.

1.1 PURPOSE OF REPORT

Upon completion of the Phase II RI for NAWC Warminster, an RI report for Operable Unit 1 (OU-1) was issued in April 1993 (Halliburton NUS, 1993a). OU-1 has been defined as contaminated groundwater attributable to Areas A and B at NAWC Warminster in overburden and shallow bedrock aquifers. Findings of the Phase II RI for Area B included the detection of volatile organic compounds (VOCs) in overburden and shallow bedrock on NAWC Warminster property. In addition, sampling of offsite residential wells by the Navy within an approximate 3,000-foot radius of Area B identified VOCs in approximately 30 residential wells at concentrations above Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act. The Area B hydrogeologic investigation was performed to further assess the potential impacts of Area B and past activities on NAWC property east of Area B on groundwater resources.

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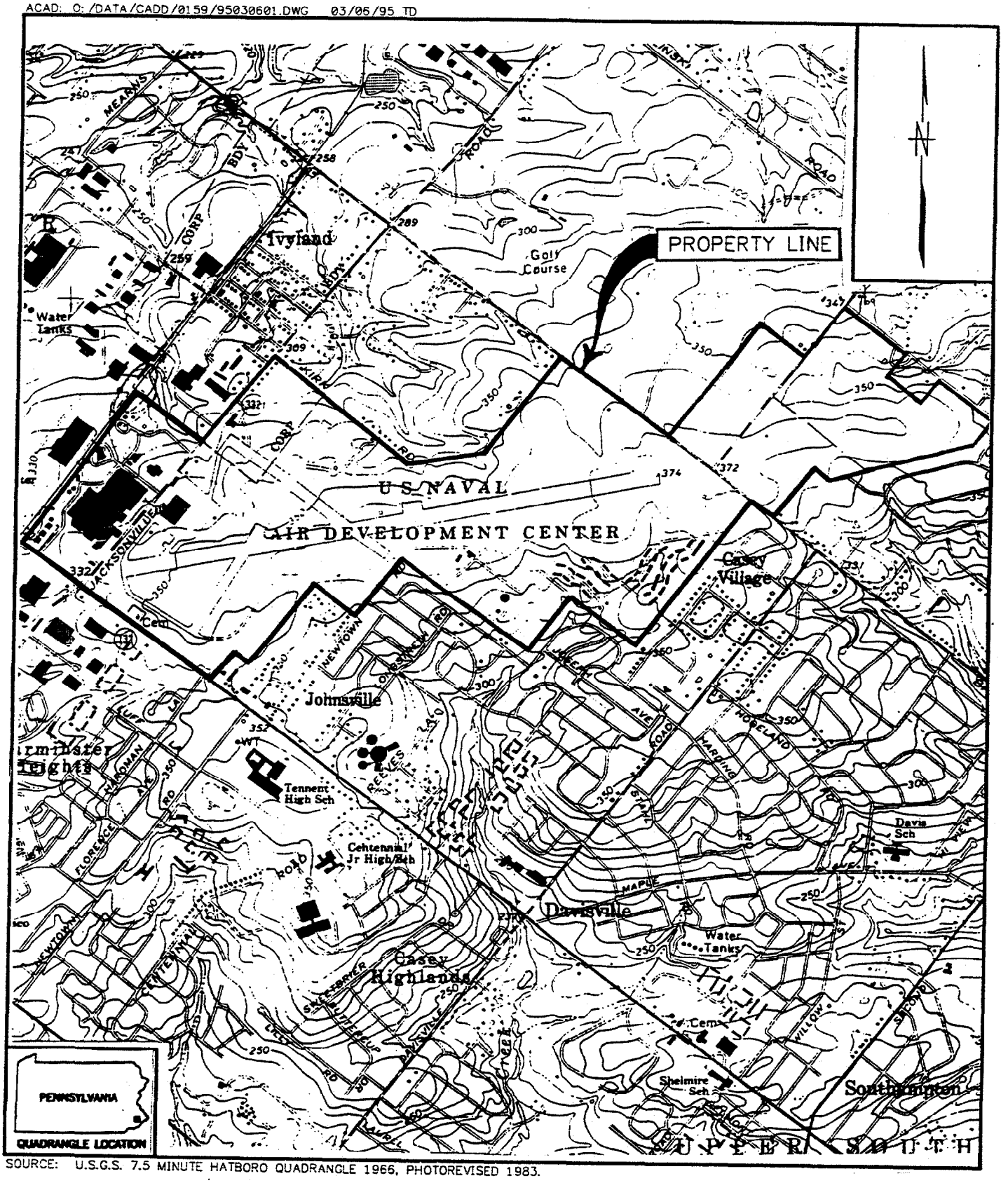

SOURCE: U.S.G.S. 7.5 MINUTE HATBORO QUADRANGLE 1966, PHOTOREVISED 1983.

SITE LOCATION MAP
NAWC WARMINSTER, PA

0 2000 4000
SCALE IN FEET

FIGURE 1-1

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The purpose of this report is to present the findings of the groundwater investigation conducted at NAWC Warminster for Area B. The results of this investigation will be used to support remedial design and action activities for groundwater in Area B, and to supplement upcoming Phase III RI source area studies.

1.2 AREA B BACKGROUND

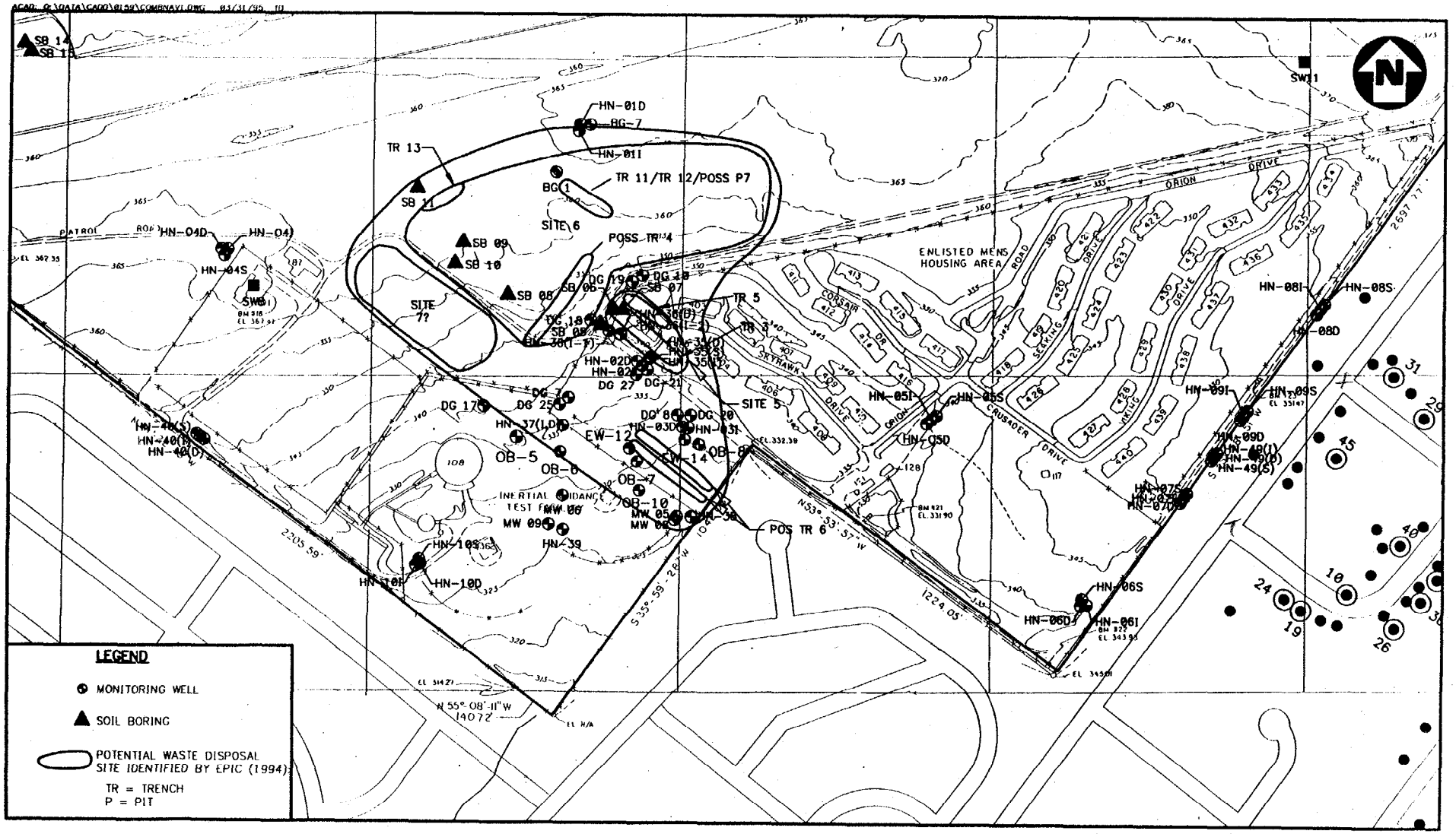
Area B consists of Sites 5 (South Runway Landfill), 6 (Waste Pit No. 3), and 7 (Sludge Disposal Pits). The general layout of Area B is shown in Figure 1-2. Site 5 is located under Housing Unit 401 in NAWC Warminster's enlisted men's housing area. Site 6 is south of the main runway and north of the patrol road near the eastern end of the facility. The location of Site 7 is uncertain, as historical information is sketchy and site investigation work performed to date has not positively identified the site. All sites are within the fenced NAWC Warminster perimeter. Groundwater and surface water flow and runoff are generally to the south for Area B. The history and status of this area is briefly discussed below. Detailed descriptions of the findings of earlier investigations within Area B are presented in the Phase II RI Report (Halliburton NUS, 1993a) and the Phase III RI Work Plan (Halliburton NUS, 1995).

1.2.1 Description and History

1.2.1.1 South Runway Landfill - Site 5

Site 5 is located south of the main runway and adjacent to a baseball field at NAWC Warminster. The site reportedly operated from 1955 to 1970 and was rediscovered during construction for the foundation of a housing unit (Unit 401). It is currently not know what, if any, removal of wastes occurred subsequent to this discovery. Site 5 reportedly consisted of up to six to eight disposal trenches in which paints, solvents, scrap metal, demolition debris, and asphalt were disposed. Each trench was reportedly 12 feet wide by 70 feet long and eight feet deep. EPIC photo analysis of Site 5 revealed two trenches (TR3 and TR5) approximately 175 to 260 feet long within the Site 5 area, underlying the current locations of two housing units (Figure 1-2). The discrepancy between the reported and photo-identified number of trenches may be due to either the two long trenches actually being the expression of several shorter trenches dug end-to-end, or may be the result of adding in the Site 6 trenches to the reported number for Site 5. Additional research will be performed to address this question.

After Site 5 was closed, two feet of fill was placed over the disposal area, and the area was reseeded. The Shenandoah Woods Navy townhouse complex was subsequently constructed in the vicinity of Site 5; within



SITE LOCATIONS
AND MONITORING WELL LOCATIONS
AREA B
NAWC WARMINSTER

FIGURE 1-2

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100 feet of the site are about eight housing units. Navy housing unit 401 was constructed adjacent to and possibly over Site 5.

1.2.1.2 Waste Pit No. 3 - Site 6

Site 6 reportedly consists of an unknown number of disposal pits or trenches on the northern side of the patrol road and the south side of the main runway, as shown in Figure 1-2. Three trenches (POSS TR4, TR11/TR12/POSS P7, and TR13) were identified within Site 6 in the EPIC report. Site 6 is north of Site 5 and northeast of Site 7. This site allegedly received paint, solvents, demolition waste, waste oils, flammable waste, and grease trap waste from 1960 to 1980. The site is currently wooded and construction debris has been observed on ground surface. To date, the extent of surface debris has not been characterized in detail, nor has sampling been performed to determine whether hazardous substances are present. The site covers an area of about 70,000 square feet.

Information regarding waste disposal operations for Site 6 is poor. An EPIC photo analysis for the site found evidence of several trenches within the Site 6 area. Site 6 is within 400 feet of the housing area described for Site 5 and about 900 feet from the facility boundary.

1.2.1.3 Sludge Pits - Site 7

Site 7 reportedly consisted of two disposal trenches that were used from 1950 to 1955 to receive sludge from the wastewater treatment plant. The site is located south of the main runway. Two potential locations for Site 7 have been identified (Figure 1-2). One location is near the southern base boundary, and was identified through EPIC photo analysis (POSS TR 6). The other potential location is due west of Site 6, based on recollections of base personnel.

The trenches were reportedly 100 feet long by 12 feet wide and eight feet deep. The trenches were reportedly backfilled with fill after each dumping episode. Upon site closure in 1955, the trenches were covered with two feet of soil, regraded, and reseeded. There is a possibility that both sites received sludges during separate time periods.

2.0 AREA B HYDROGEOLOGIC INVESTIGATION

2.1 SCOPE OF INVESTIGATION

The tasks performed during the Area B Hydrogeologic Investigation are described in the Work Plan Addendum for Area B Hydrogeologic Investigation (Halliburton NUS, 1993b) and subsequent Technical Memoranda. The scope of field work included in this project includes:

- Drilling, logging, installation, and development of 27 monitoring wells at ten cluster locations during the first phase of the investigation (well clusters HN-1 through HN-10).
- Drilling, logging, installation, and development of 16 additional monitoring wells at seven locations during Focused RI for Groundwater Investigation activities (well clusters HN-35 through HN-40 and well cluster HN-49).
- Sampling and analysis of ten subsurface soil samples (one from each original cluster location) obtained from the soil/bedrock interface.
- Sampling and analysis of 49 monitoring wells and 2 groundwater extraction wells.
- Performing three rounds of static water level measurements.
- Conducting a long-term (1 month) water level study at three monitoring well clusters.
- Conducting a long-term (72-hour) pumping test.

2.1.1 Previous Well Installation Information

Previous hydrogeologic investigations of Area B have concentrated solely on the shallow (less than 50 feet in depth) groundwater beneath this area. Prior to the present study, a total of 17 monitoring wells had been installed to investigate the groundwater. The depths of these wells range from 7 to 50 feet, with a mean depth of 26 feet. Table 2-1 provides construction details for these wells.

TABLE 2-1

AREA B
WELL CONSTRUCTION SUMMARY
AREA B HYDROGEOLOGIC INVESTIGATION
NAWC WARMINSTER, PENNSYLVANIA

Well	Elevation (Feet)		Borehole Depth (Feet)	Monitored Interval[1] (Feet)	Well Diameter (Inches)	Estimated Yield (gpm)	Well Type
	Ground	Top of Casing					
NEWLY INSTALLED MONITORING WELLS							
HN-01I	367.31	369.28	104	68 - 92	4	16	bedrock
HN-01D	367.51	369.02	155	108 - 127	4	0.5	bedrock
HN-02I	338.54	339.63	104	85 - 104	4	8	bedrock
HN-02D	338.84	340.18	153	116 - 133	4	20	bedrock
HN-03I	332.54	334.71	102	81 - 102	4	12	bedrock
HN-03D	332.54	335.26	162	115 - 140	4	1	bedrock
HN-04S	366.33	367.27	37	20 - 37	4	22	bedrock
HN-04I	366.15	367.93	104	55 - 73	4	1	bedrock
HN-04D	366.23	367.65	179	105 - 124	4	16	bedrock
HN-05S	339.42	339.11	55	36 - 55	4	6	bedrock
HN-05I	338.63	337.70	154	70 - 88	4	1	bedrock
HN-05D	338.17	338.30	204	180 - 204	4	12	bedrock
HN-06S	343.34	345.62	53	30 - 53	4	6	bedrock
HN-06I	343.24	345.52	103	80 - 103	4	4	bedrock
HN-06D	343.24	345.54	154	134 - 154	4	1.5	bedrock
HN-07S	350.83	352.86	45	29 - 45	4	9	bedrock
HN-07I	350.73	352.54	103	64 - 85	4	1	bedrock
HN-07D	350.23	350.59	201	144 - 162	4	<1	bedrock
HN-08S	355.03	356.07	54	29 - 48	4	<0.5	bedrock
HN-08I	354.83	356.23	78	60 - 78	4	6	bedrock
HN-08D	354.63	355.55	178	157 - 178	4	11	bedrock
HN-09S	351.73	355.01	52	29 - 52	4	9	bedrock
HN-09I	351.73	354.32	103	75 - 103	4	<0.5	bedrock
HN-09D	351.73	353.98	202	138 - 161	4	17	bedrock
HN-10S	331.05	331.05	54	26 - 40	4	22	bedrock
HN-10I	331.17	331.17	112	80 - 101	4	22	bedrock
HN-10D	330.89	330.89	254	225 - 245	4	<1	bedrock

TABLE 2-1 (Continued)
AREA B
WELL CONSTRUCTION SUMMARY
AREA B HYDROGEOLOGIC INVESTIGATION
NAWC WARMINSTER, PENNSYLVANIA

Well	Elevation (Feet)		Borehole Depth (Feet)	Monitored Interval[1] (Feet)	Well Diameter (Inches)	Estimated Yield (gpm)	Well Type
	Ground	Top of Casing					
HN-35S	338.63	338.69	105	35 - 48	2	1	bedrock
HN-35I	338.63	338.69		87 - 105	2		bedrock
HN-35D	339.12	338.85	150	115 - 130	2		bedrock
HN-36I1	342.16	342.76	177	82 - 100	2	2	bedrock
HN-36I2	341.22	342.68	151	101 - 115	2	<1	bedrock
HN-36D	341.22	341.94		133 - 147	2	1	bedrock
HN-37I	336.98	338.90	159	75 - 103	2	2	bedrock
HN-37D	336.98	338.42		116 - 141	2	3	bedrock
HN-38	327.53	329.16	119	97 - 119	2	5	bedrock
HN-39	326.28	326.71	150	125 - 150	2	<1	bedrock
HN-40S	353.97	354.74	69	55 - 69	2	3	bedrock
HN-40I	353.53	355.12	133	88 - 114	2	<1	bedrock
HN-40D	352.97	355.07	161	120 - 148	2	2	bedrock
HN-49S	351.51	352.72	51	36 - 51	2	<1	bedrock
HN-49I	351.56	352.45	102	55 - 75	2	1.5	bedrock
HN-49D	351.51	352.96	152	118 - 135	2	2	bedrock
PREVIOUSLY INSTALLED WELLS							
BG-1	362.80	362.63	18	7 - 15.9	2	--	overburden
BG-7	NA	368.11	37	18.5 - 37*	6	<0.5	bedrock
DG-7	338.60	338.29	15.5	5.6 - 15.05	2	--	overburden
DG-8	332.40	332.08	10	5.05 - 9.6	2	--	overburden
DG-9	342.80	342.08	15.5	6.8 - 14.7	2	--	overburden
DG-10	345.10	344.71	16	7.65 - 15	2	--	overburden
DG-17	NA	347.64	38	16.5 - 38*	6	<0.5	bedrock
DG-18	NA	343.99	27	22 - 27*	6	1	bedrock
DG-19	NA	346.25	47	21.75 - 47*	6	0.5	bedrock
DG-20	NA	333.20	32	17.6 - 32*	6	1	bedrock
DG-21	NA	338.90	33	15 - 33*	6	<0.5	bedrock
DG-25	NA	338.17	41	21 - 41*	6	1	bedrock
DG-27	NA	338.38	13.2	6.2 - 13.2	4	0.5	overburden

TABLE 2-1 (Continued)
AREA B
WELL CONSTRUCTION SUMMARY
AREA B HYDROGEOLOGIC INVESTIGATION
NAWC WARMINSTER, PENNSYLVANIA

Well	Elevation (Feet)		Borehole Depth (Feet)	Monitored Interval[1] (Feet)	Well Diameter (Inches)	Estimated Yield (gpm)	Well Type
	Ground	Top of Casing					
MW-05	NA	328.53	35	25 - 35*	6	>7	bedrock
MW-06	NA	331.84	50	18 - 50*	6	>5	bedrock
MW-08	NA	328.30	7	2 - 7	4	--	overburden
MW-09	NA	327.81	7	2 - 7	4	<0.5	overburden

* Well completed as open borehole in bedrock.
(1) The monitored interval is measured from ground surface and is equivalent to the sand-packed interval for wells installed with a screen and riser pipe. For the wells completed as open boreholes in bedrock (designated by an asterisk [*]), the monitored interval is equivalent to the length of the open borehole.
NA - Not Available

2.2 MONITORING WELL INSTALLATION

Monitoring wells were installed at various locations during the Area B Hydrogeologic Investigation in order to further quantify the hydrogeologic conditions throughout the area and to further delineate the nature and extent of groundwater contamination discovered during the previous investigations. Well clusters were installed upgradient and downgradient of Sites 5, 6, and 7 in order to evaluate the impact of these sites on the local groundwater quality. Additional well clusters were installed along the NAWC boundary with Casey Village in order to obtain hydrogeologic and analytical data to fully define groundwater conditions in this area. Finally, well clusters were installed at several locations to provide hydraulic head data from selected stratigraphic intervals during the Area B pumping test.

A total of 43 monitoring wells were installed during the hydrogeologic investigation. The locations of these wells, as well as the previously installed wells, are illustrated in Figure 1-2. The monitoring wells were generally installed in clusters, to define both vertical and lateral trends in groundwater conditions. The well clusters consisted of shallow, intermediate, and deep bedrock wells at all locations. No overburden wells were installed as part of this investigation, as the focus of the study was the bedrock aquifer. Overburden wells installed during previous investigations are present at some cluster locations. The number and depth of wells installed at a location was dependent on the presence of any pre-existing wells at the location and on the data gaps identified during the scoping of the investigation. Rationale for the new wells was presented in the Work Plan Addendum for Area B Hydrogeologic Investigation (Halliburton NUS, 1993b).

The monitoring wells were designed and installed to monitor the most significant water-bearing zone within a designated interval. The highest yielding zone typically was considered the most significant water-bearing zone within the designated target interval. If the interval contained several zones of similar yields, the results of the geophysical program (described below) were used to select the most appropriate interval to be screened.

In general, the target intervals for the well installation were from the top of bedrock to a subsurface depth of 50 feet for the shallow bedrock wells, from a subsurface depth of 50 to 100 feet for the intermediate wells, and from a subsurface depth of 100 to 150 feet for the deep wells. For cluster HN-10, the respective target intervals were the top of bedrock to 50 feet, 50 to 150 feet, and 150 to 250 feet. These target intervals were established based on observations from both the current and previous investigations at NAWC Warminster that indicated that the Stockton Formation beneath the site generally consists of highly fractured bedrock to a subsurface depth of approximately 50 to 60 feet, and a less fractured, more competent bedrock below this depth. The target intervals were based upon the goal of obtaining discrete samples in order to determine the vertical distribution of the hydraulic head and to define the vertical extent of contamination.

These target intervals, however, were used only as general guidelines. The actual depth of each monitoring well was based upon the depth that significant water-bearing zones were encountered.

The boreholes for each monitoring well were drilled, using air hammer methods, until a significant water-bearing zone within the appropriate target interval was encountered. If no significant zones were encountered, the boreholes were drilled up to an additional 50 feet in an attempt to encounter prospective intervals to be monitored. The lithologies encountered during the drilling of the boreholes and the depth(s) and approximate yields of the water-bearing zones were recorded by a Halliburton NUS field geologist. Copies of the field boring logs are included in Appendix A.

Geophysical tools were run in most boreholes to determine subsurface conditions, including lithology, fractured intervals, water-entry or exit zones, and vertical direction of groundwater flow. The overall purpose of running the borehole geophysics was to assure that each well would be completed over the optimal or most appropriate stratigraphic interval. For the deepest borehole at each location, the geophysical logs generated included caliper, natural gamma, single-point resistivity, fluid temperature, and fluid resistivity logs. In selected boreholes, brine tracing logs were also run to determine vertical movement patterns of water within the borehole. Generally, only the caliper log was run in the shallower bedrock borehole(s), to identify or confirm the depths of the fractured intervals as noted in the drilling log. A downhole video camera was run in selected boreholes to observe the lithology and to identify the nature of the fractured intervals and/or water-bearing zones as identified through the various geophysical logs.

Monitoring wells at clusters HN-1 through HN-10 were constructed with 4-inch-diameter, flush-joint and threaded Schedule 40 PVC well casing and 4-inch-diameter, Schedule 40, 0.020-inch slotted well screen fitted with a bottom cap. Monitoring wells at clusters HN-35 through HN-40 and at HN-49 were constructed with similar materials except the wells are 2 inches in diameter. For each well, the space between the bottom of the borehole and the bottom of the well (if any) was sealed with bentonite to the bottom of the desired monitoring interval, and with No. 2 quartz sand from that point to the bottom of the screen. The annular space between the well screen and the borehole was packed with No. 2 quartz sand to the top of the desired monitoring interval. The annular space from the top of the sand pack to the bottom of the surface casing was sealed with bentonite, and the annular space inside the surface casing was sealed with a bentonite-cement grout. Well construction details are summarized in Table 2-1; well construction diagrams are included in Appendix B.

The monitoring wells were developed a minimum of 48 hours after installation with a submersible pump. The groundwater temperature, pH, conductivity, and turbidity were monitored during development. The drawdown was monitored with an electronic sounding device to ensure that the pumping rate did not

exceed the yield of the well. The amount of water developed from the wells was dependent upon their yield and the time needed for the monitored parameters to stabilize. In general, the wells were developed until the parameters from three consecutive samples taken at 15-minute intervals fell within 10 percent of one another.

2.3 GROUNDWATER SAMPLING

Sampling and analysis of groundwater was conducted to determine groundwater quality conditions in the vicinity of Area B and the portion of the base between Area B and Casey Village. All bedrock monitoring wells were sampled. The primary groundwater sampling program was conducted during January 1994. A total of 36 monitoring wells were sampled, including the 27 newly installed screened wells at clusters HN-1 through HN-10 (7 shallow bedrock, 10 intermediate bedrock, and 10 deep bedrock), and 9 pre-existing shallow, open-borehole bedrock wells. Sampling of an additional 15 monitoring wells occurred during August, September, and December, 1994 and in January and February of 1995, as well clusters HN-35 through HN-40 and HN-49 were installed.

The groundwater sampling and analysis program and sampling procedures are described in the Work Plan Addendum (Halliburton NUS, 1993b) and the Quality Assurance Project Plan (Halliburton NUS, 1993c) for Area B Hydrogeologic Investigation. All wells were purged prior to sampling. Wells with yields of 1 gallon per minute or greater were purged of a minimum of three well volumes of groundwater and until the monitored parameters (pH, temperature, conductivity) of three consecutive samples of purge water fell within 10 percent of one another. The pumping rate was monitored to assure that the wells were not purged at a higher rate than the natural yield of the formation. Wells with yields of less than 1 gallon per minute were purged dry and allowed to recover overnight to the pre-pumping static water level prior to sampling. All wells were sampled with decontaminated, stainless-steel, bottom-loading bailers.

All groundwater samples were analyzed for low-concentration volatile organics. Selected samples were analyzed for Target Analyte List (TAL) metals (total and dissolved phases) and Target Compound List (TCL) semivolatile organics and PCBs/pesticides. Table 2-2 identifies the analyses performed for each monitoring well. Field measurements collected during sampling included pH, temperature, and conductivity. These parameters were recorded on sample log sheets, which are contained in the project files.

Groundwater samples were stored in coolers and submitted daily to a Naval Energy and Environmental Support Activity (NEESA)-approved laboratory using Contract Laboratory Program (CLP) methods. Quality control samples, including field duplicates, trip blanks, and rinsate blanks, were collected and analyzed as

TABLE 2-2

GROUNDWATER SAMPLING SUMMARY
AREA B HYDROGEOLOGIC INVESTIGATION
NAWC WARMINSTER, PENNSYLVANIA

Cluster Location	Well	Analysis				
		Low-Concentration Volatile Organics	TCL Semivolatile Organics	TAL Metals (Total and Filtered)	PCBs/ Pesticides	Engineering Parameters
HN-1	BG-7	X				
	HN-1I	X	X	X	X	
	HN-1D	X	X	X	X	
HN-2	DG-21	X				X
	HN-2I	X	X	X	X	X
	HN-2D	X	X	X	X	X
HN-3	DG-20	X				
	HN-3I	X		X		
	HN-3D	X		X		
HN-4	HN-4S	X				
	HN-4I	X				
	HN-4D	X				
HN-5	HN-5S	X		X		
	HN-5I	X	X	X	X	
	HN-5D	X	X	X	X	
HN-6	HN-6S	X				
	HN-6I	X				
	HN-6D	X				
HN-7	HN-7S	X		X		
	HN-7I	X	X	X	X	
	HN-7D	X	X	X	X	
HN-8	HN-8S	X				
	HN-8I	X				
	HN-8D	X				
HN-9	HN-9S	X		X		
	HN-9I	X	X	X	X	
	HN-9D	X		X		

TABLE 2-2 (Continued)
GROUNDWATER SAMPLING SUMMARY
AREA B HYDROGEOLOGIC INVESTIGATION
NAWC WARMINSTER, PENNSYLVANIA

Cluster Location	Well	Analysis				
		Low-Concentration Volatile Organics	TCL Semivolatile Organics	TAL Metals (Total and Filtered)	PCBs/ Pesticides	Engineering Parameters
HN-10	HN-10S	X		X		
	HN-10I	X		X		
	HN-10D	X		X		
HN-35	HN-35S	NS				
	HN-35I	NS				
	HN-35D	NS				
HN-36	HN-36I1	X				
	HN-36I2	X				
	HN-36D	X				
HN-37	HN-37I	X				
	HN-37D	X				
HN-38	MW-05	X				
	MW-08	NS				
	HN-38	X				
HN-39	MW-06	X				
	MW-09	NS				
	HN-39	X				
HN-40	HN-40S	X		X		
	HN-40I	X		X		
	HN-40D	X		X		
HN-49	HN-49S	X		X		
	HN-49I	X		X		
	HN-49D	X		X		
Other Wells	DG-17	X				
	DG-18	X				
	DG-19	X				
	DG-25	X				
	EW12	X				
	EW14	X				

NS Not Sampled

required by NEESA Level D sampling protocol and as specified in the Work Plan Addendum and Quality Assurance Project Plan for Area B Hydrogeologic Investigation.

The analytical results of the groundwater sampling are summarized and discussed in Section 4. Appendix C contains the complete analytical results for the groundwater sampling performed during the Area B Hydrogeologic Investigation.

2.4 SUBSURFACE SOIL SAMPLING

Subsurface soils were sampled and analyzed at cluster locations HN-1 through HN-10 in order to evaluate each location as a potential source area for groundwater contamination. One subsurface soil sample was obtained from the soil/bedrock interface at each cluster location. At most locations, hollow-stem augers fitted with a center plug were advanced to near the soil/bedrock interface (as determined during the installation of the monitoring well surface casings). The center plug was withdrawn, and the samples were obtained with a standard 2-inch by 24-inch, stainless-steel, split-spoon sampler. At cluster locations HN-3 and HN-7, the soil samples were obtained with a hand auger. All samples were analyzed for TCL volatiles and TAL metals. The sampling depths and analytical parameters for the samples are summarized in Table 2-3.

The analytical results of the soil sampling are summarized and discussed in Section 4. Appendix C contains the complete analytical results for the soil sampling performed during the Area B Hydrogeologic Investigation.

2.5 WATER-LEVEL MEASUREMENTS

Three comprehensive rounds of water levels were obtained from the Area B monitoring wells. The rounds were taken on April 27, August 17, and December 13, 1994. The water levels were obtained using a calibrated M-Scope, marked to 1/100th of a foot, and were taken from marked points on the top of each well casing. Each comprehensive round of water levels was obtained within a time period of approximately 3 hours in order to minimize the effects of short-term water level fluctuations. The water level data obtained during the three rounds of measurement are presented in Table 2-4.

A long-term (1-month) groundwater-level monitoring program was conducted in selected Area B wells in order to investigate the duration and magnitude of short-term versus long-term water level fluctuations, to determine the response of the aquifer to precipitation events, to determine the effects of nearby pumping

TABLE 2-3

SOIL SAMPLING SUMMARY
AREA B HYDROGEOLOGIC INVESTIGATION
NAWC WARMINSTER, PENNSYLVANIA

Cluster Location	Sampling Interval (Feet) (Subsurface Depth)	Number of Samples	TCL Volatiles	TAL Metals
HN-1 A	5 - 7	1	X	X
HN-2 B	2.5 - 4.5	1	X	X
HN-3 C	1 - 1.75	1	X	X
HN-4 D	5 - 7	1	X	X
HN-5 E	5 - 7	1	X	X
HN-6 F	6 - 7.5	1	X	X
HN-7 G	3.5 - 4	1	X	X
HN-8 H	5 - 7	1	X	X
HN-9 I	7 - 9	1	X	X
HN-10 J	2.5 - 4.5	1	X	X

TABLE 2-4

AREA B
MONITORING WELL GROUNDWATER ELEVATIONS
NAWC WARMINSTER, PENNSYLVANIA

Well	Monitored Interval[1]	Reference Elevation[2]	April 27, 1994		August 17, 1994		December 13, 1994	
			Static[3]	Elevation[2]	Static[3]	Elevation[2]	Static[3]	Elevation[2]
NAWC MONITORING WELLS								
BG-07	18 - 37	368.11	20.27	347.84	24.15	343.96	24.67	343.44
DG-17	17 - 38	347.64	11.16	336.48	17.19	330.45	16.08	331.56
DG-18	22 - 27	343.99	9.42	334.57	15.22	328.77	14.38	329.61
DG-19	22 - 47	346.25	11.37	334.88	16.65	329.60	16.60	329.65
DG-20	18 - 32	333.20	6.16	327.04	9.01	324.19	7.55	325.65
DG-21	15 - 33	338.89	4.39	334.50	10.62	328.27	9.10	329.79
DG-25	21 - 41	338.17	4.96	333.21	10.48	327.69	9.45	328.72
DG-27	6 - 13	338.38	3.24	335.14	10.18	328.20	8.60	329.78
MW-05	25 - 35	328.53	7.76	320.77	9.69	318.84	8.30	320.23
MW-06	18-50	331.84	9.73	322.11	12.06	319.78	10.43	321.41
HN-01I	68 - 92	369.28	21.76	347.52	26.00	343.28	26.50	342.78
HN-01D	108 - 127	369.02	32.62	336.40	37.85	331.17	38.01	331.01
HN-02I	85 - 104	339.63	18.37	321.26	20.40	319.23	18.95	320.68
HN-02D	116 - 133	340.18	19.13	321.05	21.01	319.17	19.60	320.58
HN-03I	81 - 102	334.71	13.79	320.92	15.67	319.04	14.23	320.48
HN-03D	115 - 140	335.26	15.38	319.88	16.93	318.33	15.70	319.56
HN-04S	20 - 37	367.27	13.58	353.69	17.17	350.10	16.18	351.09
HN-04I	55 - 73	367.93	14.46	353.47	18.16	349.77	17.60	350.33
HN-04D	105 - 124	367.65	28.51	339.14	33.05	334.60	31.99	335.66
HN-05S	36 - 55	339.11	7.72	331.39	9.99	329.12	10.68	328.43
HN-05I	70 - 88	337.70	6.70	331.00	9.17	328.53	8.93	328.77
HN-05D	180 - 204	338.30	9.31	328.99	13.45	324.85	13.90	324.40
HN-06S	30 - 53	345.62	14.87	330.75	16.70	328.92	16.25	329.37
HN-06I	80 - 103	345.52	11.77	333.75	14.34	331.18	14.05	331.47
HN-06D	134 - 154	345.54	12.64	332.90	14.81	330.73	14.58	330.96

TABLE 2-4 (Continued)
AREA B
MONITORING WELL GROUNDWATER ELEVATIONS
NAWC WARMINSTER, PENNSYLVANIA

Well	Monitored Interval[1]	Reference Elevation[2]	April 27, 1994		August 17, 1994		December 13, 1994	
			Static[3]	Elevation[2]	Static[3]	Elevation[2]	Static[3]	Elevation[2]
HN-07S	29 - 45	352.86	20.51	332.35	23.43	329.43	22.65	330.21
HN-07I	64 - 85	352.54	20.83	331.71	23.45	329.09	22.80	329.74
HN-07D	145 - 165	350.59	19.65	330.94	21.28	329.31	21.10	329.49
HN-08S	29 - 48	356.07	21.34	334.73	26.25	329.82	26.35	329.72
HN-08I	60 - 78	356.23	28.79	327.44	33.41	322.82	32.65	323.58
HN-08D	157 - 178	355.55	26.55	329.00	30.68	324.87	30.95	324.60
HN-09S	29 - 52	355.01	20.67	334.34	24.65	330.36	23.88	331.13
HN-09I	75 - 103	354.32	22.84	331.48	25.59	328.73	25.35	328.97
HN-09D	138 - 161	353.98	23.56	330.42	25.45	328.53	25.25	328.73
HN-10S	26 - 40	331.05	12.97	318.08	14.12	316.93	12.88	318.17
HN-10I	80 - 101	331.17	18.71	312.46	19.25	311.92	18.55	312.62
HN-10D	225 - 245	330.89	36.49	294.40	38.19	292.70	37.60	293.29
HN-35S	35 - 48	338.69	NA	NA	11.49	327.20	8.93	329.76
HN-35I	87 - 105	338.69	NA	NA	20.61	318.08	18.04	320.65
HN-35D	115 - 130	338.85	NA	NA	19.88	318.97	18.45	320.40
HN-36I1	81 - 99	342.76	NA	NA	22.43	320.33	21.00	321.76
HN-36I2	100 - 114	342.68	NA	NA	23.30	319.38	21.83	320.85
HN-36D	133 - 147	341.94	NA	NA	19.29	322.65	19.45	322.49
HN-37I	75 - 103	338.90	NA	NA	19.91	318.99	18.64	320.26
HN-37D	116 - 141	338.42	NA	NA	20.08	318.34	18.92	319.50
HN-38	97 - 119	329.16	NA	NA	10.81	318.35	9.69	319.47
HN-39	125 - 150	326.71	NA	NA	17.57	309.14	17.26	309.45
HN-40S	55 - 89	354.74	NA	NA	31.03	323.71	30.25	324.49
HN-40I	88 - 114	355.12	NA	NA	30.95	324.17	30.15	324.97
HN-40D	120 - 148	355.07	NA	NA	35.45	319.62	34.45	320.62
HN-49S	36 - 51	352.72	NA	NA	NA	NA	21.85	330.87
HN-49I	55 - 75	352.45	NA	NA	NA	NA	23.13	329.32
HN-49D	118 - 135	352.96	NA	NA	NA	NA	24.25	328.71

TABLE 2-4 (Continued)
AREA B
MONITORING WELL GROUNDWATER ELEVATIONS
NAWC WARMINSTER, PENNSYLVANIA

Well	Monitored Interval[1]	Reference Elevation[2]	April 27, 1994		August 17, 1994		December 13, 1994	
			Static[3]	Elevation[2]	Static[3]	Elevation[2]	Static[3]	Elevation[2]
CASEY VILLAGE RESIDENTIAL WELLS								
10	90	351.35	NA	NA	9.68	341.67	NA	NA
19	120	351.89	NA	NA	18.83	333.06	NA	NA
21	61	344.74	NA	NA	17.00	327.74	NA	NA
24	105	349.32	NA	NA	13.88	335.44	NA	NA
26	77	354.98	NA	NA	22.20	332.78	NA	NA
29	81	354.97	NA	NA	25.52	329.45	NA	NA
31	100	352.06	NA	NA	24.53	327.53	NA	NA
36	85	350.44	NA	NA	19.05	331.39	NA	NA
40	122	354.52	NA	NA	26.30	328.22	NA	NA
45	81	355.35	NA	NA	26.28	329.07	NA	NA
49	94	350.79	NA	NA	22.16	328.63	NA	NA

(1) feet below ground surface
(2) feet above mean sea level
(3) feet below reference elevation

wells on groundwater levels, and to provide data to be used for the design of an Area B aquifer pumping test.

For the long-term monitoring program, water-level recording instruments equipped with pressure transducers were installed in the shallow, intermediate, and deep monitoring wells at clusters HN-3, HN-5, and HN-7, and in the deep monitoring well at cluster HN-9 (see Figure 1-2). These instruments recorded the static water levels from March 28 or March 31, 1994 to April 27, 1994. Water levels were obtained at 15 minute intervals for each well. The water level data obtained during the long-term monitoring program is discussed in Section 3 and presented in graphic form in Appendix D.

2.6 LONG-TERM (72-HOUR) PUMPING TEST

A long-term pumping test was conducted in Area B during August 1994. The various components of the pumping test included:

- Conducting a step-drawdown test to determine the optimum pumping rate for the long-term test.
- Collecting trend measurements of area water-level elevations for an approximately 72-hour period prior to the test to determine if any baseline corrections should be made to the measured groundwater elevations.
- Conducting the long-term (72-hour) pumping test.
- Conducting time-series sampling of the groundwater from the pumping well at intervals of approximately 10, 100, 1000, and 4300 minutes into the test.
- Measuring atmospheric pressure and precipitation during the test to investigate any atmospheric effects on groundwater levels.

The Final Technical Memorandum - Area B Pumping Test Plan (Halliburton NUS, 1994) provides a detailed description of the pumping test technical approach and procedures. The pumping test results are described in Section 3 of this report. Drawdown graphs and calculations are presented in Appendix E.2

3.0 GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

3.1 AREA B GEOLOGY

The geology of Area B consists of a thin veneer of residual soils overlying sedimentary bedrock of the Stockton Formation. The soils consist of primarily of silt and clay, with some sand, and extend to an average depth of about 10 feet below ground surface. The transition from soils to competent bedrock occurs gradually over a distance of about 5 to 10 feet typically, due to the effects of weathering on the bedrock surface.

The bedrock surface slopes across Area B to the south and southeast as shown in Figure 3-1, mimicking ground topography. Along the southeastern base boundary near Casey Village, the bedrock surface slopes to the west and southwest, towards the topographic and bedrock surface low that bisects the enlisted man's housing area and runs along the southern edge of Area B. There is a minor depression in the bedrock surface around well cluster HN-49. Whether this depression is a localized low or trends towards cluster HN05 (or somewhere else) is not known at this time.

The bedrock of the Stockton Formation consists of alternating sequences of fine- and coarse-grained, gently dipping rock units. Lithologic units vary in thickness from less than a foot to a maximum observed thickness of about 60 feet within Area B. The fine-grained lithologies are described as mudstones and consist primarily of reddish-brown siltstones and shales. Coarser-grained rock units include fine- to coarse-grained arkosic sandstones that range in color from reddish to brown to gray-green. Well defined, gradational fining-upward sequences were encountered in some areas; in other areas fairly sharp transitions between sandstones and mudstones were identified.

Bedding within the Stockton Formation strikes approximately north 71° east and dips approximately 5° to 8° to the northwest. This dip of the rock units is approximately opposite to the overall topographic slope of the ground surface within Area B. Beds encountered at shallow (< 100 to 150 feet) depths within Sites 5 and 6 outcrop to the south, near the southern boundary of NAWC. Figure 3-2 shows the locations for three geologic cross sections developed for Area B and the southeastern base boundary. The cross sections are shown in Figures 3-3, 3-4, and 3-5. These cross sections are generalized interpretations of subsurface conditions and are based on boring log and geophysical log information. The interpretations in some cases combine several individual beds of minor thickness into larger lithologic units, based on the overall dominant characteristics of a given sequence.

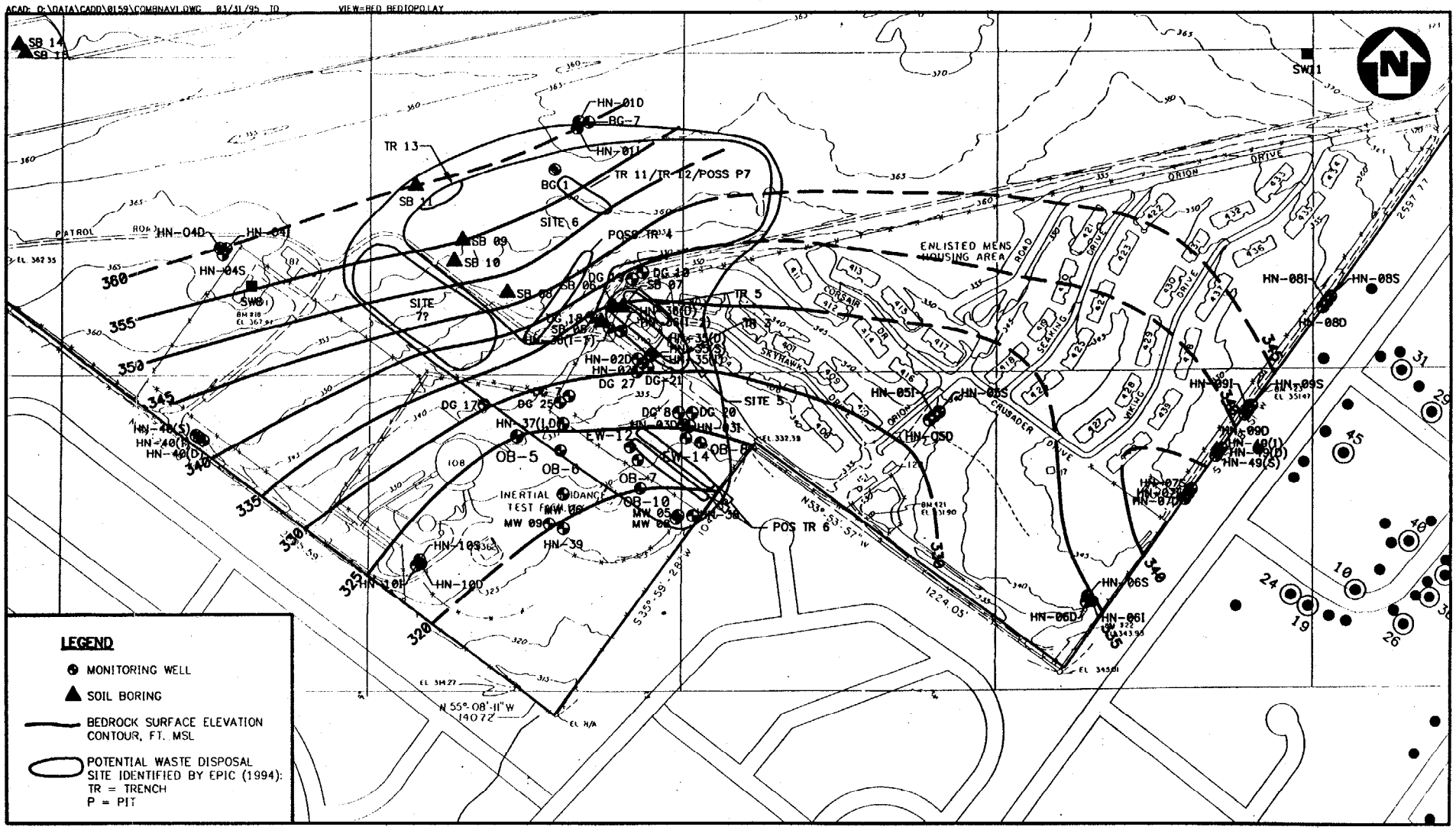

FIGURE 3-1

BEDROCK SURFACE TOPOGRAPHY
AREA B
NAWC WARMINSTER

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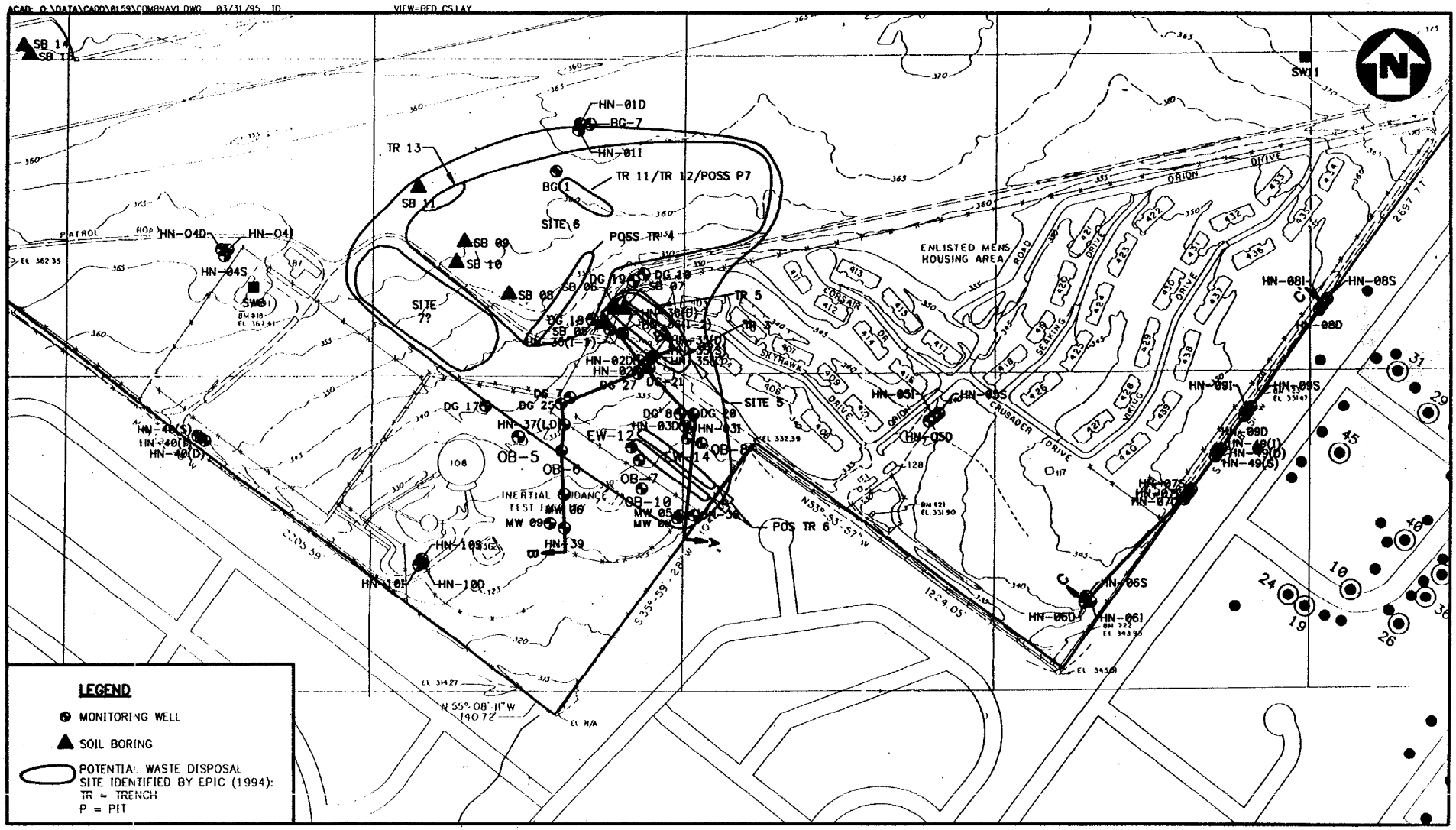

FIGURE 3-2

GEOLOGIC CROSS SECTION LOCATION MAP
AREA B
NAWC WARMINSTER

0 300 600
SCALE IN FEET

Halliburton NUS CORPORATION

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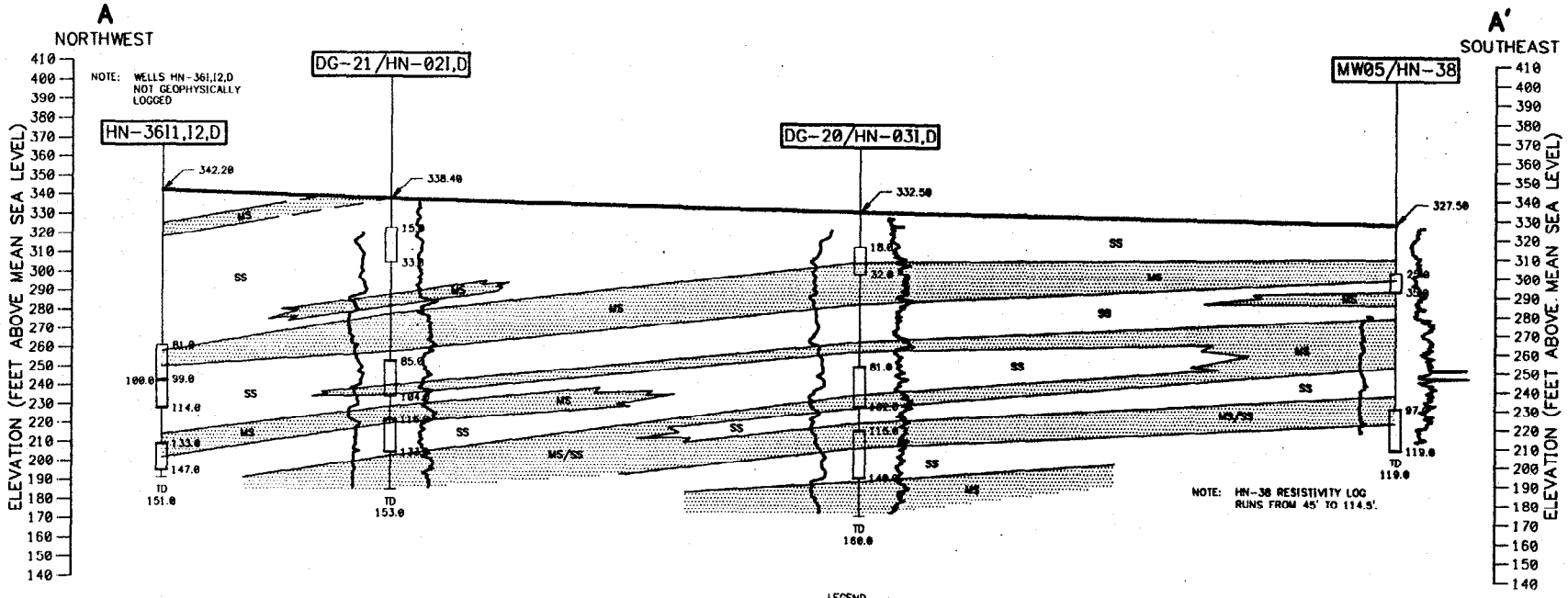

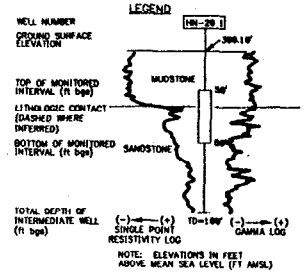

LEGEND:

SS - FINE TO MEDIUM GRAINED SANDSTONE, GRAY/BROWN/PINK

MS - MUDSTONE/SILTSTONE, RED-BROWN (SHADED IN CROSS SECTIONS)

MS/SS - INTERBEDDED ALTERNATING MUDSTONE AND SANDSTONE BEDS, INDIVIDUAL BED THICKNESS GENERALLY < 5 FEET

NOTE: LITHOLOGIC CONTACTS ARE INFERRED FROM GEOPHYSICAL AND BORING LOGS. ACTUAL CONDITIONS MAY VARY FROM THOSE DEPICTED

DRAFT

GENERALIZED GEOLOGIC CROSS SECTION A-A'
AREA B
NAWC WARMINSTER

0 60 120
HORIZONTAL SCALE IN FEET
0 60 120
VERTICAL SCALE IN FEET

FIGURE 3-3

Halliburton NUS CORPORATION

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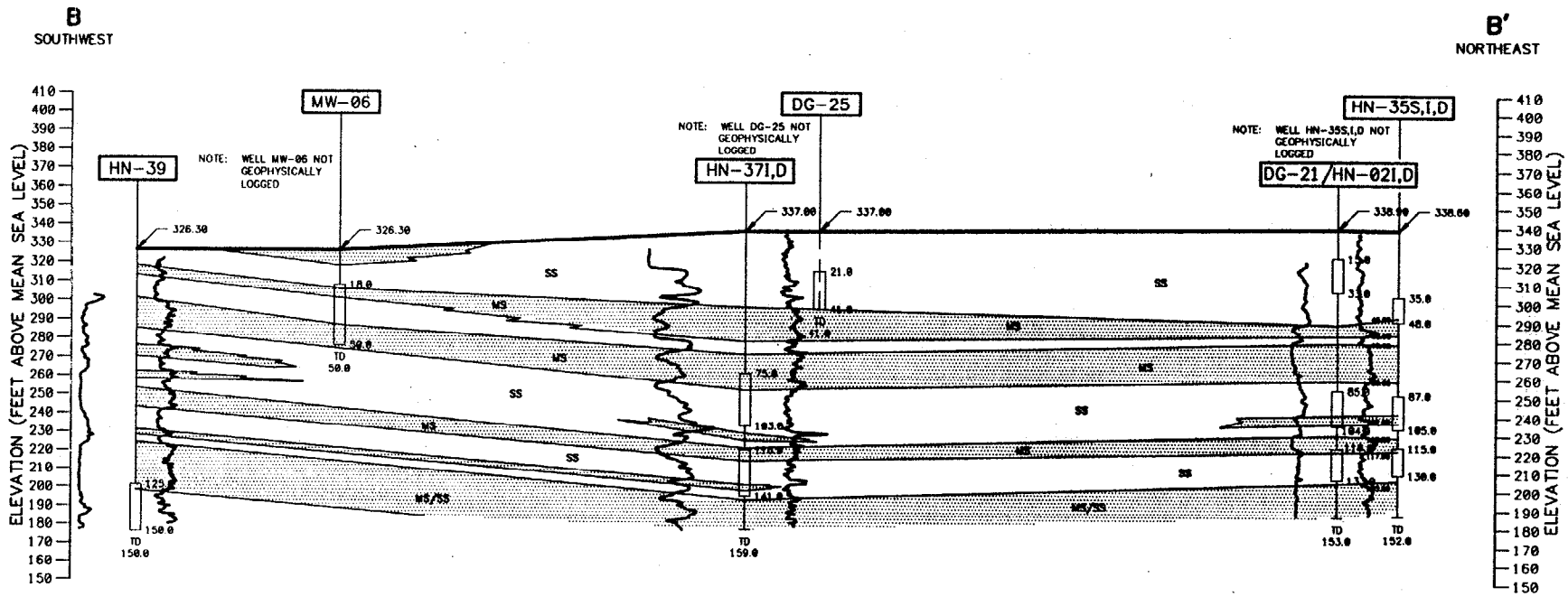

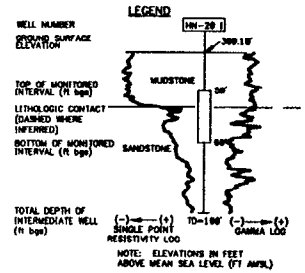

LEGEND:

SS - FINE TO MEDIUM GRAINED SANDSTONE, GRAY/BROWN/PINK

MS - MUDSTONE/SILTSTONE, RED-BROWN (SHADED IN CROSS SECTIONS)

MS/SS - INTERBEDDED ALTERNATING MUDSTONE AND SANDSTONE BEDS, INDIVIDUAL BED THICKNESS GENERALLY < 5 FEET

NOTE: LITHOLOGIC CONTACTS ARE INFERRED FROM GEOPHYSICAL AND BORING LOGS. ACTUAL CONDITIONS MAY VARY FROM THOSE DEPICTED

DRAFT

GENERALIZED GEOLOGIC CROSS SECTION B-B'
AREA B
NAWC WARMINSTER

0 60 120
HORIZONTAL SCALE IN FEET
0 60 120
VERTICAL SCALE IN FEET

FIGURE 3-4

Halliburton NUS CORPORATION

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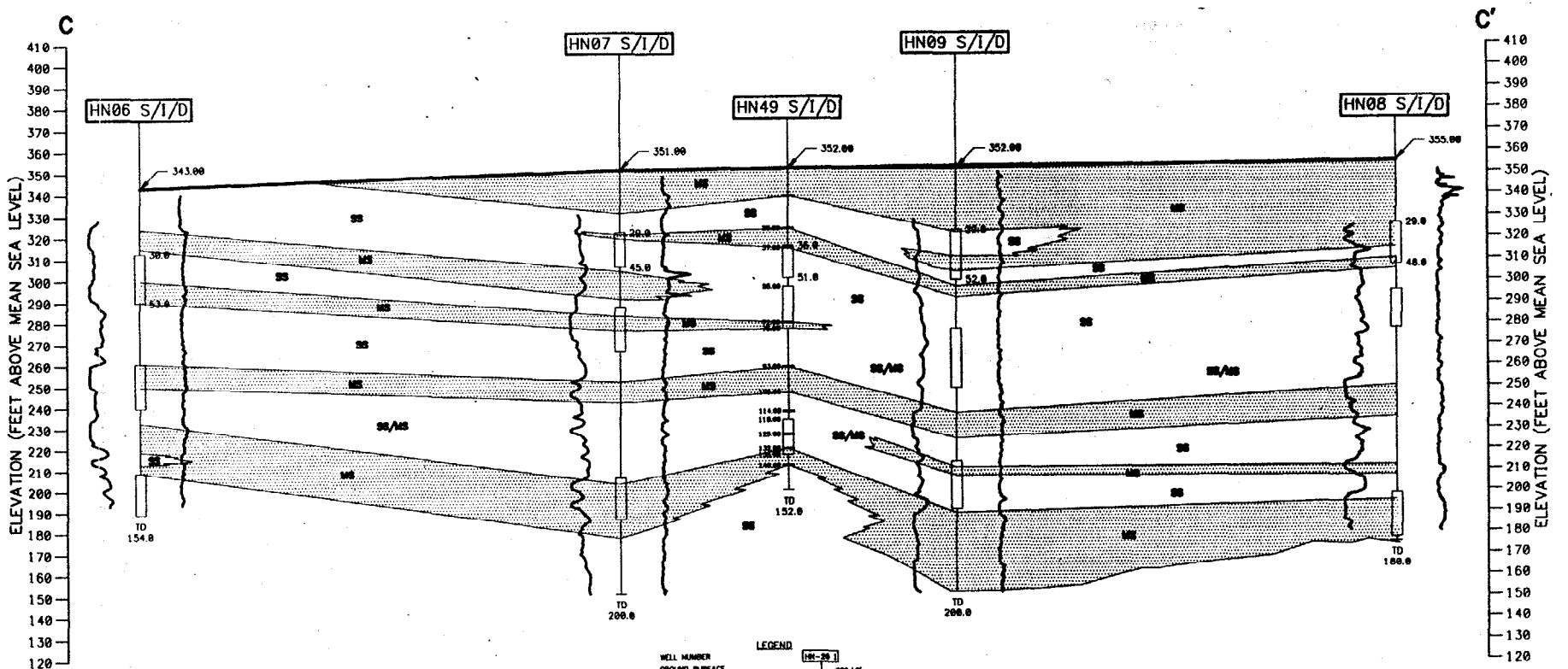
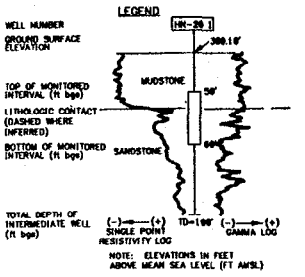




LEGEND:

SS - FINE TO MEDIUM GRAINED SANDSTONE, GRAY/BROWN/PINK

MS - MUDSTONE/SILTSTONE, RED-BROWN (SHADED IN CROSS SECTIONS)

MS/SS - INTERBEDDED ALTERNATING MUDSTONE AND SANDSTONE BEDS, INDIVIDUAL BED THICKNESS GENERALLY < 5 FEET

NOTE: LITHOLOGIC CONTACTS ARE INFERRED FROM GEOPHYSICAL AND BORING LOGS. ACTUAL CONDITIONS MAY VARY FROM THOSE DEPICTED

DRAFT

GENERALIZED GEOLOGIC CROSS SECTION C-C'
AREA B
NAWC WARMINSTER, PA

0 100 200
HORIZONTAL SCALE IN FEET
0 50 100
VERTICAL SCALE IN FEET

FIGURE 3-5

Halliburton NUS CORPORATION

Individual rock units vary both in thickness and in areal extent, with some lithologies extending for significant distances across Area B and others pinching out within relatively short distances. Thicker beds typically extend laterally for greater distances than the thinner beds, which tend to be localized in areal extent. The relationship between bedding thickness and areal extent can be seen in all three cross sections. Finer grained beds tend to be more laterally extensive than coarser grained beds, although coalescing sandstone beds may form laterally (and vertically) extensive packages of coarse grained rock units. This pattern of bedding is consistent with the depositional environment of the Stockton Formation (alluvial fan).

Fractures were encountered at varying depths of the well borings drilled in and around Area B. Based on geophysical and boring log information, the fractures included both bedding plane fractures and cross-formation joints. Fractures were observed within both the sandstone and mudstone units, with the fractures in the sandstones more likely to yield significant quantities of water. There are no outcrops in the vicinity of Area B at which to measure fracture orientations, however according to Rima, et al. (1962), the most frequently occurring joint sets within the Stockton Formation trend parallel and perpendicular to strike, with a subordinate set trending approximately 50° from strike.

3.2 AREA B HYDROGEOLOGY

3.2.1 General Conditions

Groundwater within Area B is primarily encountered within the Stockton Formation, which was the hydrogeologic unit of focus for the Area B hydrogeologic investigation. The overlying residual soils do in places contain minor amounts of water, however the saturated thickness is generally limited to a few feet or less and due to the low permeability of the soils, the volumetric groundwater flow rate within the soils is minor. Groundwater within the Stockton Formation is primarily encountered within and moves through interconnected networks of fractures that on a local scale form discrete flow zones related to lithology but on a larger scale are part of a complex, hydraulically interconnected, groundwater flow system. Primary permeabilities of the rock units that comprise the Stockton Formation are considered negligible in comparison to the secondary (fracture) permeability. In some of the coarse sandstone units, the primary porosity may be well enough developed to contribute some minor flow to a well, but it is insignificant in comparison to the fracture flow contribution. In the finer-grained mudstone units, the primary porosity/ permeability is even less developed than in the sandstones.

The coarser-grained rock units within the Stockton Formation act as preferential flow zones for groundwater, while the finer-grained mudstone units generally act as semiconfining layers to groundwater flow. In all

lithologies, however, significant water-yielding fractures were encountered during the Area B field investigation activities.

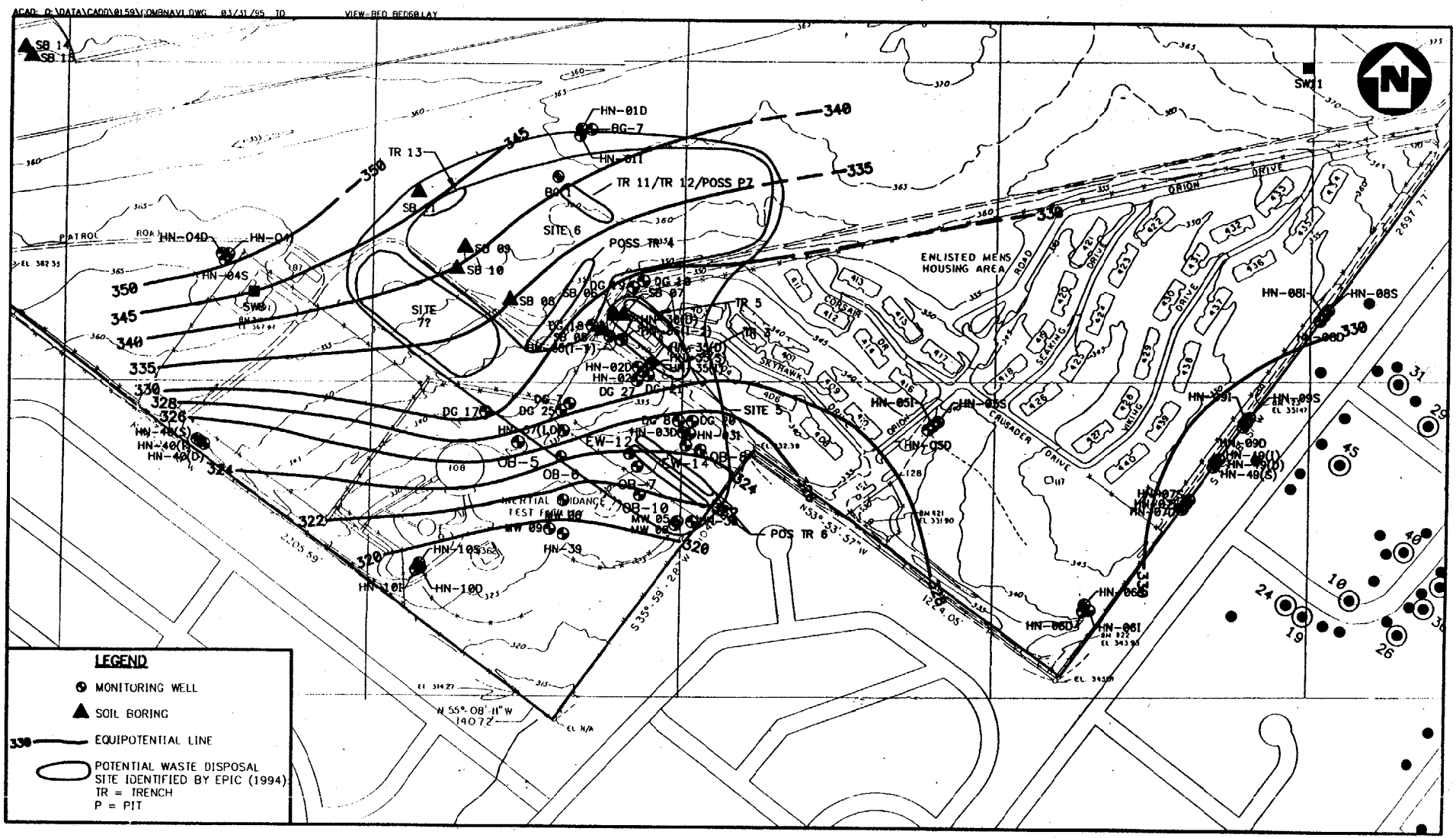
The nearest historic groundwater users are located approximately 1,600 feet from and sidegradient (east) of Area B (Casey Village residences). Due to water quality problems within Casey Village, the residences in this area have recently been hooked up to municipal water and no longer use domestic wells as water sources. Groundwater users are also located approximately 1/2 mile south and southwest of Area B, but are not considered to be receptors of groundwater from Area B.

3.2.2 Groundwater Flow Directions

The overall direction of groundwater flow across Area B is to the south. Figures 3-6, 3-7, and 3-8 show groundwater flow directions at increasing depths within the Stockton Formation, in and around Area B. The groundwater flow maps were generated using data from the December 13, 1994 round of water levels (see Table 2-4), which is the most comprehensive round available for Area B. Groundwater flow patterns identified using this data are consistent with the flow patterns observed using earlier, more limited rounds of water levels.

As part of a separate work assignment, a round of water level data was collected on August 17, 1994 from both the Area B monitoring wells and 11 residential wells located within Casey Village. The data was used to evaluate groundwater flow directions in and around Casey Village, and to evaluate groundwater flow patterns between Area B and Casey Village. In summary, the water level data indicates that along the southeastern boundary of NAWC, near Casey Village, the groundwater flow direction is to the north and northeast (see Figure 3-9). Intermediate depth monitoring well data was used to generate the flow map since the residential wells are completed to depths equivalent to the depths of the intermediate-depth monitoring wells. An area of groundwater mounding was identified within Casey Village. The Casey Village area is currently under investigation by the USEPA to determine the source(s) of the VOC contamination found in the residential wells.

The stream trace of one of the headwaters of Southampton Creek appears to exert some control over groundwater flow directions, as shown by the convergence of flow along the southern boundary of Area B and the accompanying change in flow direction parallel to the stream trace to the southwest. In general, groundwater flow directions within the upper portions of the Stockton Formation were observed to mimic the ground surface topography and are expected to be controlled by topography and the locations of streams in the area. Conversely, the flow direction across Area B is opposite the dip direction of the bedrock units. This flow direction of groundwater opposite the dip direction of the bedrock is confirmed by



SHALLOW BEDROCK (< 60 FEET)
GROUNDWATER FLOW MAP
AREA B
NAWC WARMINSTER

FIGURE 3-6

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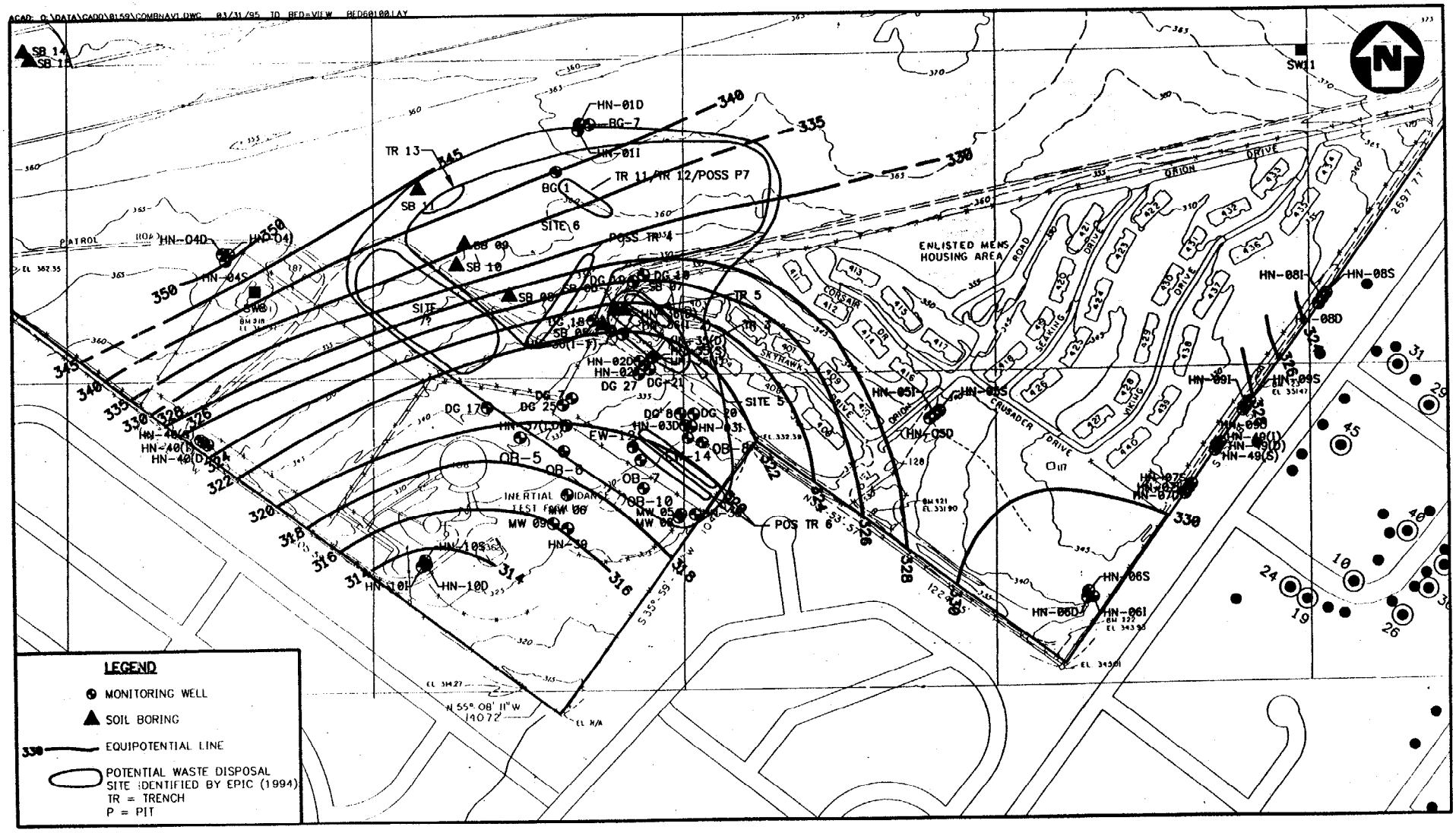
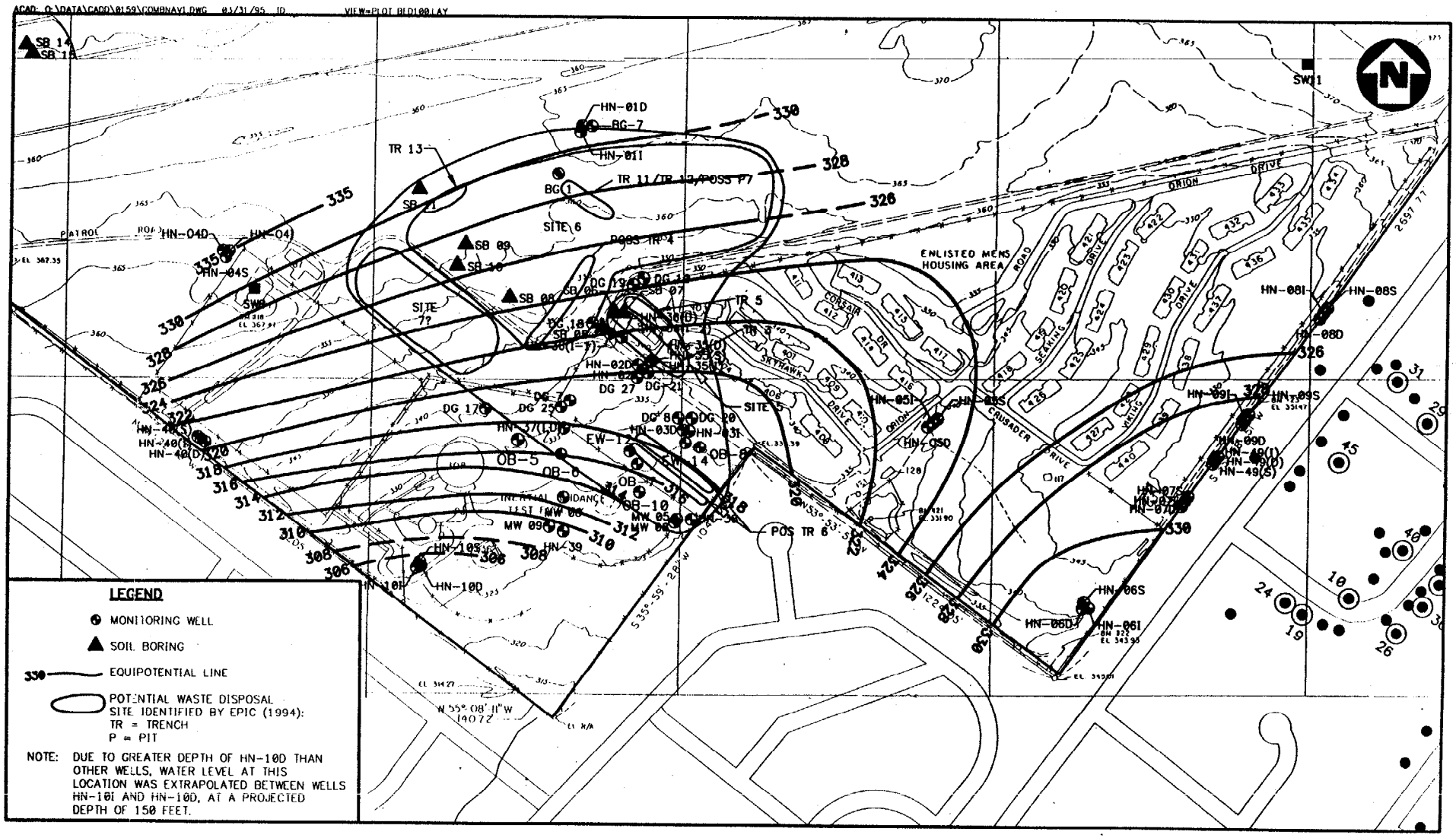


FIGURE 3-7

INTERMEDIATE BEDROCK (60-100 FEET)
GROUNDWATER FLOW MAP
AREA B
NAWC WARMINSTER

Halliburton NUS CORPORATION



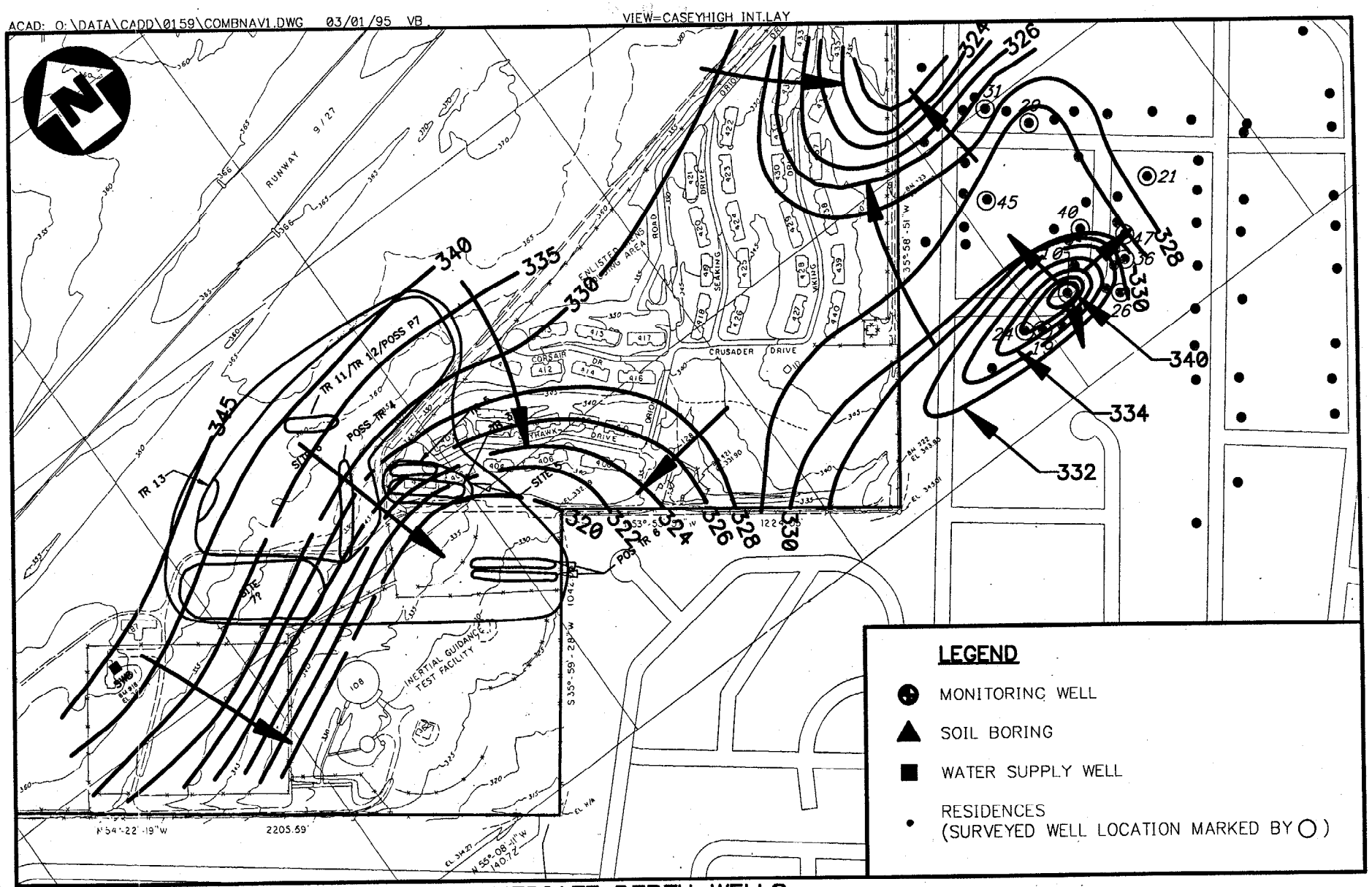
DEEP BEDROCK (100+ FEET)
GROUNDWATER FLOW MAP
AREA B
NAWC WARMINSTER

0 300 600
SCALE IN FEET

FIGURE 3-8

Halliburton NUS CORPORATION

ACAD: O:\DATA\CADD\0159\COMBNAV1.DWG 03/01/95 VB VIEW=CASEYHIGH INT.LAY



WATER LEVELS – INTERMEDIATE DEPTH WELLS

CASEY VILLAGE/AREA B

NAWC WARMINSTER

0 500 1000

SCALE IN FEET

FIGURE 3-9

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water level data from wells screened within the same lithologic units. Wells HN36D, HN02D, and HN03I are screened across the same sandstone unit (see Figure 3-3). Well HN36D is the furthest well downdip but also has the highest hydraulic head. HN03I is the furthest updip of the three wells and also has the lowest hydraulic head. This pattern of hydraulic heads indicates that groundwater moves with topography and against the dip of the rock in Area B. The same pattern of flow against the dip of the rock units can be seen by comparing water levels from shallow wells DG21 and DG20; and from wells HN36I2, HN02I, and MW05.

Lateral groundwater flow gradients are generally steepest along the flank of the east-west trending ridge upon which the runway is situated, along the northern edge of Area B. This is also the area of steepest topographic relief within Area B. Across the ball field that is located adjacent to Site 5 and directly downgradient of Site 6, the groundwater flow gradient flattens out, as does the topography. Based on the intermediate groundwater flow map (Figure 3-7), the average flow gradient along the hillslope area is approximately 0.045. In the downgradient portion of Area B the gradient flattens out to an average of approximately 0.01. Gradients in the shallow bedrock are slightly lower in the hillslope area and slightly higher in the downgradient area (Figure 3-6) than in the intermediate bedrock. In the deep bedrock (Figure 3-8), there is a gradual increase in flow gradient from the hillslope area to the downgradient area.

Based on groundwater-level measurements made in wells completed at different depths within well cluster locations, the overall vertical groundwater flow gradient is downward. Hydraulic heads within the shallow bedrock wells were generally higher than the water levels in the deeper wells, with a few exceptions. This pattern of vertical flow was expected and reflects that the source of water to the deeper groundwater flow zones within the bedrock is primarily leakage from overlying flow zones. The lowest groundwater elevations observed within Area B was at well HN-10D, where the December 13, 1994 water level of 293 ft msl is similar to the base level of the tributary to Southampton Creek in the vicinity of this well cluster (based on USGS topographic map information). This further suggests that groundwater flow directions within the upper portion of the Stockton Formation in the vicinity of Area B are controlled by topography and stream locations.

3.2.3 Long-term Groundwater Elevation Monitoring

A long-term (one-month) groundwater-level monitoring program was conducted in selected Area B wells in order to investigate the duration and magnitude of short-term versus long-term water level fluctuations, to determine the response of the aquifer to precipitation events, to determine the effects of nearby pumping wells on groundwater levels, and to provide data to be used for the design of the Area B pumping test.

For the long-term monitoring program, water-level recording instruments equipped with pressure transducers were installed in the shallow, intermediate, and deep monitoring wells at clusters HN-02, HN-05, and HN-07, and in the deep monitoring well at cluster HN-09. Water levels were recorded at 15-minute intervals in these wells from March 25, March 28, or March 31, 1994 to April 27, 1994. The water level data for each well is presented in graphic form in Appendix D. The daily precipitation during this same time period is also presented in graphic form in the same appendix.

3.2.3.1 Aquifer Response to Precipitation

All wells show a marked response to precipitation. Significant rainfall events occurred from March 27 to March 29 (over 2 inches of cumulative precipitation), March 12 and March 13 (over 1 inch of cumulative precipitation), and on March 16 (approximately 1/2 inch of precipitation). Lesser amounts of rainfall fell during several other periods during the monitoring interval (see the precipitation graph in Appendix D). The individual well responses to the rainfall events appear to vary more by cluster location than by well depth within individual clusters. This is probably due to the marked lateral heterogeneity of the Stockton Formation, as described in many reports and studies.

For example, at well cluster HN-02, the shallow, intermediate, and deep wells all rapidly respond to the precipitation events, and the individual peaks in the water-level curves can be correlated to the individual precipitation events. The magnitude of the water-level fluctuation at this cluster to the March 27 to March 29 event ranges from about 1.5 feet in HN-02S to about 0.8 feet in HN-02I. The deep well (HN002D) showed a greater water level fluctuation (about 1.25 feet) than the intermediate well.

At well cluster HN-07, however, only a more general correlation can be made between the individual precipitation events and the water-level curves. The aquifer at all three monitored levels exhibits a broader, or more "averaged" response to the two main precipitation events that occurred from March 27 to March 29 and March 12 to March 13. The magnitude of the response, however, is greater at this location than at HN-02. The vertical fluctuation ranged from about 3 feet in HN-07S and HN-07D to about 4 feet in HN-07I.

3.2.3.2 Long-term Water-level Trend

All wells exhibit a general declining water-level trend over the long term (1 month) period of investigation. After rising relatively sharply in response to a precipitation event, the water level in each well appears to decrease at a slower rate that is generally similar to the rate of decline (as measured by the slope of the curve) exhibited by the aquifer prior to the precipitation. Sloto and Schreffler (1994) noted that groundwater

levels generally decline during the late spring when groundwater evapotranspiration and soil-moisture evapotranspiration is at a maximum and recharge is at a minimum.

3.2.3.3 Short-term Water-level Trend

The short-term water-level fluctuations also vary by cluster location. For example, at cluster HN-09 (well HN-09D), daily fluctuations of up to 0.5 foot were common. At cluster HN-07, however, (at well HN-07D), the daily fluctuation was much less than 0.1 foot.

The short-term water-level fluctuations at cluster HN-05 appear to be affected by earth tides. Earth tides are caused by the force of gravity exerted on the earth's crust by the moon (and to a lesser extent, the sun), and are characterized as semi-diurnal fluctuations that correspond to the moon's transit at upper and lower culmination (Sloto and Schreffler, 1994; Todd, 1980). Well HN-05D, for example, exhibits a regular, daily water-level fluctuation that is superimposed over the long-term trend. Part of this curve was plotted at a different scale (see Appendix D) to show the fluctuations during a time of steady decline in the long term trend (from April 19 through April 22). The semi-diurnal fluctuations shown by this curve appear to be caused by earth tides.

Earth tides are indicative of confined groundwater conditions. Note that at cluster HN-05, the shallow well (HN0-5S) does not exhibit the effects of earth tides. Earth tides are evident in both the intermediate (HN005I) and deep (HN-05D) wells, but the magnitude of the daily fluctuation is greater in the deep well. This may reflect shallow, unconfined conditions and deeper, confined conditions (with the degree of confinement increasing with depth) at this cluster location.

One objective of the long-term water-level study was to determine if the pumping of residential wells in Casey Village affects the groundwater levels (and therefore the groundwater flow) on the base. The potential effects and interference of the earth tides make the effects of the Casey Village groundwater pumping difficult to isolate. Well clusters HN-07 and HN-09 are located on the base but adjacent to the Casey Village neighborhood (see Figure 1-2). As discussed, well HN-09D exhibits daily fluctuations of up to 0.5 foot. The peaks and troughs of the water level curve appear to correlate with those of well HN-05D when plotted for the same time interval (April 19 through April 22, see Appendix D), indicating that earth tides may be affecting the water levels in both wells. Well HN-09D, however, exhibits an even smaller magnitude, higher frequency water-level oscillation. These oscillations also occur at well HN-05D, but at a lower magnitude. The wells at cluster HN-07 show little short-term fluctuation. Based on the data collected, short-term fluctuations in water levels are generally low amplitude and appear to be primarily related to earth tides. The effects of Casey Village domestic well pumping on monitoring well water levels appear to be negligible.

3.2.4 Bedrock Aquifer Hydraulic Characteristics

The hydraulic characteristics of the shallow portion of the Stockton Formation in Area B were investigated through a long-term pumping test, performed as part of the focused Remedial Investigation for groundwater. The results of the pumping test are presented in this report in order to provide a comprehensive description of the hydrogeologic conditions within and around Area B.

The Area B pumping test was performed during the week of August 7, 1994. For the long term pumping test, well HN-02I was pumped at a constant rate of 9 gpm (with <5 percent variation) for a period of 72 hours, beginning on August 8 and ending on August 11. Prior to the startup of the test, trend measurements were obtained, starting on August 5 and ending immediately prior to starting the pumping test on August 8. After the completion of pumping activities, recovery measurements were made in the pumping and observation wells for a minimum of 12 hours, and up to 72 hours for selected wells. The Area B Pumping Test Plan (Halliburton NUS, 1994) describes in detail the technical approach followed and the procedures used. There were no notable deviations from the planned approach.

The pumped well is screened primarily within a sandstone unit located at a depth of 80 to 110 feet below ground at the pumping well location. The unit is bounded on top and bottom by mudstones. Observation wells were screened within, above, and below the geologic unit pumped by HN-02I, as shown in geologic cross sections A-A' and B-B' (Figures 3-3 and 3-4).

Significant drawdowns were observed in wells located up to 580 feet from the pumping well. Drawdown data from observation wells HN-03I, HN-35I, HN-36I1, HN-36I2, HN-37I, HN-38, and MW-06 showed sufficient responses for pumping test evaluation purposes. Based on trend water level data, background fluctuations in water levels were insignificant during the test and the drawdown data did not require any corrections.

The water level data was evaluated using several analysis techniques. Log-log plots of the time-drawdown data were evaluated using manual type curve matching techniques, using type curves developed by Hantush (1960) for leaky aquifers with storage in the confining layer. This analysis technique likely provides the best true estimate of the aquifer transmissivity, as leakage effects are filtered out of the transmissivity determination. Storativity was also determined using the log-log data plots.

A second analysis method employed for the time-drawdown data was a semilog inflection point analysis technique developed by Hantush (1956) for semiconfined aquifers. This method assumes no change in storage in the confining layer(s) and was employed as a supplement to the curve matching results.

Finally, a semilog distance-drawdown analysis was performed (Cooper-Jacob, 1946), using drawdown data from all of the wells showing a drawdown response during the test. This method was developed for confined aquifers, thus it ignores the leakage effects that occur in a semiconfined aquifer. It was considered, however, to be useful as an evaluation tool to evaluate directional-dependent trends in drawdowns and for an approximate transmissivity determination that employs all of the well responses in one analysis. Drawdowns from each well at t=4,000 minutes into the test were plotted along with the radial distance of each well from the pumping well. In theory, for an aquifer with an equivalent porous medium (EPM) response to pumping, the data points should all fall along a straight line, however the data plot showed some scatter of the points plotted. It appears that two parallel lines can be extrapolated through the points present, as shown in Figure 3-10. No obvious directional, depth-related, or yield-related trends were identified within the distance-drawdown data subsets, i.e., there were no obvious features within each

drawdown set that appeared consistent within the sets and unique to the sets. The distance-drawdown line slope, which was the same for both lines, was used to estimate transmissivity.

An analysis technique was also applied to the drawdown data from wells installed within, above, and below the strata being pumped, to evaluate the vertical permeability of the confining layers (Neuman and Witherspoon, 1972).

The results of the data analysis are presented in Table 3-1. From the leaky confined test evaluation methods, an average transmissivity of 139 ft^2/day was obtained. This value for T is considered to be the most accurate of the estimates generated. The semilog distance-drawdown estimation of transmissivity was 106 ft^2/day. Assuming an average thickness of the sandstone unit being pumped of about 25 feet, this yields an average bulk hydraulic conductivity (K) value of about 5-6 ft/day. In reality most of the groundwater flow is through discrete fractures which typically occur at a frequency of 2 to 4 fractures per borehole, thus the true K of these fractures is much higher than the bulk K value and the K of the rock matrix much less. An average storativity in the 10^{-5} range was calculated. Based on the Neuman-Witherspoon analysis, an average vertical hydraulic conductivity for the underlying and overlying aquitards of 0.003 ft/day was obtained. Drawdown graphs and calculations are presented in Appendix E.

Drawdown responses in the observation wells indicated that pumping effects are projected laterally, along bedding, out much more so than vertically, across bedding. For the observation well clusters surrounding the pumping well, drawdowns in the wells screened across the same lithologic interval as the pumping well had much higher drawdowns than wells screened above and below the interval being pumped. This effect was most pronounced in wells located near the pumping well, with the effects being dampened further out in the updip and strike-parallel directions. Downdip, little or no drawdowns were observed in the shallow

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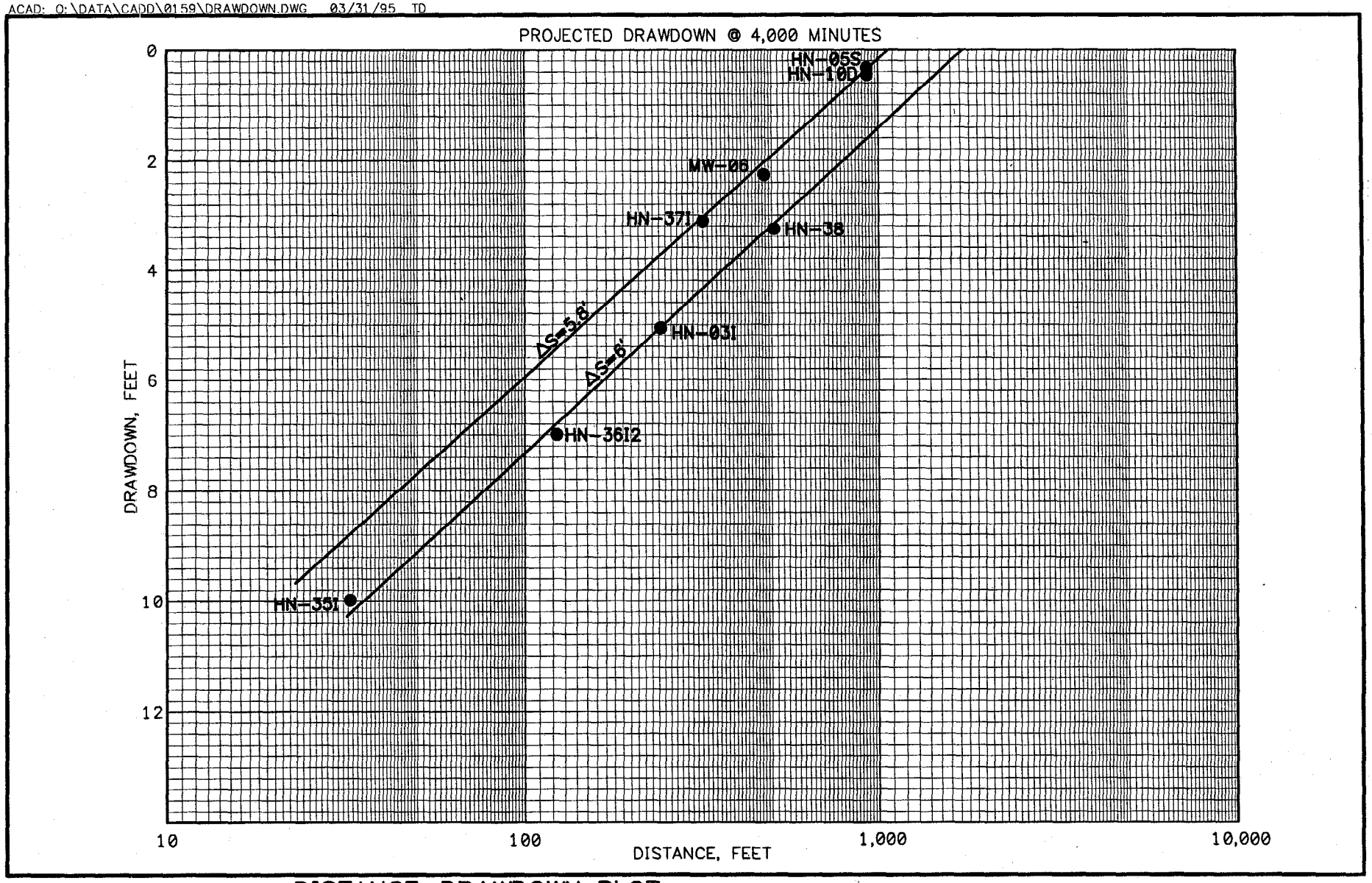

DISTANCE-DRAWDOWN PLOT
HN-02I PUMPING TEST
AREA B
NAWC WARMINSTER

FIGURE 3-10

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TABLE 3-1

AREA B PUMPING TEST
SUMMARY OF RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Well	Distance from Pumping Well (feet)	Transmissivity		Storativity		Vertical Hydraulic Conductivity, K[1] (ft/day)
		Curve Matching (ft^2/day)	Semilog Analysis (ft^2/day)	Curve Matching	Semilog Analysis	
HN 35I	32.5	106	104	6.0×10^{-6}	2.8×10^{-5}	7.2×10^{-3}
HN 36I1	122	131	148	2.0×10^{-5}	2.4×10^{-5}	2.3×10^{-3}
HN 36I2	122	115	---	2.1×10^{-5}	---	---
HN 03I	250	144	193	1.3×10^{-5}	1.0×10^{-5}	4.0×10^{-4}
HN 37I	317	98	198	1.9×10^{-5}	1.3×10^{-4}	---
HN 38	520	134	135	1.1×10^{-4}	1.1×10^{-4}	---
MW 06	480	144	---	1.0×10^{-5}	---	---

Average T, Time-Drawdown Analysis - 139 ft^2/day (Average of each average T per cluster).
Average S, Time-Drawdown Analysis - 2.7×10^{-5}.
T, Distance-Drawdown Analysis - 106 ft^2/day.

wells at any distance, due to the increased vertical separation between the shallow bedrock wells and the stratigraphic interval being pumped. There was no apparent preferential drawdown observed along bedrock strike versus in the dip direction, within the strata being pumped.

Within the test area, the fine-grained mudstone units appeared to function as aquitards, as expected. A three order-of-magnitude difference between the bulk K of the unit being pumped and the bulk vertical K of the adjacent aquitards is indicative of the relative resistance to flow through the finer-grained rock units (although some flow does undoubtedly occur through them).

In addition to the pumping test described above, a pumping test was performed on extraction well EW-12 by OHM Remediation Corporation, Inc., as part of the ongoing remedial action for Area B groundwater. For this test, EW-12 was pumped at a rate of 55 gpm for 48 hours, then the rate reduced to 15 gpm for an additional 24 hours. Data from the first 48 hours of the test was analyzed by OHM, using techniques developed for confined and leaky confined aquifers. Based on time-drawdown analyses, a range of transmissivity from 178 to 406 ft^2/day was obtained. Extraction well EW-12 is open over a depth interval from 20 to 100 feet as opposed to the more restricted open interval of HN-02I (85-104 feet), thus the discrepancy in transmissivity values obtained in the two tests is likely a function of the vertical extent of the aquifer pumped rather than local variations in hydraulic characteristics.

3.2.5 Geologic Controls on Contaminant Migration

The migration of contaminants in groundwater across Area B is influenced by several factors. Groundwater primarily moves through interconnected networks of fractures within the bedrock. Lateral groundwater (and contaminant) migration directions are to the south across Area B and are controlled by topography and by the presence of the tributary of Southampton Creek south of Area B. It is expected that groundwater from Area B will eventually discharge within the Southampton Creek drainage.

Groundwater flow follows the slope of the ground surface topography across Area B, flowing against the dip direction of the bedrock units. Based on the dip of the bedrock units, DNAPL compounds would be expected to migrate downdip from any source areas to the north-northwest, however no evidence of potential DNAPL presence was found.

Fine grained mudstone beds act as semiconfining layers to groundwater flow, restricting but not preventing the vertical movement of groundwater across bedding. The hydraulic heads within the bedrock generally were observed to decrease with increasing depth, indicating that vertical flow potential is downward. Based

on sampling results, however, contamination appears to be limited to the top 100-150 feet of the bedrock aquifer.

There are no known groundwater users that influence groundwater flow directions within Area B. Historic domestic well usage in the Casey Village area may have flattened groundwater flow gradients along the southeast boundary of the base in the past, however, these wells are no longer in operation. Based on the results of the long-term water level study, the historic usage of these wells did not significantly impact on-base groundwater levels. The Northampton municipal wells located along Bristol Road also do not appear to have a significant effect on on-base groundwater levels, based on the long-term water level study.

4.0 DISCUSSION OF ANALYTICAL RESULTS

Soil and groundwater conditions Area B were defined based on the analytical results from ten soil borings, 49 monitoring wells, and 2 extraction wells. The wells provide data for shallow groundwater, primarily less than 150 feet deep. Soil samples were analyzed for total and dissolved Target Analyte List (TAL) metals and Target Compound List (TCL) volatile and semivolatile organic and pesticide and PCB compounds. At a minimum, all groundwater samples were analyzed for volatile organic compounds (VOCs). Selected groundwater samples were also analyzed for pesticides and PCBs, TAL inorganics, and miscellaneous parameters including total organic carbon (TOC), alkalinity, biological and chemical oxygen demand (BOD and COD), hardness, pH, and total dissolved and suspended solids (TDS and TSS). Discussion of the sampling results will be made on a medium-specific basis in order to elucidate trends or patterns of contamination.

4.1 SOIL

Eleven soil samples from Area B were collected from locations associated with the installation of monitoring wells HN01 through HN10, including one duplicate sample pair (SB-A and SB-K, cluster HN01). Table 4-1 provides a summary of analytical results for positively detected chemicals in the soils collected from Area B. Appendix C contains the complete analytical results for soils. Hydraulically upgradient sampling locations (SB-D and SB-A/-K) were used to define background conditions for Area B. Although acetone was detected in two of the three samples, this organic is a common laboratory contaminant and it's presence does not invalidate the use of these locations as background.

Generally, low to nondetect levels of VOCs were found in soils. Positive detections included low concentrations of chloromethane (3 μg/kg), detected at locations SB-B, SB-F, and SB-G (clusters HN-02, HN-06, and HN-07), and acetone (12 μg/kg maximum), a common lab artifact, detected in samples SB-D, SB-E, SB-I, and SB-K (clusters HN-04, HN-05, HN-09, and HN-01). Because of the low concentrations of the detected organics, the dissimilar locations where detected, and the highly volatile nature of these two chemicals, it is not believed that these positive results are indicative of significant environmental contamination.

A variety of metallic constituents were detected in the soils collected from Area B. All TAL metals except antimony, selenium, and silver were detected in at least one soil sample collected from the Area. A review

TABLE 4-1

SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B SOILS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Soil Borings (mg/kg)										
	W-SB-A	W-SB-B	W-SB-C	W-SB-D	W-SB-E	W-SB-F	W-SB-G	W-SB-H	W-SB-I	W-SB-J	W-SB-K
Chloromethane	ND (0.012)	0.003 J	ND (0.012)	ND (0.012)	ND (0.012)	0.003 J	0.003 J	ND (0.011)	ND (0.011)	ND (0.011)	ND (0.012)
Acetone	ND (0.012)	ND (0.011)	ND (0.012)	0.012 J	0.009 J	ND (0.012)	ND (0.017)	ND (0.011)	0.008 J	ND (0.011)	0.010 J
Aluminum	16,400	11,900	11,000	13,200	9,310	4,760	12,700	11,700	5,260	5,860	17,500
Arsenic	1.6	4.0	3.0	ND (0.23)	2.4	ND (0.2)	1.3	0.28	0.35	0.83	2.1
Barium	58.2	45.6 K	36.0	61.1 K	64.8	ND (7.8 B)	44.1	225	ND (15.0B)	35.6	59.6 K
Beryllium	1.6	0.72 K	0.71	0.98 K	0.56	0.31	0.69	0.46	0.42	0.57	1.7 K
Calcium	481	827	768	1910	681	414	408	292	544	443	498
Chromium	20.3 J	21.7 J	18.0 J	18.5 J	15.2	13.1 J	20.3 J	12.4 J	13.3 J	7.9 J	20.3 J
Cobalt	20.2	18.8	13.2	14.5	8.3	1.6	7.7	14.0	5.9	5.9	22.1
Copper	16.3	14.5 K	5.3	3.6 K	13.8	4.6	21.6	15.4	30.6	4.6	15.1 K
Iron	23,400	24,400	17,500	28,900	16,000	6,980	19,200	9,290	9,990	10,500	24,900
Lead	4.6 J	12.2 J	8.2 J	23.5 J	5.7 J	1.6 J	3.9 J	1.6 J	1.7 J	3.3 J	4.1 J
Magnesium	1,640	2,510	1,270	4,960	1,300	518	1,660	583	644	660	1,750
Manganese	486	757 K	657	470 K	700	30.9	344	2,010	151	636	477 K

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TABLE 4-1 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B SOILS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Soil Borings (mg/kg)										
	W-SB-A	W-SB-B	W-SB-C	W-SB-D	W-SB-E	W-SB-F	W-SB-G	W-SB-H	W-SB-I	W-SB-J	W-SB-K
Mercury	0.37	ND (0.08B)	ND (0.05)	ND (0.12B)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.19B)	ND (0.05)	ND (0.05)	ND (0.13B)
Nickel	16.5 J	10.0 J	6.6 J	17.1 J	9.1 J	ND (3.0UJ)	11.5 J	8.0 J	ND (3.6UJ)	4.1 J	21.7 J
Potassium	332	732	280	3,050	357	89.1	516	90.5	200	142	314
Sodium	70.3	132 L	59.6	ND (115 B)	86.7	ND (84.7B)	ND (65.6B)	74.1	ND (78.9B)	55.2	74.1 L
Thallium	ND (0.42)	ND (0.34)	ND (0.38)	ND (0.26)	ND (0.37)	ND (0.40)	ND (0.36)	ND (0.44)	ND (0.35)	ND (0.36)	0.42
Vanadium	29.3	41.2 K	27.9	19.4 K	23.9	15.7	30.5	15.4	18.7	15.8	31.3 K
Zinc	28.8	29.2	15.6	48.6	18.0	ND (3.1 B)	15.8	10.5	ND (8.0 B)	9.0	30.8

NA - Sample not analyzed for this parameter.
Metals results for unfiltered samples are presented in left hand column and for filtered samples in right hand column.
Positive results for compounds/analytes denoted by shading in table cell.
Qualifier codes:

- ND = analyte not detected at quantitation/detection limit in parenthesis
- J = estimated result
- B = not detected due to blank contamination
- K = positive result biased high
- L = positive result biased low
- UJ = estimated quantitation/detection limit
- UL = estimated quantitation/detection limit, biased low

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of the locations of the maximum detected concentrations for each of the metals failed to reveal any site-related pattern of metallic contamination. In general terms, the maximum detected metal concentrations were encountered at locations nearest to the runway (SB-B, SB-D, and SB-A/K; clusters HN-02, -04, and -01). Other locations which contained the maximum detected concentration of a metallic analyte include SB-E/HN-05 (barium), SB-H/HN-08 (manganese), and SB-I/HN-09 (copper).

The detected analytes are all naturally occurring in the soils and groundwater at NAWC Warminster and are at levels comparable to background. By comparing the two highest sample results for the whole soil data set to the two highest background sample results, all but a few analytes are noted to be less than background. The two highest background results for aluminum, beryllium, cobalt, iron, mercury, nickel, thallium, and zinc are also the maximums for the entire data set. The maximum background result for calcium, chromium, lead, magnesium, potassium, and vanadium was the second highest detected concentrations overall in the entire data set. Finally, the maximum soil sample result for arsenic, barium, copper, manganese, and sodium are less than twice the respective maximum background concentrations.

In conclusion, no pattern of organic or metallic chemical contamination is observed in the soils at Area B. Although a variety of chemicals are detected, the low observed concentrations (at or near quantitation or detection limits) the presence of inorganics within background concentrations, and the lack of detection of chemicals that are known to be historical contaminants to other media (i.e., chlorinated organics in groundwater) indicate that the soils investigated are not a source of contamination within Area B.

4.2 GROUNDWATER

Groundwater conditions in and around Area B were evaluated based on the analytical results for shallow, intermediate, and deep monitoring well samples. TCL volatile organic analyses were performed for all groundwater samples, utilizing low concentration analysis techniques. Semivolatile organics, pesticide/PCB compounds, and/or metal analyses were performed on selected samples. Chemical analyses for metals were performed for filtered and/or unfiltered groundwater to provide a qualitative indication of which metals may be present in the suspended material (of unfiltered samples) and which may be dissolved in the groundwater. Although total metals results can be used to identify the presence or absence of chemical contamination, the dissolved results are more useful for evaluating migration potential for the metals.

The results of three groundwater sampling events are presented and used as the basis for the nature and extent discussion. An initial round of sampling was performed in 1994 by Halliburton NUS for 38 monitoring wells. A summary of the validated analytical results for positively detected compounds and analytes is presented in Table 4-2. A summary of the associated physical data is presented in Table 4-3.

TABLE 4-2

SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)											
	15 BG-7	HN-01I (W-MW-AI)		HN-01D (W-MW-AD)		HN-02S (W-MW-BS)	HN-02I (W-MW-BI)		HN-02D (W-MW-BD)		HN-03I (W-MW-CI) Duplicate of HN-13I	
1,1-Dichloroethane	ND (1)	ND (1)		ND (1)		ND (1)	ND (1)		ND (1)		ND (1)	
cis-1,2-Dichloro-ethene	ND (1)	ND (1)		ND (1)		ND (1)	1		ND (1)		ND (1)	
Chloroform	ND (1)	ND (1)		ND (1)		ND (1)	ND (1)		ND (1)		ND (1)	
Carbon tetrachloride	ND (1)	ND (1)		ND (1)		ND (1)	ND (1)		ND (1)		ND (1)	
Trichloroethene	ND (1)	ND (1)		ND (1)		3	3		2		3	
Tetrachloroethene	ND (1)	ND (1)		ND (1)		ND (1)	2		ND (1)		1	
Toluene	ND (1)	ND (1)		4		ND (1)	7		ND (1)		ND (1)	
Endosulfan II	NA	ND (0.10)		ND (0.10)		NA	ND (0.10)		ND (0.10)		NA	
Aluminum	NA	285	29.2 B	13,100	16.5 B	NA	50.2 B	ND (13)	294	ND (13)	278	ND (13)
Antimony	NA	ND (27)	41.0 B	30.0 B	39.0 B	NA	ND (27)	ND (27)	ND (27)	ND (27)	ND (27)	ND (27)
Arsenic	NA	ND (3)	ND (3)	8.3	ND (3)	NA	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)
Barium	NA	163	141	628	222	NA	136	291	108	96.2	403	401
Beryllium	NA	ND (1)	ND (1)	ND (1)	ND (1)	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Calcium	NA	23,900	22,700	44,000	23,100	NA	28,600	58,700	31,800	29,000	52,100	50,200
Copper	NA	8.8	6.7 B	ND (6)	6.2 B	NA	ND (6)	ND (6)	ND (6)	6.9 L	ND (6)	11.8 L
Iron	NA	749	30.8 B	5,740	25.2 B	NA	81.5 B	14.6 B	605	43.3 B	215 B	46.6 B

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)											
	BG-7	HN-01I (W-MW-AI)		HN-01D (W-MW-AD)		HN-02S (W-MW-BS)	HN-02I (W-MW-BI)		HN-02D (W-MW-BD)		HN-03I (W-MW-CI) Duplicate of HN-13I	
Lead	NA	9.8	ND (1)	19.3	ND (1)	NA	ND (1)	ND (1)	ND (1)	ND (1)	1.5 B	2.9 B
Magnesium	NA	9,600	9,110	11,800	6,120	NA	6,660	13,200	11,700	10,500	13,600	12,900
Manganese	NA	258	221	387	100	NA	234	517	97.4	84.8 B	560	513
Mercury	NA	ND (0.13)	ND (0.14)	0.22	ND (0.14)	NA	ND (0.14)	ND (0.14)	ND (0.15)	0.17 L	0.57 L	ND (0.13)
Nickel	NA	ND (17)	ND (17)	ND (17)	ND (17)	NA	ND (17)	ND (17)	ND (17)	ND (17)	ND (17)	ND (17)
Potassium	NA	885	817	2,540	1,060	NA	656	1,170	711 B	1,140	711 B	1,300 J
Silver	NA	ND (1)	ND (1)	ND (1)	ND (1)	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	2.1 B
Sodium	NA	7,790	7,690	18,900	13,200	NA	27,200	37,900	13,800 J	14,100 J	24,700 J	25,400 J
Thallium	NA	ND (4)	ND (4)	ND (4)	ND (4)	NA	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Vanadium	NA	ND (4)	ND (4)	4.4	ND (4)	NA	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Zinc	NA	26.2	12.2	33.6	ND (7)	NA	18.1	20.6	59.2	44.4	17.3 B	11.0 L

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)										
	HN-03D (W-MW-CD)		HN-04S (W-MW-DS)	HN-04I (W-MW-DI)	HN-04D (W-MW-DD)	HN-05S (W-MW-ES)		HN-05I (W-MW-EI) Duplicate of HN-15I		HN-05D (W-MW-ED) Duplicate of HN-16D	
1,1-Dichloroethane	ND (1)		ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
cis-1,2-Dichloroethene	ND (1)		ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
Chloroform	ND (1)		ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
Carbon tetrachloride	ND (1)		ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		2	
Trichloroethene	2		ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
Tetrachloroethene	ND (1)		ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
Toluene	3		ND (1)	ND (1)	ND (1)	ND (1)		8		5	
Endosulfan II	NA		NA	NA	NA	NA		ND (0.10)		ND (0.10)	
Aluminum	5,080	ND (13)	NA	NA	NA	61.3	ND (13)	4,120	ND (13)	3,430	ND (13)
Antimony	ND (27)	ND (27)	NA	NA	NA	ND (27)	41.6 L	ND (27)	ND (27)	ND (27)	ND (27)
Arsenic	ND (3)	ND (3)	NA	NA	NA	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)
Barium	485	330	NA	NA	NA	178	146	470	196	263	105
Beryllium	ND (1)	ND (1)	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	1.3	ND (1)
Calcium	51,000	44,600	NA	NA	NA	22,400	21,100	30,200	27,800	18,000	10,500
Copper	ND (6)	ND (6)	NA	NA	NA	ND (6)	14.1 L	ND (6)	6.0 L	ND (6)	6.9 L
Iron	1,650	22.7 B	NA	NA	NA	352	19.4 B	2,160	45.4 B	1,620	24.5 B
Lead	7.7 B	ND (1)	NA	NA	NA	2.3 B	1.2 B	12.0	ND (1)	17.8	2.7 B
Magnesium	12,500	10,300	NA	NA	NA	11,000	10,100	8,830	7,770	5,860	3,120

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)										
	HN-03D (W-MW-CD)		HN-04S (W-MW-DS)	HN-04I (W-MW-DI)	HN-04D (W-MW-DD)	HN-05S (W-MW-ES)		HN-05I (W-MW-EI) Duplicate of HN-15I		HN-05D (W-MW-ED) Duplicate of HN-16D	
Manganese	277	172 B	NA	NA	NA	16.4 B	6.1 B	204	140	39.0	9.3 B
Mercury	ND (0.13)	ND (0.13)	NA	NA	NA	ND (0.12)	ND (0.14)	ND (0.13)	ND (0.14)	ND (0.13)	ND (0.14)
Nickel	ND (17)	ND (17)	NA	NA	NA	ND (17)	ND (17)	ND (17)	ND (17)	ND (17)	ND (17)
Potassium	1,110 J	1,340 J	NA	NA	NA	434 B	905	748 B	857	1,170	1,540
Silver	ND (1)	ND (1)	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Sodium	18,800 J	18,300 J	NA	NA	NA	9,610 J	10,000 J	13,200 J	13,600 J	66,900 J	67,000 J
Thallium	ND (4)	ND (4)	NA	NA	NA	ND (4)	ND (4)	4.0	ND (4)	ND (4)	ND (4)
Vanadium	ND (4)	ND (4)	NA	NA	NA	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Zinc	12.1 L	ND (7)	NA	NA	NA	17.4	ND (7)	19.0	ND (7)	45.7	ND (7)

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)									
	HN-06S (W-MW-FS)	HN-06I (W-MW-FI)	HN-06D (W-MW-FD)	HN-07S (W-MW-GS)		HN-07I (W-MW-GI)		HN-07D (W-MW-GD)		HN-08S (W-MW-HS)
1,1-Dichloroethane	ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)		1
cis-1,2-Dichloroethene	ND (1)	ND (1)	ND (1)	2		1		ND (1)		ND (1)
Chloroform	ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)		ND (1)
Carbon tetrachloride	ND (1)	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)		ND (1)
Trichloroethene	ND (1)	ND (1)	ND (1)	7		8		4		ND (1)
Tetrachloroethene	9	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)		ND (1)
Toluene	ND (1)	ND (1)	10	ND (1)		1		4 J		9
Endosulfan II	NA	NA	NA	NA		ND (0.10)		ND (0.10)		NA
Aluminum	NA	NA	NA	2,340	37.8 B	150	ND (13)	43.5	ND (13)	NA
Antimony	NA	NA	NA	ND (27)	30.7 B	ND (27)	ND (27)	ND (27)	ND (27)	NA
Arsenic	NA	NA	NA	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	NA
Barium	NA	NA	NA	83.7	61.1	103	88.2	58.3	59.8	NA
Beryllium	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	NA
Calcium	NA	NA	NA	17,200	18,300	30,700	27,100	15,200	14,800	NA
Copper	NA	NA	NA	ND (6)	ND (6)	ND (6)	9.2 L	ND (6)	ND (6)	NA
Iron	NA	NA	NA	2,890	20.6 B	184 B	21.4 B	395	49.2 B	NA
Lead	NA	NA	NA	ND (1)	ND (1)	4.3 B	1.2 B	1.5 B	1.2 B	NA
Magnesium	NA	NA	NA	7,380	7,520	15,700	13,400	5,740	5,560	NA
Manganese	NA	NA	NA	55.6	5.7	32.8	14.3 B	10.6 B	7.9 B	NA

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)									
	HN-06S (W-MW-FS)	HN-06I (W-MW-FI)	HN-06D (W-MW-FD)	HN-07S (W-MW-GS)		HN-07I (W-MW-GI)		HN-07D (W-MW-GD)		HN-08S (W-MW-HS)
Mercury	NA	NA	NA	0.21	ND (0.13)	ND (0.14)	ND (0.13)	ND (0.13)	ND (0.13)	NA
Nickel	NA	NA	NA	ND (17)	ND (17)	ND (17)	ND (17)	ND (17)	ND (17)	NA
Potassium	NA	NA	NA	1,420	1,410	637 B	876	1,100	1,290	NA
Silver	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	NA
Sodium	NA	NA	NA	17,000	17,800	17,000 J	16,500 J	18,000 J	18,600 J	NA
Thallium	NA	NA	NA	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	NA
Vanadium	NA	NA	NA	5.7	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	NA
Zinc	NA	NA	NA	8.7	11.5	27.3 J	10.9	ND (7)	14.1	NA

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)											
	HN-08I (W-MW-HI)	HN-08D (W-MW-HD)	HN-09S (W-MW-IS)		HN-09I (W-MW-II)		HN-09D (W-MW-ID)		HN-10S (W-MW-JS)		HN-10I (W-MW-JI)	
1,1-Dichloroethane	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)		ND (1)		ND (1)	
cis-1,2-Dichloro-ethene	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)		ND (1)		ND (1)	
Chloroform	ND (1)	1	ND (1)		ND (1)		ND (1)		ND (1)		ND (1)	
Carbon tetrachloride	ND (1)	ND (1)	8 L		ND (1)		ND (1)		ND (1)		ND (1)	
Trichloroethene	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)		ND (1)		ND (1)	
Tetrachloroethene	ND (1)	ND (1)	ND (1)		ND (1)		ND (1)		ND (1)		ND (1)	
Toluene	ND (1)	18	ND (1)		ND (1)		5		ND (1)		3	
Endosulfan II	NA	NA	NA		0.34 L		NA		NA		NA	
Aluminum	NA	NA	37.2	ND (13)	3,520	20.6 B	123 B	ND (13)	20	ND (13)	146	ND (13)
Antimony	NA	NA	ND (27)	ND (27)	ND (27)	ND (27)	ND (27)	41.6 B	ND (27)	ND (27)	ND (27)	ND (27)
Arsenic	NA	NA	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)
Barium	NA	NA	125	120	162	92.6	245	206	224	218	156	135
Beryllium	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Calcium	NA	NA	18,800	19,500	36,400	37,200	45,800	41,100	44,500	48,000	27,200	27,700
Copper	NA	NA	7.3	ND (6)	8.3	ND (6)	ND (6)	ND (6)	ND (6)	ND (6)	ND (6)	13.0 L
Iron	NA	NA	54.4	15.2 B	2,400	22.0 B	84.8 B	12.6 B	126 B	29.6 B	227 B	26.1 B
Lead	NA	NA	ND (1)	ND (1)	4.9 B	ND (1)	ND (1)	ND (1)	3.2 B	1.5 B	4.1 B	ND (1)
Magnesium	NA	NA	8,860	9,020	15,800	15,500	11,900	10,300	14,600	15,400	8,100	7,950

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)											
	HN-08I (W-MW-HI)	HN-08D (W-MW-HD)	HN-09S (W-MW-IS)		HN-09I (W-MW-II)		HN-09D (W-MW-ID)		HN-10S (W-MW-JS)		HN-10I (W-MW-JI)	
Manganese	NA	NA	15.1	15.7	200	163	561	482	7.0	6.4 B	25.1	22.5
Mercury	NA	NA	ND (0.13)	ND (0.13)	ND (0.12)	ND (0.13)	ND (0.11)	ND (0.14)	ND (0.13)	ND (0.14)	ND (0.13)	ND (0.13)
Nickel	NA	NA	ND (17)	ND (17)	ND (17)	ND (17)	ND (17)	ND (17)	48.5	ND (17)	ND (17)	ND (17)
Potassium	NA	NA	954	904	1,470	1,240	1,480	1,310	932	1,440	867	1,340
Silver	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Sodium	NA	NA	14,400	14,800	25,300	26,400	23,000	30,000	29,700 J	30,100 J	23,300 J	22,000 J
Thallium	NA	NA	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Vanadium	NA	NA	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	4.5 K	ND (4)	ND (4)	ND (4)
Zinc	NA	NA	22.9	27.8	19.9	ND (7)	12.1	ND (7)	27.7	16.6	45.6	32.4

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)									
	HN-10D (W-MW-JD)		HN-38 (W-MW-HN-38)	HN-39 (W-MW-HN39)	HN-40S (W-MW-HN40-S)		HN-40I (W-MW-HN40I)		HN-40D (W-MW-HN40D)	
1,1-Dichloroethane	ND (1)		ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
cis-1,2-Dichloroethene	ND (1)		ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
Chloroform	ND (1)		ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
Carbon tetrachloride	ND (1)		ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
Trichloroethene	ND (1)		ND (1)	ND (1)	ND (1)		ND (1)		1	
Tetrachloroethene	ND (1)		ND (1)	1	ND (1)		ND (1)		ND (1)	
Toluene	ND (1)		ND (1)	ND (1)	ND (1)		ND (1)		ND (1)	
Endosulfan II	NA		NA	NA	NA		NA		NA	
Aluminum	87.3	ND (13)	NA	NA	5,590	108 B	398	19.7 B	293	ND (16)
Antimony	ND (27)	ND (27)	NA	NA	ND (37)	ND (37)	ND (37)	ND (37)	ND (37)	ND (37)
Arsenic	ND (3)	ND (3)	NA	NA	5.6	4.3	3.8	4.0	2.3	3.4
Barium	276	250	NA	NA	445	174	220	99.3	435	344
Beryllium	ND (1)	ND (1)	NA	NA	1.1	ND (1)	ND (1)	ND (1)	ND (1	ND (1)
Calcium	32,600	33,700	NA	NA	45,400	39,900	40,000	40,300	58,600	50,600
Cobalt	ND (3)	ND (3)	NA	NA	5.5	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Copper	ND (6)	6.0 L	NA	NA	19.0 B	13.0 B	ND (5)	ND (5)	11.1 B	6.2 B
Iron	119 B	45.2 B	NA	NA	7,210	155 B	389	33.1 B	492	36.9 B
Lead	1.5 B	3.3 B	NA	NA	8.5	ND (1)	1.1 L	ND (1)	4.6 L	ND (1)
Magnesium	8,030	8,130	NA	NA	18,400	15,300	14,600	14,500	19,000	16,400

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)									
	HN-10D (W-MW-JD)		HN-38 (W-MW-HN-38)	HN-39 (W-MW-HN39)	HN-40S (W-MW-HN40-S)		HN-40I (W-MW-HN40I)		HN-40D (W-MW-HN40D)	
Manganese	68.2	67.7	NA	NA	897	157	131	119	359	227
Mercury	ND (0.13)	ND (0.13)	NA	NA	ND (0.13)	ND (0.14)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)
Nickel	ND (17)	ND (17)	NA	NA	ND (12)	ND (12)	ND (12)	ND (12)	ND (12)	ND (12)
Potassium	2,440	2,740	NA	NA	2,380	1,200	1,090	1,180	2,330	1,870
Silver	ND (1)	ND (1)	NA	NA	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Sodium	27,300 J	27,200 J	NA	NA	10,900	10,200	11,500	11,700	17,200	14,900
Thallium	ND (4)	ND (4)	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Vanadium	ND (4)	ND (4)	NA	NA	9.7 B	3.2 B	ND (3)	ND (3)	ND (3)	ND (3)
Zinc	8.5	7.5	NA	NA	29.9 K	12.3 K	5.9 B	ND (4)	83.2	11.7 K

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)				
	HN-49S (W-MW-HN49S)	HN-49I (W-MW-HN49I)	HN-49D (W-MW-HN49D)	MW-05 (W-MW-05)	MW-06 (W-MW-06)
1,1-Dichloroethane	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
cis-1,2-Dichloroethene	ND (1)	30	2	ND (1)	ND (1)
Chloroform	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Carbon tetrachloride	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Trichloroethane	1	120	7	ND (1)	ND (1)
Tetrachloroethene	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Toluene	ND (1)	12	14	ND (1)	ND (1)
Phenanthrene	1 J	NA	NA	NA	NA
Butylbenzylphthalate	10	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	2 J	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA
Aluminum	25,500	3,650	13,400	NA	NA
Antimony	ND (32)	ND (32)	ND (32)	NA	NA
Arsenic	9.8	ND (2)	4.2	NA	NA
Barium	991	445	300	NA	NA
Beryllium	5.0	ND (1)	1.4	NA	NA
Calcium	50,500	37,800	23,000	NA	NA
Chromium	41.3	ND (5)	ND (5)	NA	NA
Cobalt	17.4	ND (3)	ND (3)	NA	NA

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)				
	HN-49S (W-MW-HN49S)	HN-49I (W-MW-HN49I)	HN-49D (W-MW-HN49D)	MW-05 (W-MW-05)	MW-06 (W-MW-06)
Copper	41.1	7.0 B	9.7 B	NA	NA
Iron	42,300	2,240	4,980	NA	NA
Lead	14.6	2.7 B	10.1 B	NA	NA
Magnesium	35,600	24,900	9,040	NA	NA
Manganese	1,200	275	176	NA	NA
Mercury	0.14	ND (0.13)	ND (0.13)	NA	NA
Nickel	45.2	ND (7)	ND (7)	NA	NA
Potassium	9,310	1,650	2,360	NA	NA
Silver	4.0 UL	4.0 UL	4.0 UL	NA	NA
Sodium	18,400	20,700	70,600	NA	NA
Thallium	4.4 B	6.4 B	3.5 B	NA	NA
Vanadium	33.6	2.2	ND (1)	NA	NA
Zinc	99.4	29.5	90.0	NA	NA

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TABLE 4-2 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS IN AREA B MONITORING WELLS
HALLIBURTON NUS 1994 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)					
	DG-17 (W-MW-DG17)	DG-18 (W-MW-DG18)	DG-19 (W-MW-DG19)	DG-20 (W-MW-DG20)	DG-21 (W-MW-DG21)	DG-25 (W-MW-DG25)
1,1-Dichloroethane	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
cis-1,2-Dichloroethene	ND (1)	5	ND (1)	2	ND (1)	1
Chloroform	ND (1)	ND (1)	2	ND (1)	ND (1)	ND (1)
Carbon tetrachloride	ND (1)	ND (1)	1	ND (1)	ND (1)	ND (1)
Trichloroethene	ND (1)	12	4	7	3	4
Tetrachloroethene	ND (1)	ND (1)	ND (1)	2	ND (1)	ND (1)
Toluene	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)

NA - Sample not analyzed for this parameter.
Metals results for unfiltered samples are presented in left hand column and for filtered samples in right hand column.
Positive results for compounds/analytes denoted by shading in table cell.
Qualifier codes:

- ND = analyte not detected at quantitation/detection limit in parenthesis
- J = estimated result
- B = not detected due to blank contamination
- K = positive result biased high
- L = positive result biased low
- UJ = estimated quantitation/detection limit
- UL = estimated quantitation/detection limit, biased low

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TABLE 4-3

SUMMARY OF ANALYTICAL RESULTS FOR MISCELLANEOUS PARAMETERS (mg/L)
AREA B GROUNDWATER
NAWC WARMINSTER, PENNSYLVANIA

Parameter	HN-02I (W-MW-BI)	Field Duplicate Samples		DG-21 (W-MW-BS)
		HN-02D (W-MW-BD)	HN-02D (W-MW-ND)	
Total Organic Carbon	3.1	4.0	2.5	2.4
Alkalinity (as $CaCO_3$)	201	119	118	85.1
Biochemical Oxygen Demand (BOD)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)
Chemical Oxygen Demand (COD)	10.7	8.1	ND (5.0)	11.0
Hardness (as $CaCO_3$)	98.8	128	123	123
pH	6.56	6.25	6.27	5,90
Total Dissolved Solids (TDS)	398	191	200	233
Total Suspended Solids (TSS)	10.0	20.0	22.0	18.0

NA - Sample not analyzed for this parameter.
NR - TIC sample results not reported.
Positively detected compounds/analytes denoted by shading in table cell.
Qualifier codes:

- ND = analyte not detected at quantitation/detection limit in parenthesis
- J = estimated result
- B = not detected due to blank contamination
- K = positive result biased high
- L = positive result biased low
- UJ = estimated quantitation/detection limit
- UL = estimated quantitation/detection limit, biased low

Table 4-4 summarizes analytical results (positive detections) for 11 monitoring wells which were sampled in the first quarter of 1995 as part of the OU-1 groundwater extraction system installation. Included in this analytical data are results of volatile organic analyses (including Tentatively Identified Compound scan results) and Target Analyte List (TAL) metals analyses. Table 4-5 presents a summary of analytical results for chemicals which were detected in extraction wells installed by OHM in January of 1995. In all tables, positive results have been shaded for easy identification. The complete analytical results for groundwater are presented in Appendix C.

4.2.1 Halliburton NUS 1994 Sampling Results

Low concentrations of contaminants were detected in some monitoring wells within Area B, primarily along the downgradient (southern) edge of Site 6. Organic chemicals detected in Area B groundwater include chlorinated organics (tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, 1,1-dichloroethane, chloroform, and carbon tetrachloride), mono- and polycyclic aromatic hydrocarbons (toluene, xylenes, and phenanthrene), phthalate esters (butylbenzylphthalate and bis(2-ethylhexyl)phthalate), and a pesticide (endosulfan II). Positive results are reported in at least one sample for all TAL metals except cadmium, chromium, cobalt, and selenium. Of the detected compounds, only trichloroethene, tetrachloroethene, and carbon tetrachloride exceed respective MCLs.

For evaluation purposes, the monitoring wells in Area B were grouped as shallow (approximately 15 to 50 feet below ground surface), intermediate (approximately 50 to 100 feet below ground surface), and deep (approximately 100 to 245 feet below ground surface) wells. Monitored intervals vary from 5 to 32 feet in length. Results for samples collected at various depths permit evaluation of both horizontal and vertical contaminant extent and migration.

The hydrogeologic and analytical information for Area B indicate two distinct areas of groundwater flow and contamination, one centered around Area B and the other in the southeastern base boundary/Casey Village area. Potentiometric surface maps for shallow, intermediate, and deep groundwater monitoring wells were provided in Figures 3-6, 3-7, and 3-8, respectively. Tag maps showing shallow, intermediate, and deep monitoring well sample results are presented in Figures 4-1, 4-2, and 4-3.

The maximum detected concentrations of volatile organics in shallow monitoring wells include 1,1-dichloroethane (1 μg/L), cis-1,2-dichloroethene (5 μg/L), chloroform (2 μg/L), carbon tetrachloride (8 μg/L), trichloroethene (12 μg/L), tetrachloroethene (9 μg/L), and toluene (9 μg/L). The maximum concentrations of cis-1,2-dichloroethene and trichloroethene were found in the sample collected from

TABLE 4-4

SUMMARY OF POSITIVELY DETECTED CHEMICALS FOR AREA B MONITORING WELLS
HALLIBURTON NUS 1995 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)				
	January 16, 1995 Sampling Event				
	HN-36I1	HN-36I2	HN-36D	HN-37I	HN-37D
Methylene chloride	2	3	1 J	1 BJ	2 B
Acetone	21	15	17	ND (5)	ND (5)
Carbon disulfide	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,2-Dichloroethene (total)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
2-Butanone	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Trichloroethene	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Benzene	2	1	20	ND (1)	ND (1)
Toluene	ND (1)	ND (1)	1	ND (1)	ND (1)
Tentatively Identified Compounds (TICs)	Freon-12 27	Freon-12 40	Freon-11 34 2,3,4-Trimethylpentane 2 C_8H_{18} isomer 3	NR	NR
Arsenic	NA	NA	NA	NA	NA

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TABLE 4-4 (Continued)
SUMMARY OF POSITIVELY DETECTED CHEMICALS FOR AREA B MONITORING WELLS
HALLIBURTON NUS 1995 SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)								
	February 7 and 8, 1995 Sampling Event								
	DG-21	HN-02I	HN-02D	HN-36I1	HN-36I2	HN-36D	DG-18	EW-12	EW-14
Methylene chloride	ND (10)	ND (10)	ND (10)	2 J	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
Acetone	11 B	ND (10)	7 B	10 B	8 B	11 B	ND (10)	24 B	ND (10)
Carbon disulfide	ND (10)	ND (10)	ND (10)	1 J	ND (10)	ND (10)	46	ND (10)	ND (10)
1,2-Dichloroethene (total)	ND (10)	1 J	ND (10)	ND (10)	ND (10)	ND (10)	5 J	ND (10)	ND (10)
2-Butanone	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
Trichloroethene	1 J	2 J	ND (10)	ND (10)	ND (10)	1 J	12	ND (10)	2 J
Benzene	ND (10)	ND (10)	ND (10)	4 J	1 J	18	ND (10)	ND (10)	ND (10)
Toluene	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
Tentatively Identified Compounds (TICs)	NR	NR	NR	NR	NR	NR	NR	NR	NR
Arsenic	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)

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TABLE 4-5

SUMMARY OF POSITIVELY DETECTED CHEMICALS FOR AREA B MONITORING WELLS
OHM EXTRACTION WELL SAMPLING RESULTS
NAWC WARMINSTER, PENNSYLVANIA

Chemical	Area "B" Monitoring Wells (mg/L)					
	EW-12 (01/04/95) 12-hour pump test	EW-12 (01/18/95) 72-hour pump test Bailer	EW-12-DIP (01/18/95) 72-hour pump test	EW-12-DIPA (01/19/95) 72-hour pump test	EW-12-DIPB (01/20/95) 72-hour pump test	EW-14 (01/12/95) 72-hour pump test
1,2-Dichloropropane	ND (1)	2.0	ND (1)	0.3 J	0.7 J	ND (1)
Methylene chloride	2.0	ND (1)	ND (1)	ND (1)	ND (1)	4.1 B
Trichloroethene	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	1.5
Freon-11 (Trichlorofluoromethane)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	3.1
Dibromomethane	1.4	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)

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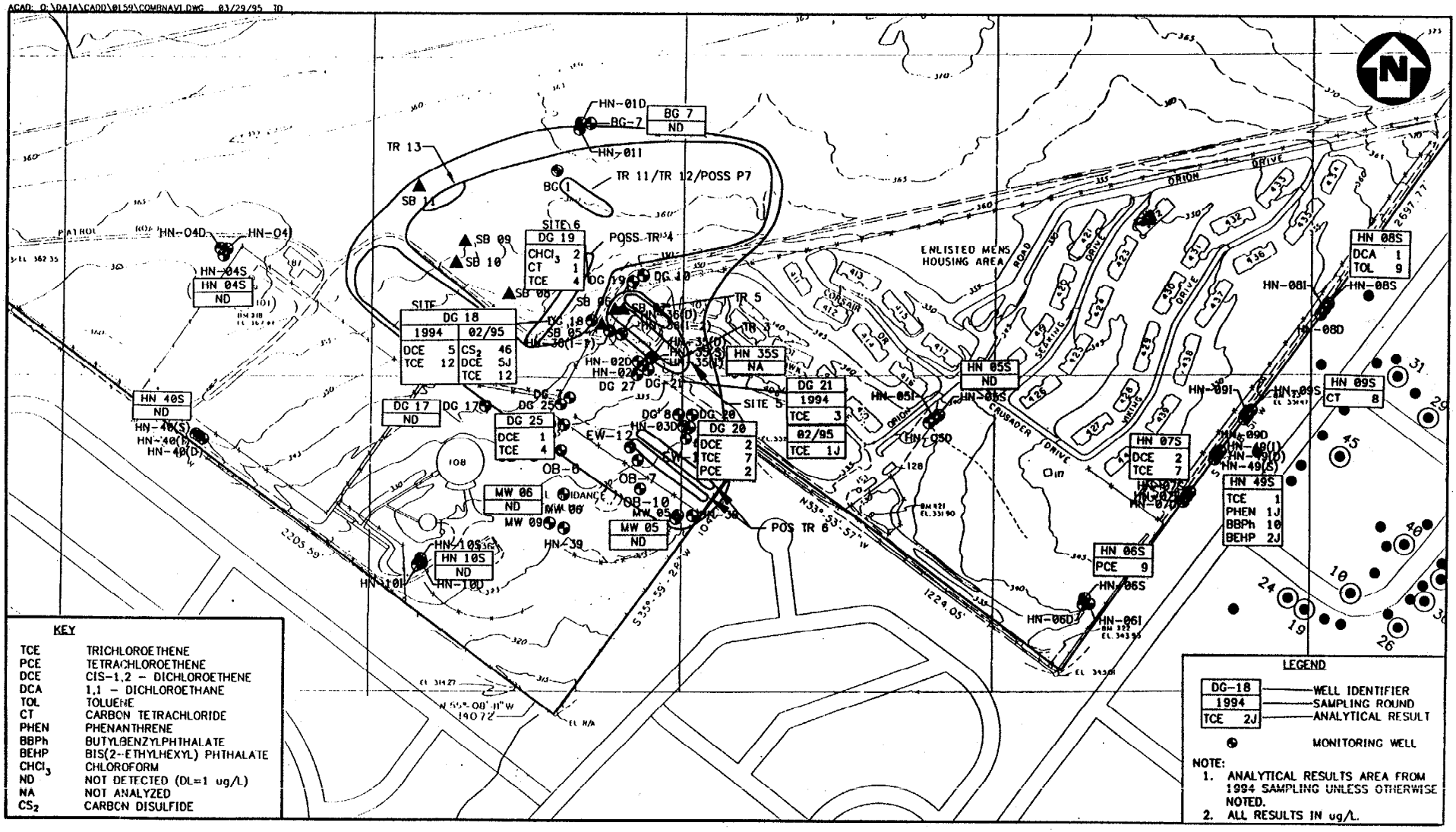
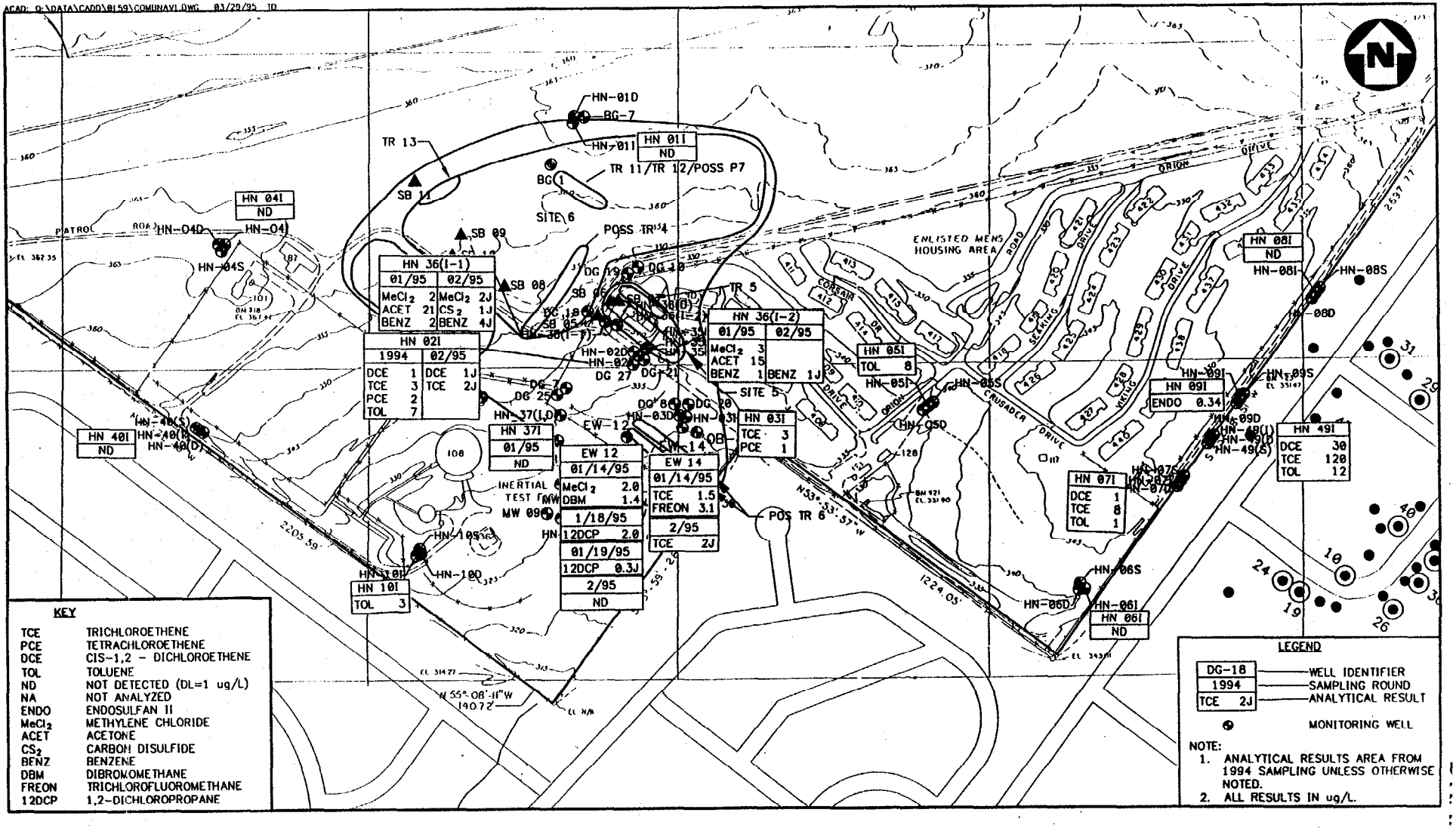


1994-1995 HALLIBURTON NUS
GROUNDWATER SAMPLING RESULTS
AREA B - SHALLOW GROUNDWATER
(ALL RESULTS IN ug/L)

FIGURE 4-1

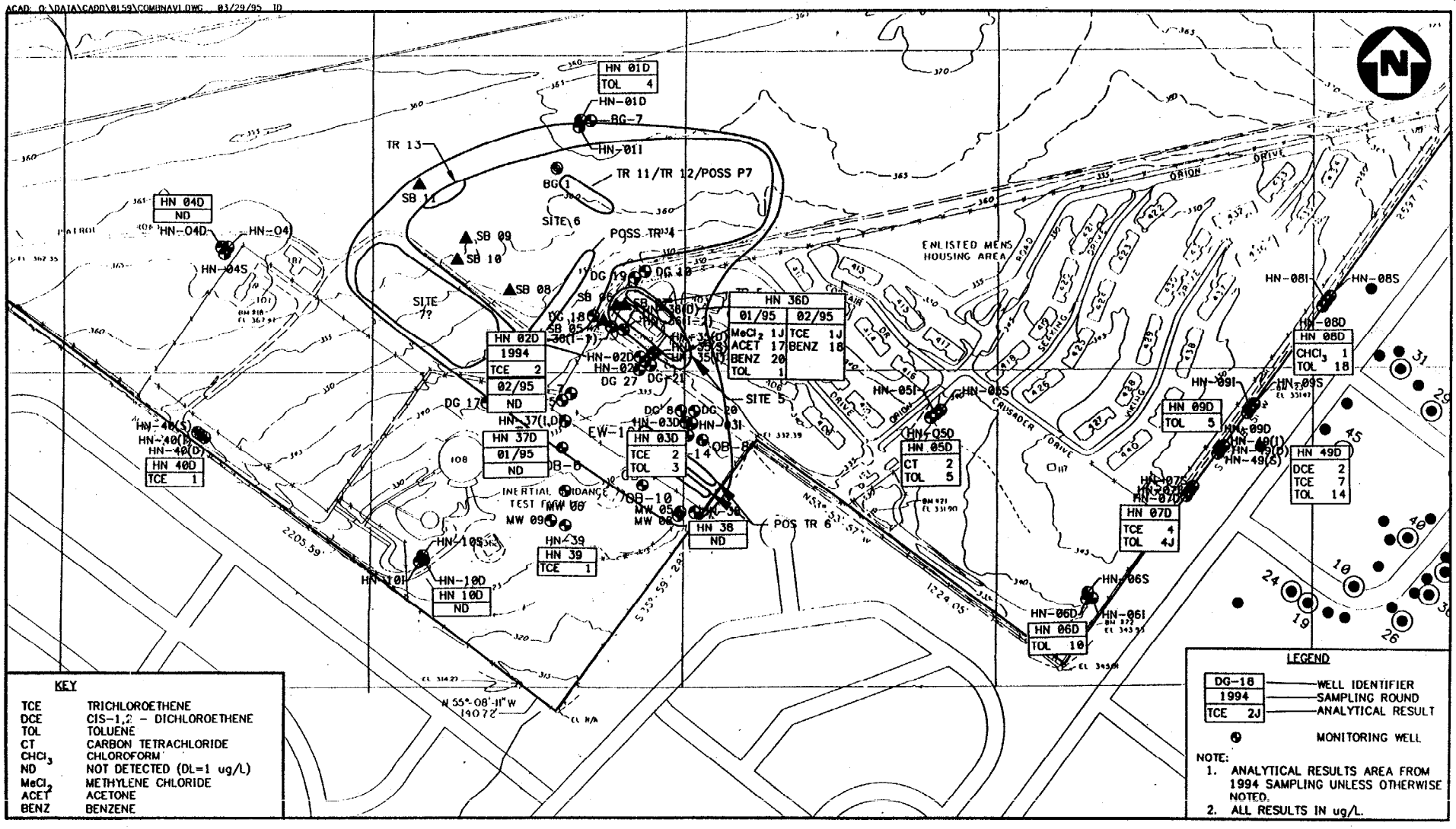
Halliburton NUS CORPORATION



1994-1995 HALLIBURTON NUS
GROUNDWATER SAMPLING RESULTS
AREA B - INTERMEDIATE GROUNDWATER
(ALL RESULTS IN ug/L)

FIGURE 4-2

Halliburton NUS CORPORATION



1994-1995 HALLIBURTON NUS
GROUNDWATER SAMPLING RESULTS
AREA B - DEEP GROUNDWATER
(ALL RESULTS IN ug/L)

0 300 600
SCALE IN FEET

FIGURE 4-3

Halliburton NUS CORPORATION

monitoring well DG-18, located immediately downgradient of Site 6. Other shallow wells containing maximum concentrations include HN-06S (tetrachloroethene), HN-08S (1,1-dichloroethane and toluene), and HN-09S (carbon tetrachloride); all of these samples are located along the southeast base boundary near Casey Village. Shallow wells which did not have detectable quantities of organic compounds include HN-01S, HN-04S, HN-05S, HN-10S, MW-05, MW-06, BG-7, and DG-17.

The shallow groundwater sample data for organics identifies the two contaminant plumes which exist in the area of investigation. One plume, noted to primarily contain dichloroethenes, trichloroethene, chloroform, and carbon tetrachloride, is located very close to Sites 5 and 6 within Area B. The lateral extent of this plume is defined by monitoring wells HN-01S, HN-05S, HN-10S, MW05, MW06, and DG-17. The pattern of detections is consistent with the prevailing shallow groundwater flow pattern depicted in Figure 3-6, which shows groundwater flow in the area generally toward HN-10, MW-05, and MW-06.

The second shallow groundwater contaminant plume, detected along the Casey Village/southeast base boundary, is evidenced by data from monitoring wells HN-06S, HN-07S, HN-08S, HN-09S, and HN-49S. This plume is primarily comprised of trichloroethene (TCE), tetrachloroethene (PCE), 1,1-dichloroethane (DCA), and dichloroethene (DCE) isomers. The shallow groundwater flow pattern around this plume suggests an off base source (in Casey Village), since flow is generally to the north and northwest. Groundwater samples collected from residential wells in Casey Village have significant amounts of trichloroethene (up to 1,200 μg/L), tetrachloroethene (up to 720 μg/L), and dichloroethene isomers (up to 530 μg/L). These concentrations are up to two orders of magnitude greater than those detected on base for identical chemicals.

Chlorinated ethenes and toluene are the most frequently detected compounds in the intermediate depth monitoring wells, at levels <10 μg/L (with the exception of well HN-49I, discussed below). Figure 4-2 shows the distribution of contaminants in intermediate depth wells. Toluene detections appear over a wider area than chlorinated organics, as evidenced by positive results in well clusters HN-01, HN-07, and HN-10, as well as locations between. Detections of chlorinated organics are primarily associated with the area on the downgradient edge of Sites 5 and 6. A second area of frequent detection of chlorinated compounds is along the southeastern base boundary (well clusters HN-07 and HN-49). Wells HN-49I and HN-07I were the only intermediate wells containing VOCs (TCE and DCE) at concentrations above the MCLs. Chlorinated organics were not detected in the intermediate wells located on either side of these two well clusters (HN-06 and HN-09). Of particular note is the detection of 120 μg/L of TCE and 30 μg/L DCE in well HN-49I. These levels are by far the highest concentrations of TCE and DCE found in on-base monitoring wells in and

around Area B. Well HN-49I is located in close proximity to the residential wells with the highest reported detections of TCE (1,200 μg/L) and DCE (530 μg/L).

Toluene and chlorinated organic detections in deep monitoring wells are consistent with detections which were observed in the intermediate groundwater samples. Toluene detections are noted across the area, from HN-01D to HN-03D and HN-06D. The detected concentrations of this compound varies from 1 μg/L to 18 μg/L, with the maximum concentration noted at HN-08D. Low levels of toluene are detected consistently in deep wells east of Area B, but incidence of detection at locations close to Sites 5 and 6 are much lower.

The isolated, low concentration chlorinated ethene and methane isomer detections reported in deep wells do not reveal any consistent pattern which would suggest a single, common source or a significant plume of contamination. Close to Sites 5 and 6, trace levels of trichloroethene were detected in deep wells HN-02D and HN-03D, at concentrations below its MCL. A second area of chlorinated ethene detection is noted along the southeastern base/Casey Village boundary, where the concentration of TCE in HN-49D (7 μg/L) slightly exceeded the MCL of 5 μg/L. This was the only detection above MCLs in deep wells in the 1994 data. The sample collected at HN-05D contained only carbon tetrachloride.

Semivolatile organic analyses were performed for the groundwater sample collected from obtained from monitoring well HN-49S. Positive results were reported for only three compounds at concentrations equal to or less than quantitation limits. These results include phenanthrene (1 μg/L), butylbenzylphthalate (10 μg/L), and bis(2-ethylhexyl)phthalate (2 μg/L). The low levels reported for these chemicals and their absence in the shallow and deep wells may indicate their detection to be anomalous.

Although several inorganic analytes were detected in groundwater samples collected in Area B, no significant patterns of contamination are noted. Based on comparison to upgradient well data (HN-01I, HN-01D, HN-04S, HN-04I, HN-04D, and BG-7) sample results, positive results for metals exceed maximum background concentrations for at least one parameter in either total or dissolved sample analyses in every sample. However, the exceedences are neither consistent for every parameter in an individual sample nor is there a pattern of exceedence in a group of sample locations. The results appear to be characteristic of the normal variation in inorganics that would be expected in groundwater.

4.2.2 Halliburton NUS 1995 Sampling Results

Two sampling events were conducted in January and February 1995 for monitoring wells in cluster HN-36 (both events), cluster HN-37 (January only), and for monitoring wells HN-02I, HN-02D, DG-18, and DG-21 and extraction wells EW-12 and EW-14 (for February only). Theses groundwater samples were analyzed for TCL volatile organics and arsenic. A summary of the analytical results for positively detected compounds/analytes for the 1995 sampling is presented in Table 4-4.

In general, positive detections of VOCs were at trace levels, with the exceptions of DG-18 and HN-36D. These two wells are located adjacent to one another on the downgradient edge of Site 6. In addition to compounds which were detected in previous sampling of the Area B monitoring wells (i.e., chlorinated solvents and toluene), methylene chloride, acetone, carbon disulfide, 2-butanone, and benzene were also detected in at least one well. Methylene chloride, acetone, and 2-butanone are common laboratory contaminants and will not be addressed pending the results of complete data validation. Carbon disulfide and benzene, however, may be site-related contaminants. Reported concentrations of 1,2-dichloroethene and trichloroethene in samples HN02-I and DG-18 are consistent with concentrations detected in the 1994 sampling. Trichloroethene was also detected in the sample collected from DG-21 at a concentration which is slightly lower in the 1995 sampling than it was in 1994 (1 μg/L versus 3 μg/L).

Carbon disulfide was detected in two wells: HN-36I1 (1 μg/L) and DG-18 (46 μg/L). Previous sampling for DG-18 did not result in detection of this compound (see Table 4-2), and it's presence may be attributable to blank contamination. Benzene detections at cluster HN-36 are attributable to contamination, as this compound is detected in both sampling events in monitoring wells HN-36I1, HN-36I2, and HN-36D. In both rounds of sampling, the relative concentrations of benzene observed in the wells are consistent, with samples from HN-36D containing the highest concentrations (18 μg/L in January and 20 μg/L in February). The January data also includes TIC results. Reported in the samples also noted to contain benzene are freon (in all three) and two hydrocarbons (in HN-36D only). Benzene was not detected in any other wells within Area B, including a number of wells located directly down gradient of cluster HN-36. The concentration in HN-36D was, however, above the MCL of 5 μg/L.

Arsenic, an analytical parameter in the February 1995 sampling, was not detected in any of the monitoring wells. Analysis for this metal was not performed in the January 1995 sampling event.

4.2.3 OHM Extraction Well Sampling Results

Two extraction wells which have been installed on the downgradient edge of Sites 5 and 6 in Area B (EW-12 and EW-14), were sampled in January 1995 while pumping tests of varying duration were performed. Analytical results for positively detected compounds in samples collected from EW-12 and EW-14 are presented in Table 4-5. These data have not been subjected to data validation and are considered preliminary. Analysis was limited to the low concentration CLP SOW for volatile organic compounds.

Two initial sampling events were performed separately for wells EW-12 (sampled on January 4, 1995) and EW-14 (sampled on January 12, 1995). Trace levels of methylene chloride and dibromomethane were detected in well EW-12, at concentrations of 2 μg/L and 1.4 μg/L, respectively. Trichloroethene and trichlorofluoromethane were detected in the sample collected from EW-14 at concentrations of 1.5 μg/L and 3.1 μg/L, respectively.

During 72-hour pump tests performed on the well EW-12, only 1,2-dichloropropane was detected. This compound was not noted in sample collected from this well previously, and has not been historically detected in samples collected this area. The detected concentrations in the samples collected from the later portions of the pump test are less than the respective reporting limit for this compound.

4.3 CONTAMINANT TRENDS OVER TIME

Data from previous investigations was compared to 1994-1995 sampling results to identify contaminant trends over time. Over the monitoring period, which started in 1991, an established group of compounds have been detected at specific locations in Area B.

During the Phase I RI groundwater sampling for Area B, conducted in November 1991, samples from overburden and shallow bedrock wells were analyzed for full TCL organic and TAL inorganic parameters. The Phase II RI groundwater sampling was conducted in July 1992 and analyzed for the same parameters. However, Phase II analyses for volatile organic compounds was performed utilizing the low concentration CLP statement of work. Analytical results for these sampling rounds are presented in the Phase II RI Report (Halliburton NUS, 1993a). The discussion of contaminant trends over time is limited to volatile organic compounds in shallow bedrock groundwater, as this portion of the aquifer exhibits the greatest degree of contamination and this analytical fraction includes the chemicals of concern for the Area B groundwater. Monitoring wells which are considered include MW-05, MW-06, BG-7, DG-17, DG-18, DG-19, DG-20, DG-21, and DG-25.

Results of analyses for past (1991 and 1992) and present (1994 and 1995) sampling of monitoring wells MW-05, BG-7, and DG-17 indicate no detectable amounts of volatile organic compounds in these wells. Groundwater collected from MW-06 contained a positive detection of tetrachloroethene in 1991 (4 μg/L) and nondetects for all volatiles in the 1994 sample.

Groundwater sample analyses for monitoring well DG-18 indicate the presence of 1,2-dichloroethene and trichloroethene, which were detected in both sampling rounds at concentrations which are not significantly variant over time. The results for 1,2-dichloroethene (7 μg/L in 1991, 8 μg/L in 1992, and 5 μg/L in 1994) and trichloroethene (8 μg/L in 1991, 13 μg/L in 1992, and 12 μg/L in 1994) have not shown any significant change over time. Carbon tetrachloride, detected at a concentration of 0.3 μg/L in 1991, was not detected in the 1992 or 1994 sampling rounds.

Similar organics were detected in DG-20 over the 1991-1994 time period, and the results are consistent over time. Tetrachloroethene (ND in 1991, 3 μg/L in 1992, and 2 μg/L in 1994), 1,2-dichloroethene (2 μg/L in 1991 and 1994 and 3 μg/L in 1992) and trichloroethene concentrations (6 μg/L in 1991, 8 μg/L in 1992, and 7 μg/L in 1994) do not vary over time. Toluene was detected only in 1992 at a concentration equal to the quantitation limit (1 μg/L).

Groundwater samples collected from DG-25 contained 1,2-dichloroethene (2 μg/L in 1991 and 1992 and 1 μg/L in 1994) and trichloroethene (6 μg/L in 1991 and 1992, and 4 μg/L in 1994). These results are noted to decline marginally over the 3-year period. Carbon tetrachloride was detected in 1991 (1 μg/L) but not in 1992 or 1994.

Monitoring wells DG-19 and DG-21 initially appear to be exceptions to the trend of steady state or decreasing concentrations, with detections of trichloroethene and other compounds in 1992 and 1994 samples which were not detected in 1991. These results are, however, not considered to be indicative of an increase in contamination, as the associated results are sufficiently low in concentration (i.e., less than 5 μg/L) to be below limits of quantitation for the analytical method used in 1991. The nondetects reported for the 1,2-dichloroethene isomer in DG-21 (1992 and 1994 results) suggests this compound is no longer present in the groundwater at this location.

In conclusion, the detected concentrations of volatile organic contaminants in the Area B groundwater appear to have decreased or remained stable over the 3-4 year period between sampling rounds. The

analytical data indicates that the plume has not migrated beyond the affected area identified in the Phase II RI Report and that additional contamination has not entered the shallow groundwater.

5.0 CONCLUSIONS

The Stockton Formation within and around Area B consists of alternating sequences of fine and coarse grained sedimentary rock units which strike to the east-northeast and dip to the northwest. Groundwater flow within the Stockton Formation is primarily through fractures; both cross bedding joints and bedding plane fractures. The finer grained siltstone and shale rock units act as semiconfining layers to groundwater flow, however some groundwater does move through the units. Coarser grained sandstone units are preferential zones for groundwater movement.

Based on pumping test results, the transmissivity of the top 100-120 feet of the Stockton Formation is on the order of approximately 200-300 ft^2/day. It is expected that the transmissivity will vary somewhat locally due to differing percentages of coarse grained versus fine grained rock units and with local variations in the degree of fracturing within the rock units.

Groundwater flow across Area B within the Stockton Formation is to the south, following topography. Flow directions are controlled by topography and the Southampton Creek drainage. Groundwater flow directions are similar to depths of at least 150+ feet, based on monitoring well cluster water level information. Based on the overall pattern of flow directions in and around Area B, there does not appear to be a groundwater migration pathway from Area B to Casey Village.

Soils analytical results indicate that there are no contaminant sources in soils in the well cluster locations sampled. Analytical results for groundwater in Area B suggest two discrete contaminant plumes.

One low-concentration volatile organics plume exists immediately downgradient of Sites 5 and 6 within Area B, centered around well DG-18 and well cluster HN-36. The only compounds detected above MCLs within this plume are TCE and benzene, at levels slightly above MCLs. Through comparisons between sampling results for selected wells across the 1991 to 1995 time frame, it appears that the plume within Area B is in a steady-state condition. The distributions and concentrations of contaminants within groundwater appear to be stable, indicating that the plume is neither migrating further downgradient nor increasing in concentration. Based on the groundwater sampling data, the contaminant plume does not extend off site and is not expanding toward the base boundary at this time. With the exception of benzene in well HN-36D, contaminants appear to be confined to the top 100 feet of the bedrock aquifer.

The second discrete area of groundwater contamination, located along the southeastern boundary of NAWC adjacent to Casey Village, does not appear to be related to Area B. Based on water level elevation data, the boundary wells (and Casey Village wells) have water levels at least several feet higher than the water levels in the impacted wells within Area B. Based on this data, and the resultant groundwater flow maps, the boundary well clusters are not downgradient of Area B and the source of the localized contamination is separate from Area B. Significantly higher levels of VOC contamination have been detected in residential wells within Casey Village than have been found in the site boundary wells, and the EPA is currently initiating site investigation activities in Casey Village to evaluate the potential for an off-base source of this contamination.

REFERENCES

Halliburton NUS, 1993a. Phase II Remedial Investigation Report for Operable Unit 1, NAWC Warminster, Pennsylvania. Wayne, Pennsylvania.

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Halliburton NUS, 1993c. Quality Assurance Project Plan for Area B Hydrogeoloic Investigation. Wayne, Pennsylvania.

Halliburton NUS, 1994. Final Technical Memorandum-Area B Pumping Test Plan. Pittsburgh, Pennsylvania.

Rima, D. R., H. Meister, and S. Longwill, 1962. Geology and Hydrology of the Stockton Formation in Southeastern Pennsylvania, Bulletin W=14. Pennsylvania Department of Internal Affairs, Topographic and Geologic Survey.

Todd, David Keith, 1980. Groundwater Hydrology. John Wiley & Sons, New York.

Sloto, Ronald A., and Curtis L. Schreffler, 1994. Hydrogeology and Ground-Water Quality of Northern Bucks County, Pennsylvania. U.S. Geological Survey, Water-Resources Investigations Report 94-4109.

APPENDIX A
BORING LOGS

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-01 I
PROJECT NO.: 0159 — DATE: 11-11-93 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					OR	CLAY		
	3					bN	SILTY CLAY		
	7					TN	f. gr. SS		ARKOSIC
	13			8" at 12 ft.		RD-BN	MUDSTONE		SOFT
1009	17								BEGIN ADDING H2O TO Borehole
	18					BN	SILTSTONE/f. gr. SS		
									CUTTINGS "CLUMPED"; NO H2O flow from hole
	21					RUST RD-BN	MUDSTONE		
									SOFT
	25						LITHOLOGY AS Above		
	33					RD-BN	SILTSTONE		
1025	38					LT. TO RD. BN	SILTSTONE & SS		HARDER DRILLING;
						& GY			PICK-UP 1-2 GPM
1030	42					PK. GY	f. gr. SS		
	45					LT. BN & GY	f. gr. SS		IRON OXIDE STAINING
1040	48								YIELD ~4 gpm

REMARKS

BORING HN-01 I

PAGE 1 OF 2

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN01I
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	51					RD.BN	SILTSTONE		large fragment
	52					LT.BN	f. gr. SS		
	55								
1049						TN	f. gr. SS		Some coarse, angular, quartz
	58					TN	f. gr. SS		
	61					LT.BN	f. gr. SS		Lignitic film
	63					RD.BN	SILTSTONE		
	64					LT.BN + TN	f. gr. SS.		Yield ~5 gpm. Fracture at 64.5?
1057	68					RD.BN	SILTSTONE		
									~5 gpm TOTAL YIELD
1109	80					RD.BN	SILTSTONE		
	84					PK.GY	f-gr. SS		
	87								Pick up ~4 gpm
1124	89					RD.BN	SILTSTONE/f-gr. SS		
	93					RD.BN	SILTSTONE/f-gr. SS		
	97					RUST RD	MUDSTONE		
	103			TD					Yield ~ 8-9 gpm

REMARKS _____

BORING HN-01

PAGE 2 OF 2

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-01 D
PROJECT NO.: 0159 — DATE: 11-9-93 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					OR	SILTY CLAY		
	4					BN	SILTY CLAY		
	5					TN	f. gr. SS; arkosic		large fragments
	8								DRY
				8" at 12 ft					
1015	17					RD.BN	SILTSTONE		
	20					BN	SILTSTONE/f. gr. SS		
1020	22					RD.BN	SILTSTONE		
1029	36			*		RD.BN + GY	SILTSTONE		4-5 gpm
									NO HNU > BK
	42					RD.BN	SILTSTONE		
1043	45					LT.BN	f. gr. SS		
	48					PK-GY	f. gr. SS		
	50					TAN	f. gr. SS		

REMARKS

BORING HN-01D

PAGE 1 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 01D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	52					LT. GY	F. gr. SS		
	56					TAN	F. gr. SS		
1105	59						Lithology as Above		
	61								Lignitic film
	63					GY	f. gr. SS		
	65					TN/GY	f. gr. SS		
1115									
	71					RD, BN	Siltstone		
									Gain water to
									~10 gpm
1124	77					RUST RED	Siltstone		
1131	83					BN	Siltstone		
	87					RD, GY + BN	F. gr. SS		
	88								Yield ~15 gpm
1142	92					BN	Siltstone/f. gr. SS		
1151	98					RUST RED	Mudstone		

REMARKS _____

BORING HN-01

PAGE 2 OF 3

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN01D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1324	112					RD	SILTSTONE		
1327	117					RD, BN	SILTSTONE		
1350	128								Pick up ~2 gpm
1357	132					PK-GY	f. gr. SS		No HNU > BK
	135					RD, BN	SILTSTONE		
					X	GY	f. gr. SS		
1406	138					PK-GY	f. gr. SS		
	141					RD, BN	SILTSTONE		
					X	GY	f. gr. SS		
	145					BN	SILTSTONE		
1425	152								Yield ~ 18 gpm

REMARKS _____

BORING HN-01D

PAGE 3 OF 3

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-02I
PROJECT NO.: 0159 DATE: 11-29-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: KC Kilmartin
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					LT. BN	SILTY CLAY		
	4					DK. BN	CLAYEY SILT		
	5					DK. BN	CLAYEY SILT / ROCK FRAGS		Perched water ~8 ft
	9					RD. GY	SILTSTONE / f. gr. SS		MODERATELY TO HIGHLY FRACTURED
	11					RD. GY	f. gr. SS		MORE COMPETENT
	14					RD. GY	SILTSTONE		
				8" at 14 ft.					
	20					DK. GY	V.f. gr. SS + SILTSTONE		DRY; HNU (BK) = 0.5
1001	25					LT. BN	V.f. gr. SS		NO HNU > BK
	27			*			CUTTINGS DAMP; NO DUST		H2O ZONE
1004	28						NO H2O flow from borehole		
1010	33					BN	SILTSTONE with CLAY		NO HNU > BK
							"TIGHT DRILLING"		DAMP
1015	35						CUTTINGS DRYING UP →		DUSTY
1020	38			*		LT. BN	CLAYEY SILTSTONE		~ 1 gpm
							grading TO ↓		
1025	43					LT. GY	f. gr. SS w/ QUARTZ		NO HNU > BK
1033	45						LITHOLOGY AS ABOVE, DRILLING SKIP = FRACTURE?		~2 gpm TOTAL
	50			*		DK. GY	SILTSTONE TO V.f. gr. SS		DRILLER BEGINS ADDING HGPM TO hole

REMARKS

BORING

PAGE ___ OF ___

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN02I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR ROD (ft.)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1045	53								Blow ~10 gal after rod connection
1050	55								Yield ~4 gpm
1052	57						Driller notes fracture.		Decrease in borehole flow
1055	63					RD. BN	Claystone/mudstone		Very little H2O flow from borehole
1059	68						Bit chatter increases		Yield ~ 1 gpm
1102	70						Siltstone to v.f.-gr. SS		Yield ~2 gpm
1106	75						harder drilling		Yield ~ 3 gpm
1112	78								Blow 5-10 gal after rod connection
1115	80						Yield steady at ~3 gpm		
1122	83						Slight increase in yield?		
1125	85			*					Noticeable increase in yield to 5-6 gpm
1131	88								Yield ~6-8 gpm
1131	90						Possible fracture		Decrease in yield to 2-3 gpm
1136	94						Bit chatter increases		Yield 4-5 gpm
1140	98						Q = grayish		Yield ~5 gpm
1142	100			*			Possible fractures		Yield ~5 gpm
1143	101						Sig. increase in yield		Yield ~6-8 gpm
1146	103			TD					

REMARKS Blow H2O from hole until 12:15. Driller feels yield may be decreasing slightly (losing H2O)

BORING HN-02I

PAGE 2 OF 2

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-02 D
PROJECT NO.: 0159 DATE: 11-10-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	2					LT.BN	SILTY CLAY		
	4					BN	SILTY CLAY		Channery
	9					RD.GY	SILTSTONE		Perched H_2O at 8.5
									Bedrock = DRY
	13					RD.GY	SILTSTONE		
1016	18			8" at 14 ft.		BN	f. gr. SS/SILTSTONE		
	21					RD.BN	SILTSTONE		RUST STAINS ON SOME FRAGMENTS
	26					LT.BN	f. gr. SS		
1025									
	31					reddish, GY-BN	f. gr. SS		
1033									
	34					LT.BN	f. gr. SS		
	39					RD.BN	f. gr. SS		
	41					reddish, GY-BN	f. gr. SS		
1046				*					
	46					TAN	f. gr. SS		SOME RUST STAINS; 1-2 gpm ?
1052	50					PK.GY	f. gr. SS		

REMARKS

BORING HN-02

PAGE 1 OF 3

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-02D
PROJECT NO.: 0159 DATE: 11-10-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	51					RD, BN	Siltstone		
	55					RD-GY BN	Siltstone		
1100	58					PK. GY	f. gr. SS		Fracture? Quartz crystals
	60					RD. BN	Siltstone		
1107	66					RUST RD	Mudstone (some green + white clay)		2 gpm Total
1113	75					RD. BN	Siltstone		
1120	79					RD. GY	Siltstone/v.f. gr. SS		
	83					PK. GY	f. gr. SS		No HNU > BK
	87						Lithology as Above		
	89								Possible fracture
	92					RD, GY-BN	f. gr. SS		
1140									
	95						Lithology as Above		
	98			*		RD, GY-BN	f. gr. SS/some Siltstone		Fracture, Large rock frags w/ calcite

REMARKS

BORING HN-02D

PAGE 2 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN02D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	101					PK.GY	f. gr. SS		
1151	103								Yield ~ 6 gpm
	105					PK, GY, BN	f. gr. SS		large fragment
	109					RUST RD-BN	MUDSTONE		
1328	116					RD, GY-BN	f-gr. SS; whitish clay		
1331	121								Yield up to 10-12gf
									(gain 4-5 gpm
									Through the 120's
1335	128					LT.GY	f. gr - SS		large fragment
1344	135					RD.BN	SILTSTONE		
	143					RD.BN	SILTSTONE		
					X	PK. TO LT. GY	f. gr. SS		
									TOTAL YIELD ~ 12g
	149					RUST RD	MUDSTONE		NO HNU > BK
	153			TD					

REMARKS _____

BORING HN-02.

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-03I
PROJECT NO.: 0159 DATE: 11-24-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					LT. BN	CLAYEY SILT		
	2					LT. BN			
	5					RD-BN	SILTSTONE		
	7					LT. BN & GY	M. GR. SS		
0917	8			8" at 7 ft		TN	f. gr. SS		very weathered
	16					PK-GY	v. f. gr. SS		
	21					LT. BN	f. gr. SS		
	43					BN	v. f. gr. SS		
	48					PK-GY	f. gr. SS.		

REMARKS

BORING HN-03I

PAGE 1 OF 2

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN03I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
0944	53					PK-GY	f. gr. SS		MICA
	58					PK-GY	f. gr. SS (slightly coarser-grained)		
0948	63								1 gpm ?
	65					RUST RD-BN	MUDSTONE / minor f. gr. SS		chlorite
	78					RUST RD	MUDSTONE		
					X	PRP	SILTSTONE		
1000	83								Yield ~ 2 gpm
	85					GY	f. gr. SS		Gain 2-3 gpm.
	98					RUST RD+BN	SILTSTONE		calcite + chlorit
1012	103					RUST RD+BN	SILTSTONE		Some calcite
									Yield ~ 7 gpm

REMARKS _____

BORING HN-0[illegible]

PAGE 2 OF 2

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-03D
PROJECT NO.: 0159 — DATE: 11-23-93 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					LT. BN	SILTY CLAY		
	2					LT. BN	M.-C. GR. SS		
	6					LT. BN	M.-C. GR. SS		1ST H2O
				8" at 8ft					
	16					RD-BN & PRP	SILTSTONE/f. gr. SS		
1102	18					BN	V. f. gr. SS		
	25								Gain ~1.5 gpm
	28					BN	V. f. gr. SS		
1112	33					BN	SILTSTONE/V.f. gr. SS		
1117	43					RD-BN	SILTSTONE		YIELD ~1.5-2 gpm
	46					RUST RD-BN	SILTSTONE		

REMARKS

BORING HN-03D

PAGE 1 OF 4

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN03D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1127	51					GY	f. gr. SS		
1130	58					GY	f. gr. SS		
1133	63								Yield ~ 2-2.5 gpm
									No HNU > BK
	67					RUST RD-BN	Siltstone		
1143	73					GY	f. gr. SS		
	78					GY	f. gr. SS (coarser)		
1149	83					GY	f. gr. SS		
					X	RUST RED	Siltstone		
	85					GY	f. gr. SS		
	88					PK-GY	v.f. gr. SS		
1200	93					LT.GY	f. gr. SS		Gain 1-2 gpm
									No HNU > BK

REMARKS _____

BORING HN-03D

PAGE 2 OF 4

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN03D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	103					RUST RD-BN	MUDSTONE with chlorite & kaolinite		Yield ~ 8 gpm
1213	108					RD-BN	Siltstone/v.f. gr. SS		
1217	113					RD-BN	Siltstone/v.f. gr. SS		"Sparkling" MICA
1221	123					RD-BN	Siltstone		Yield ~ 8-10 gpm
					&	PK-GY	f. gr. SS		
	128					RD-BN	Siltstone		Gain 3-4 gpm
1237	133					RD & GY-BN	V.f. gr. SS		
1250	143					PK & GY-BN	V.f. gr. SS		Yield ~ 12 gpm
							Some calcite & mica		
	146					RUST RD-BN	Siltstone		
							Some calcite & chlorite		

REMARKS _____

BORING HN-03D

PAGE 3 OF 4

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN03D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1309	158					PK-GY	f. gr. SS		
1311	163					PK-GY	f. gr-SS		YIELD ~ 12gpm

REMARKS _____

BORING HN-03D

PAGE 4 OF 4

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-04S
PROJECT NO.: 0159 — DATE: 12-2-93 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					OR	CLAY		
	7						Rock fragments		
	8					RUSTY BN	MUDSTONE		
1125	11					RUSTY BN	MUDSTONE		DRY
				8" at 12 ft					
	13					RD.BN	v.f. gr. sandstone/siltstone		
	15								DUSTY
1129	18					RD.BN	v.f. gr. SS		Damp; hard Drilling
	22								CUTTINGS WET
1135	23			*		BN	v.f. gr. SS (SILTY)		2 GPM at 22.5
	25					BN	f. gr. SS - rust staining		Fracture, Large fragment
	27					BN-GY	f. gr. SS		Yield ~ 12 gpm
1142									
	33					BN-GY	f. gr. SS w/rust staining		No HNU > BK
1158	35								Yield ~ 15 gpm

REMARKS

BORING HN-04S

PAGE 1 OF 1

* See Legend on Back

BORING LOG **HALLIBURTON NU.**

PROJECT: NAWC WARMINSTER BORING NO.: HN-04I
PROJECT NO.: 0159 DATE: 11-24-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					OR	CLAY		MOIST
	4					RUSTY BROWN	CLAY		
	8					RUSTY BROWN	MUDSTONE		
	12					RUSTY BROWN	MUDSTONE		DRY
				8" at 12 ft					
	16					PK-GY	V. f. gr. SS		
1327									
	26					RD-PURP	f. gr. SS; SILTY		5 gpm
									Large fragments
	33					GY	f-gr. SS; SILTY		12 gpm
1336	38					LT. BN & GY	f. gr-SS		NO HNU > BK
1338	43					LT. BN	M.-C. gr. SS		
	48					RUST RD-BN	MUDSTONE		

REMARKS

BORING HN-01.

PAGE 1 OF

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN04I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR ROD (ft.)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1345	53					RD.BN	MUDSTONE/f.gr.SS(SILTY)		
1347	58								
1348	63					RD.BN	V.f.gr.SS (SILTY)		
	66								Pick-up 2 gpm
	68					RD.BN	SILTSTONE/V.f.gr.SS		
1356	73					RD.BN	V.f.gr.SS		
									FAST, QUIET drilling
	78					BRIGHT RUST-RD	MUDSTONE		SOFT
									Possible H2O
									Zone
1400									
	85					RD.BN	V.f.gr.SS (SILTY)		
1407	88					RD.BN	V.f.gr.SS (SILTY)		Fracture
							with calcite		
1412	93					RD.BN	V.f.gr.SS (SILTY)		
	97								Possible water increase
	103						Vf-f.gr.SS		YIELD 20-25 GPM NO HNU > BK

REMARKS _____

BORING HN-04I

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-04D
PROJECT NO.: 0159 DATE: 11-16-93 DRILLER:
ELEVATION: FIELD GEOLOGIST:
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK SR OR USCS	REMARKS
						RUST BN	CLAY		
							↓		
	7					RD	MUDSTONE		
									IRON-OXIDE STAINING FRACTURED
	11					RD	MUDSTONE		
908	12			8" at 12ft		RD-BN	SILTSTONE		
	21					TAN	f. gr. SS		
	23					LT.BN	SILTSTONE/f.gr.SS		
916	25								Fracture, 1-2 gpm
	29					LT.BN	f. gr. SS		
924	32					GY & LT BN	f.-m. gr. SS		
	35					GY & LT BN	f.-m. gr. SS		YIELD 5-6 gpm
929	38					GY & LT BN	M. gr. SS		SOME QTZ PEBBLE
									39-48 fractured interval
933									
	48					RD BN	SILTSTONE		

REMARKS

BORING HN-04

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN04D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
937	53					RD.BN	f. gr. SS		YIELD 5 gpm
	55								ADD 1-2 gpm
943	56						SILTSTONE		
	58								~ 20 PPM
951	63					RD.BN	SILTSTONE		
954	68					RD.BN	SILTSTONE		
	70					PK-GY	f. GR. SS		
	72					RUST RD	MUDSTONE		
	81					RD.BN	SILTSTONE		
1069	83						SILTSTONE/f. gr. SS		
	86					GY & RD-BN	SILTSTONE/f. gr. SS		GAIN 1-2 gpm?

REMARKS _____

BORING HN-04D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN04D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1045	103					PK-GY	v. f. gr. SS		
	105						f. gr. SS		Pick-up 1-2 gpm
	108								Yield 10-12 gpm
	111					PK-GY	f. gr. SS (slightly coarser grained)		Pick-up 2-3 gpm
1107	115								Fracture
	122					BN	F. GR. SS		
	125								Pick up 2 gpm
1139	135					RD, BN	Siltstone + Mudstone		
1141	138						Lithology as Above		
1145	143						Lithology as Above		
1150	148					RUST RD-BN	Siltstone		

REMARKS _____

BORING HN-04

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN04D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1155	153								Yield ~ 20 gpm
↓									-Rig Maintenance-
1447	158					RD.BN	Siltstone		
1457	165					RD.BN + GY	Siltstone/f.-v.f.-gr. SS		
	169					PK-GY	f.-m. gr. SS		Pick-up 2-3 gpm
1511									
	173					PK-GY	f.-m. gr. SS		
1519	178								Total Yield
									~ 30 gpm

REMARKS _____

BORING HN-04D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-05S
PROJECT NO.: 0159 DATE: 11-22-93 DRILLER:
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					BN	SILTY CLAY		
	4						SANDY SILT		
	6					RDBN	SILTY SAND		
	9					RDBN	f. gr. SS		
1124				8" at 13 ft.					
	15					LTBN	f.-M. gr. SS		low Yield
	20					GY & LT. BN	f.-M. gr. SS		
	24					TAN	M-gr. SS		
1139									Fx at 26.5
	29					TAN	M.-C. GR. SS		Angular QTZ Pebble
1152									Pick-up 1 GPM.
	34						Lithology As Above		
	38					RDBN	SILTSTONE		
	44					BN	f-M. gr. SS		
1207	48					LT BN	f-M. gr. SS		
	50					RD & GY-BN	f-M. gr. SS		Pick-up 2-3 GPM
	53					GY & RD-BN	f. gr. SS & Siltstone		TOTAL YIELD ~ 10 GPM. NO HNU > BK
	54			TD					

REMARKS

BORING HN-05

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-05I
PROJECT NO.: 0159 — DATE: 11-8-93 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA: —
(Date, Time & Conditions) —

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	9					BN	f. gr. SS		
	12					RD.BN	f. gr. SS		Soft, wet
1000	15			8" at 14ft		TN	f. gr. SS		
	20						Lithology as Above		
1009	26					TN	M.-C. gr. SS		Angular Quartz Pebbles
	31					YL-TN	f.-M. gr. SS		H_2O zone ?
1026	38					RD. BN	Siltstone		
	40					RD.GY	f. gr. SS		
	42					RD.BN	Siltstone/f. gr. SS		
	43					PK-GY	f. gr. SS		
1035	46					RD.BN	Siltstone		

REMARKS —

BORING HN-05I

PAGE 1 OF 3

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 05 I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1042	53					RD, BN	Siltstone/f. gr. SS		
1050	57					RD, BN	Siltstone		
1056	61					RD, BN	Siltstone		
	64					PK-GY	Siltstone/f. gr. SS		
	70					PK-GY, BN	f. gr. SS		
1114	73					RUST RD	Siltstone		
	78					RUST RD	Siltstone		
	83					RUST RD+BN	Siltstone		
	88					RUST RD+BN	Siltstone		
	93					RD, BN	Siltstone		
	94					PK-GY	f. gr. SS		
1144	97					PK-GY	f. gr. SS/red siltstone		
	98					RD-BN	Siltstone/ v.f. gr. SS		
	99					LT. GY	f-gr. SS.		

REMARKS _____

BORING HN-05

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN05I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	102					PK-GY	f.gr.SS + red Siltstone		
1309									
	108					LT.GY	f.gr. SS		
	111					PK.GY	f. gr. SS		
	113					RD.BN	Siltstone		
	118					RD.BN	Siltstone		
1320	123					RD.BN	Siltstone		
	128					GY — f.gr. SS RD — Siltstone			
	133					RD.BN	Siltstone		
1338	136					RD.BN	Siltstone		
	138					RD.BN & GY	Siltstone / f.gr. SS		
	143					RD.BN & GY	Siltstone / f. gr. SS		
1351									
	148					RD.BN & GY	Siltstone / f.gr. SS		
1402	153					PK.GY	f. gr. SS		Yield ~ 10 gpm

TD=155

REMARKS _____

BORING HN-05I

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-05D
PROJECT NO.: 0159 — DATE: 11-18-93 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR OR USCS	REMARKS
	1					LT. BN	SILTY CLAY		
	5					BN	Channery Sand		
	9					BN	f. gr. SS		
	12								WET CUTTINGS
	14					LT. BN	f.-m. gr. SS		
	16					LT. BN + TN	f. gr. SS		
1254	17			8" at 14ft		BEIGE + TN	f.-m. gr. SS		
	24					GY + TN	f.-m. gr. SS		
	35					RD. BN	SILTSTONE		
1315									
	40								2-3 gpm
	41				X	RD. BN PK. GY	SILTSTONE f. gr. SS		HNU 3-4 ppm
	45					RD. BN	SILTSTONE		
	47				X	RD. BN PK. GY	SILTSTONE f. gr. SS		
1330	50					RUST RD + BN	SILTSTONE		

REMARKS

BORING HN-05D

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN05D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	55					RUST RD + BN	SILTSTONE		Some white clay
	59					RD. BN.	SILTSTONE		some white and Green clay
	62						LITHOLOGY AS Above		
1355	66					PK-GY	SILTSTONE/f. gr. SS		
1404	72					PK-GY	f. gr. SS		fast DRILLING ↓
1406	77					RUST RD+BN	SILTSTONE/MUDSTONE		
									some white and Green clay
	83					RUST RD+BN	SILTSTONE/MUDSTONE		
	90					RUST RD+BN	SILTSTONE/MUDSTONE		
									5 PPM
1427	93					RD. BN	SILTSTONE		
	96					PK-GY	f. gr. SS		
	97						f. gr. SS/SILTSTONE		

REMARKS _____

BORING HN-05D

PAGE 2 OF 4

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN05D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	104					LT. GY	f. gr. SS		
							(Minor Red-brown Siltstone)		
1501	111						Lithology as Above		
	120					Rust Rd + BN	Siltstone		Some white and green clay
1517	128					Rust Rd	Mudstone		~40 green shale
	130				X	Rd. BN — PK-GY —	Siltstone f. gr. SS		
									15-20 gpm
1534	137					Rd, BN	Siltstone		
	140				X	Rd. BN — PK. GY —	Siltstone f. gr. SS		
1545	143					Rd. BN + GY	Siltstone / f. gr. SS		
	150					Rd. BN + GY	Siltstone / f. gr. SS		Some red and green mudstone

REMARKS _____

BORING HN-05D

PAGE 3 OF 4

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN05D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1625	155					PK.GY	f. gr. SS		
					X	RUST RD	MUDSTONE		
	160					PK-GY	f. gr. SS		
	163								
	165								
	168					RD.BN + GY	SILTSTONE		
	177					PK-GY	f. gr - SS		
1753	180						f. gr - SS		
1809	183					LT.GY	f. gr. SS		
					X	RD.BN	SILTSTONE		
1824	188					PK.GY	f. gr SS		H_2O Increase NO HNU > BK
1838	192					PK.GY	f. gr. SS		FRACTURE — YIELD DECREASE
	194					RD.BN	SILTSTONE		
1902	198					RD.BN	SILTSTONE and some LT. GY. f. GR. SS		FRACTURE 196.5 — YIELD DECREASE
	200					RUST RD	MUDSTONE		
	203			TD		RUST RD	MUDSTONE & SILTSTONE, SOME LT. GY. SS		

REMARKS _____

BORING HN-05D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-06S
PROJECT NO.: 0159 DATE: 11-30-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: KEVIN C. KILMARTIN
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	9					GY-RD	M. GR. SS		ARKOSIC
	11						M-C. GR. SS		conglomeratic
	13								
1415	14			8" at 13 ft		GY	Vf. gr. SS		DRY
	20								DAMP CUTTINGS
1425	21								3-5 GPM
1428	28					RD BN	SILTSTONE		>10 gal at ROD connection
1434	33						Harder DRILLING		
	37					DK GY	Vf. gr. SS.		Yield ↑ 8-10 gp
1440	40					RD BN	SILTSTONE		DRILL BREAK — Possible fracture
1443	45						Fractures?		Several drill breaks
1446	50								Yield > 10 gpm
1448	53						Abd. pale whitish to YL-GY MINERAL: Fractures? FILL		Yield 10-12 gpm

REMARKS Blow formation water until 1509 to clean borehole.

BORING HN-C

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-06I
PROJECT NO.: 0159 — DATE: 11-30-93 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: Kevin C. KILMARTIN
WATER LEVEL DATA (Date, Time & Conditions):

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	2					LT.BN	SILTY CLAY		
	6					BN/RD	CHANNERY SAND		
	8					GY-RD	M.-C. GR SS		DRY
	11					GY-RD	M.-C. GR SS		ARKOSIC, DRY, Angular QUARTZ
946	15			8" at 13'		GY	f-M. GR. SS		DRY
950	20					LT.BN	f-M.GR.SS w/ pebbles		DAMP
952	23						HARDER DRILLING		SLIGHTLY DAMP, STILL DUSTY
	25								Possible Fx
955	27					RD-BN	SILTSTONE		DRY CUTTINGS
									±2 gal of H_2O connection
	33					DK RD BN	SILTSTONE TO V. f. gr. SS		DAMP
1005	35						RAPID Changes between hard & soft DRILLING		LOTS of DUST
1007	40					RDBN	SILTSTONE		
	43					GY	V. f. gr. SS		WET
1010	44			*					~1 gpm
1014	50						Soft Drilling TO 53'		Possible Fx

REMARKS

BORING HN-06I

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN06I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
				50-78 does not appear to be a prospective screen interval: Monotonous lithology, no fractures, no increase in yield					
1025	55					DKGY	v. f. gr. SS		~1 gpm
	58						very hard drilling		Yield ~ 3 gpm
1044	63						Slight water increase?		Yield ~ 3 gpm
1052	67						"Monotonous" hard drilling		Yield ~ 3 gpm
1055	70					DKGY	f. gr. SS		
	74						Slightly easier drilling		Yield ~ 3 gpm
	75					DKGY	f. gr. SS		
	78								Driller begins addin ~4 GPM
1120	80					GY	f. gr. SS.		Apparent Yield 5-6 gpm
	83						fracture ?		
1125	85					RDBN	Siltstone		Possible gain 1 gpm
1132	96								Possible H2O Gain
	98						Driller notes fracture		H2O increase ?
1140	100-103					GY	F. gr. SS		Final Apparent Yield 6-8 gpm

REMARKS Blow formation water until 1220 to clean borehole. Hear cascading water inside borehole 1220 - 1300.

BORING HN-06

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-06D
PROJECT NO.: 0159 — DATE: 11-4-93 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					BN	SILTY CLAY		MOIST
	4					BN, RD	Sandy SILT		
	9					RD-GY + TN	M-C. gr. SS		ARKOSIC
	11					RD-GY + TN	Sand + Pebble Conglom.		
	13			8" at 14ft.		RD, BN	f. gr. SS		
1356									CLAY-RICH CUTTINGS
	23					RD	SILTSTONE/MUDSTONE		SOFT
1403									
	29					RD, BN	MUDSTONE		
1416									
	38					RD, GY + BN	SILTSTONE		
	43					RD, BN	SILTSTONE/f. gr. SS		
							MUDSTONE		CUTTINGS CLUMPING; NO H2O DISCHARGE
									SOFT
	49					RD, BN	MUDSTONE		

REMARKS

BORING HN-06D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN06D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	54					RD.BN	SILTSTONE		
1438	58					RD.GY + BN	SILTSTONE/f.gr. SS		green CLAY; IRON-OXIDE COATINGS
	59					PK.GY	f. gr. SS		
	62					RD.BN	SILTSTONE/f. gr. SS		
1446	63					PK.GY	f. gr. SS		
	68					PK.GY	f. gr. SS		
	73						f. gr. SS		
	76					RD.BN	SILTSTONE		
1504									
	84					RUST RD	SILTSTONE		
	88					RUST RD	SILTSTONE/MUDSTONE		
1517									
	98					RD.BN + GY	SILTSTONE		

REMARKS _____

BORING HN-06D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN06D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	104					RD.BN + GY	SILTSTONE		
1536									
1545	118					RD.BN	SILTSTONE		
	123					RD.BN	SILTSTONE		
1556	128					RD.BN	f. gr. SS		
1602	133					RD.BN + GY	SILTSTONE		
	138					RD.BN + GY	f. gr. SS		
									Pick up ~5 GPM
1615	144					PK.GY	f. gr. SS		
1627	153					PK.GY	f. gr. SS		NO HNU > BK

REMARKS _____

BORING HN-06D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-07S
PROJECT NO.: 0159 DATE: 12/1/93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST:
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	0					BN	SILTY CLAY		
	3					RD-BN	CLAYEY SILT		MOIST
	5					RD-BN	SILTY Shale		SOFT
	8					RD-BN	SILTY Shale		MICACEOUS
	10					RD-BN	SILTY Shale/SILTSTONE		ARKOSIC
				8" at 10'			+ f. gr. SS		
1459	13					RD-BN GY	f. gr. SS MUDSTONE		
1501	17					GY	v. f. gr. SS		DRY
	21					LT. BN	f. gr. SS		DUSTY
	26								DAMP, less DUST
1517	28					LT. BN	f. gr. SS		
					&	RD-BN	SILTSTONE		
	31					LT. BN	f. gr. SS		
	33								DUSTY
	35			*		GY	v. f. gr. SS and SILTSTONE, IRON OXIDE STAINING		3 gpm
	38					LT. BN	f. gr. SS		
	43					GY	f.-M. gr. SS		
					&	RD-BN	SILTSTONE		
	45			TD		GY-TN	M. gr. SS		TOTAL YIELD
									4-5 gpm

REMARKS

BORING HN-07

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-07I
PROJECT NO.: 0159 — DATE: 12/1/93 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1010	1					OR	CLAY		DAMP
	3					RD-BN	SILTY CLAY		DAMP
	5					RD-BN	SILTY Shale		SOFT, DRY
1023	10						SILTSTONE, f. gr. SS.		ARKOSIC
				8" at 10ft					
	13					RD-BN	SILTSTONE		
	15					RD-BN	MUDSTONE		SOFT, DRY
	19					LT. BN	Sandstone		hard DRILLING
									DRY
	23					TAN	f. gr. SS		
	25								H_2O at 1-2 gpm
	27					LT. BN	M. gr. SS		NO HNU > BK
	33					LT. BN	F-M. gr. SS		
1047	38					TAN	M-C. gr. SS		Add water TO
									borehole
	43						LITHOLOGY AS ABOVE		Angular quartz pebbles
	47					GR-GY	SILTSTONE / f. gr. SS		LIGNITIC film
1106	50					LT. GY	f. gr. SS		LIGNITIC film

REMARKS

BORING HN-07I

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN07I
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	52			*					GAIN 1-2 gpm
1113	53					TAN + LT. GY	f.-M. gR. SS		IRON OXIDE STAINING ON CUTTINGS
1128	58					LT. GR + GY	f. gR. SS		IRON OXIDE STAINING
	60								LIGNITIC FILM
	62					RD-BN	f. gR. SS		
	64					BN	f. gR. SS		
1140	68					GY	f. gR. SS		IRON OXIDE STAININ
					+	RD-BN	SILTSTONE		
	72								EASY DRILLING
	74					BN, RUST RED	SILTSTONE		
1149	78					BN, RUST-RED	SILTSTONE		
					+	Yellowish	SILTSTONE		
	83					RD-BN	vf- f. gR. SS and		
							SILTSTONE		
1206	88					PK-GY	f. gR. SS		
1218	93					PK-YL GY	f. gR. SS		
1226	97					PK-GY	f. gR. SS		
1240	103					RD-BN	SILTSTONE / f. gR. SS		TOTAL YIELD ~8gf

REMARKS _____

BORING HN-07

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* See Legend on Back

BORING LOG | **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-07D
PROJECT NO.: DATE: 11/3/93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR OR USCS	REMARKS
						OR	CLAY		
						RD-BN	SILTY CLAY		
	6					RD	SILTY Shale		
	10					BN	SS		ARKOSIC, friable
				8" at 10'					
1352	13					RD-BN	SILTSTONE		
1355	18					BN	SILTSTONE/f.gr.SS		
1401	23					LT.BN	f.gr. SS		ARKOSIC
1405	28					LT.BN	f-M.gr. SS		ARKOSIC; Angular QTZ Pebbles
1410	32					LT.BN	f.gr. SS		ARKOSIC; iron OXIDE STAINING
	36					BEIGE	f-M. gr. SS with		QUARTZ Pebbles
1420							SOME RED & GY SILTSTONE		
	42					YL-TN	M-C.gr. SS		near conglomeratic
1424									
	46					GY	SILTSTONE		LIGNITIC FILM 46 TO 49
	48					YL-TN	f.gr. SS		ARKOSIC

REMARKS

BORING HN-07D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN07D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1436	53					LT.BN	f. gr. SS		
1446	58					LT.BN	f. gr. SS		ARKOSIC
1450	63					RD-BN	f. gr. SS		
	65					BN	f. gr. SS		
	69								
1455	70					RD-BN	SILTSTONE		
1457	73					RD	SILTSTONE		
1501	78						LITHOLOGY AS ABOVE		
1510	83					RD-BN	SILTSTONE		NO HNU > BK
1515									
	88					RD-BN	SILTSTONE / f. gr. SS		
1519	90					GY-PK	f. gr. SS		
1523	93								20-30 ppm HN
1530	98					RD-BN	SILTSTONE		

REMARKS _____

BORING HN-07

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BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN07D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	101					GY-PK	f. gr. SS		
1535	103					RD-BN	Siltstone		
	109					GY-PK	f. gr. SS		
	113					GY-PK	f. gr. SS		
1555	118					PK-GY	f. gr. SS		
	120								<10 ppm HNU
1602	123					RD-BN	Siltstone		
	126					GY-PK	f. gr. SS		
	129					RD-BN	Siltstone		
1616									
									NO HNU > BK
	133					RD-BN	Siltstone		
	138					PK-GY	f. gr. SS		
1637	143					PK-GY	f. gr. SS		
	147								lignitic film
	149					RD-BN	Siltstone/Mudstone		

REMARKS _____

BORING HN-07D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN07D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	151								Pickup 2-3 gpm
1657	160					RD-BN	SILTSTONE		
1701	163					RD-BN	SILTSTONE		
	168					PK-GY	f. gr. SS		
	171					GY	f. gr. SS		lignitic film
	172					RD-BN	SILTSTONE		
	177					GY & RD-BN	SILTSTONE/f. gr. SS		
	182						SILTSTONE		
	188					RD-GY	f. gr. SS		
1744	193					PK-GY	f. gr. SS		
1752	198					PK-GY	f.-M. gr. SS		
1757	200					LT-GY	f. gr. SS		<10 ppm HNU

REMARKS _____

BORING HN-0..

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-08S
PROJECT NO.: 0159 — DATE: 11/17/93 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OK USCS	REMARKS
							SILTY CLAY		
							↓		No HNU > BK
							SILTY SAND		
	9					RD-BN	f. gr. SS		
928	14			8" at 13'		LT.BN	f. gr. SS		DRY
	18					RD-BN	Siltstone/f-gr. SS		
932	23								fracture
	26								fracture
	27					RUST RED	MUDSTONE		
937	36					RUST RD-BN	MUDSTONE		
941	43					RD-BN	SILTSTONE		
									H_2O at 47
944	48					RD-BN	SILTSTONE		
947	53			TD					TOTAL Yield 1.5 gpm

REMARKS

BORING HN-08S

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-08I
PROJECT NO.: 0159 DATE: 11/17/93 DRILLER:
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
						BN	CLAY		
							↓		
							SILT & fine sand		
	9					RD-BN	F. GR. SS		
1208	13			8" at 13'		LT. BN	F. GR. SS		
	15					RD-BN	MUDSTONE & SILTSTONE		
	26					RUST RED	MUDSTONE		
1226									
	32					RD-BN	SILTSTONE		
	38					RD-BN	MUDSTONE		
	41								DRY
	43					RD-BN	SILTSTONE		
1234									
	48					RD-BN	SILTSTONE		

REMARKS

BORING HN-08

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 08I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1237	53					BN	F. GR. Sandstone		
	58						F. GR. Sandstone		
1253	63					RD-BN	SILTSTONE		
	66								3-4 gpm
	68					TAN	F-M. GR. SS		
	72					TAN	F-M. GR. SS		
	76					BN	F.G. SS + SILTSTONE		
1304	78					TAN	F. GR. SS		

REMARKS _____

BORING HN-08I

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-08 D
PROJECT NO.: 0159 DATE: 10/26/93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					BN	TOPSOIL / SILTY CLAY		
							↓		
	7					OR-BN	SILTY SAND		
	8			TOR @ 8 FT.		RD-BN	f. gr. SS.		DRY
				8" at 13'					
1141	15					RD-BN	Siltstone + f. gr. SS		
1147	20					RD-BN	Siltstone		Add water TO borehole (~3 gpm)
1153	25						Lithology AS Above		
1205	30						Lithology AS Above		
	32					GY-RD	MUDSTONE & SILTSTONE		
1215	36					RD-BN	Siltstone / f. gr. SS		hard Drilling
1419	39								DUSTY
	42					RD/GY	Siltstone		
1427	47					DK RD	Siltstone		

REMARKS Water added TO borehole 20 - 152 ft.

BORING HN-08D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN08D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1431	52					DKRD	Siltstone/f. gr. SS		
1439	57					RD-GY	f. gr. SS		
	62					PK-GY	f. gr. SS.		
	65			*					H_2O ~ 5 gpm
1449	67					GY-TN	M.-C. GR. SS		Angular frags.
1456	72					LT.GY	M.-C. GR. SS		Angular
1501	76					LT.GY	M.-C.GR. SS, Red Siltstone, pebble-size Angular QTZ		
1509	80					Red	Siltstone		
1518	87					PK-GY	Siltstone & f. gr. SS		
1524									NO HNU > BK
	92					GY-TN PK	Med-C. gr. SS		Poorly Sorted
1531	97					PK-GY	Arkosic, f. gr. SS		
1535	100					GY	Same as Above + mudstone		

REMARKS _____

BORING HN-08D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN08D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1542	107					RUST RED	MUDSTONE		
	112					RED	MUDSTONE		Small fragments
1550	117					RED	SILTSTONE		larger fragment
	122					RED	SILTSTONE		
1600	125					PK-GY	f. gr. arkosic SS		
1612	132					GN-GY	f. gr. arkosic SS		No HNU > BK
1617	137					LT. GY.	f. gr. SS.		
1622	142					RED	MUDSTONE		
1627	147					GY-PK	f. gr. SS.		
1632	152			TD		PK-LT.GY	f. - C. GR. SS		

REMARKS _____

BORING HN-D8

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-09 S
PROJECT NO.: 0159 — DATE: 11/22/93 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST:
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS ON ROD (ft.)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					orange	CLAY		
						TO	↓		
	7					Brown	SILT		
	9					RD-BN	Clayey siltstone		
				8" at 14'					
	15					PK-GY	Siltstone/f.gr. SS		
	18					LT. BN	Siltstone/f. gr. SS		
1525	20					PK-GY	f. gr. SS		
	21					TAN	f.-M. gr. SS		
1529	25					RD-BN GY	SILTSTONE		
	28					PK-GY	Siltstone/f. gr. SS		FAST Drilling, DUST
	29					RD-BN	MUDSTONE		
	32					RD-BN	MUDSTONE, some greenish clay		DUSTY
1538	36					PK-GY	f. gr. SS		DAMP at 38; 2-3 gpm at 39
	40								NO HNU > BK
1544	43					RD-GY BN	SILTSTONE		
1548	48					PK-GY	f. gr. SS		ADD 1-2 gpm
	52					BN	SILTSTONE		

REMARKS TD at 53 ft. TOTAL YIELD ~ 5 gpm

BORING HN-09 S

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-09I
PROJECT NO.: 0159 DATE: 11-19-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	0					BN	SILTY CLAY		
	1					OR	CLAY		
	5					BN	CLAYEY SILT + SILTY CLAY		
	9					BN	SILT		
	10					RD, BN	CLAYEY SILTSTONE		MICACEOUS
				8" at 15'					
1059	20					LT. BN + TN	f. gr. SS		
1105	28					RD	MUDSTONE		DRY
	32					RD, GY	SILTSTONE		DUSTY
	36								DUSTY
	38					PK, GY	SILTSTONE / f. gr. SS		
1117	40					RD, GY	SILTSTONE / f. gr. SS		DUSTY
	43					REDDISH GY-BN	SILTSTONE		easy drilling
	45					Darker RED	MUDSTONE		
1126	48					LT. BN TO BGE	SILTSTONE		DUSTY

REMARKS

BORING HN-09

PAGE 1 OF 3

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN09I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	52					RED BN	SILTSTONE		NO DUST; MOIST
	57					RED	MUDSTONE		SOFT
	61								ADDING H2O TO Borehole
1149	68					PINK-GRAY	F. GR. SS		
						RED-BN	SILTSTONE		
1155	71					LT. GY	F. GR. SS		
						RED-BN	SILTSTONE		
	73								FRACTURE
	76						F. GR. SS		
1214	81					LT. GY → RD-BN →	F. GR. SS SILTSTONE		
	85						CONGLOMERITIC SS (QTZ frags) W/ MINOR MUDSTONE		
	87					RD-BN	SILTSTONE/V.F.GR. SS		
						LT. GY	F. GR. SS		
	91						SILTSTONE		FRACTURE
	92					PURPLE/GY	SILTSTONE		
	93					LT. PK-GY	F. GR. SS		
	97					PK-GY	F. GR. SS		

REMARKS _____

BORING HN-09I

PAGE 2 OF 3

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN09I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	101					PK-GY	F-MGR SS		
	103					DKGY	Siltstone/ V.f.gr. SS		~2 gpm total yield

REMARKS _____

BORING HN-09I

PAGE 3 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-09D
PROJECT NO.: 0159 — DATE: 11/2 & 11/3/93 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: D. whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					OR	SILTY CLAY		
	3					OR	SILTY CLAY		
	4					BN	CLAYEY SILT		micaceous
	8					BN	SILT		micaceous; DRY
	10					RD	SILTY Shale		
	14			8" at 14'		RD	SILTY Shale		DUSTY
1423	22					RD	MUDSTONE		
1425	28					RD	MUDSTONE		
	30						LITHOLOGY AS Above		
1431	33					BN, RD	f. gr. SS		
	38					RD, BN	f. gr. SS		large fragments
1443									
	43					RD, BN	SILTSTONE		
1450	48						LITHOLOGY AS Above		

REMARKS

BORING HN-09D

PAGE 1 OF 4

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: BORING NO.: HN09D
PROJECT NO.: DATE: DRILLER:
ELEVATION: FIELD GEOLOGIST:
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1457	53					RD, BN	f. gr. SS		
1505	58						Lithology As Above		
1510	63					RD, BN	f. gr. Quartzose SS		
	68					RD, BN	f. gr. SS		
1524	73					BR-GY	C. GR. SS; Quartz Pebbles		
1530	78					PK-GY	f.-M. gr. SS; some siltstone		arkosic
	81								No HNU > BK
1542	83					PK-GY	f.-M. gr. SS; arkosic		Some green frags.
1546	86					RD	Siltstone		
	90					PK-GY	f. gr. SS		
1611	98					PK-GY	f. gr. Arkosic SS		

REMARKS

BORING HN-09D

PAGE 2 OF 4

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN09D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1617	103					RD.BN	Siltstone		
1628	108					reddish GY-BN	Siltstone/f. gr. SS		
1635	113					reddish GY-BN	f. gr. SS		
1641	118					RD	Mudstone		
1644	123					RD	Mudstone		Soft
1647	127					RED + GY	Mudstone		
1657	132								No HNU > BK
1658	133					RD.BN	Siltstone		
1704	138					PK-GY	f. gr. SS		
						RD.BN	Siltstone		
1707	141								Yield 8-10 gpm
	148								Yield 12-15 gpm

REMARKS _____

BORING HN-09D

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 09D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	151					BN.GY	f. gr. SS		Large fragments,
1719									2" - 4"
	154								No HNu > BK
1726	158					LT.GY	f. gr. SS		Yield = 20 gpm
1732	163					LT.GY	f. gr. SS		
	165					RD	Mudstone		
	168					RD	Mudstone		
1738									
	173					RD	Mudstone + Siltstone		Yield ~20 gpm
1744	178					RD	Siltstone		Stop 11-2-93
									Start 11-3-9
0919	181					RD.BN	f. gr. SS / Siltstone		Yield ~25 gpm
0925	188					RD.BN	f. gr. SS / Siltstone		
	191								lignite
0928	192					RD	Siltstone & Mudstone		
	198					RD	Siltstone		
0934	200					RD.BN	Siltstone		Stop Drilling; Yield ~25 gpm

REMARKS _____

BORING HN-09D

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC Warminster BORING NO.: HN-1DS
PROJECT NO.: 0159 DATE: 12-14-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen (0-12') + R. Conger (USGS; 12-53')
WATER LEVEL DATA (Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					LT. BN	SILTY CLAY		
	4					BN	SANDY SILT		
	7					GY + LT. BN	f. gr. SS		arkosic
	10					GY + LT. BN	SS		QTZ. fragments
									H_2O at 11'
	14			8" at 12ft.		BN	f. gr. SS		Fracture; DAMP
	21								Fracture; fast DRILLING
1039	23					RD	F. gr. SS / siltstone		2 gpm at 28; no HNU
							↓		
	29								
	31								LOST RETURN - Blowing H_2O out of HN-1DD
	34					BN, GY	SS		Yield 5-8 gpm;
									NO HNU
	38								Yield 10 gpm
1043									
	46					RD	Siltstone		Fast Drilling
	47								47-49 fractures
1050	53								10-12 gpm TOTAL

REMARKS Blew H_2O for 30 minutes - almost cleared

BORING HN-1DS

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-10 I
PROJECT NO.: 0159 DATE: 12-15-93 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen (0'-12') & R. Conger (USGS; 12' - 112')
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	2					LT. BN	Channery sand		Rock fragments
	5					OR. TO BN	SILTY CLAY TO SILTY SAND WITH ROCK FRAGMENTS		
	7					BN	f. gr. SS		large pieces
				8" at 12ft					
	15					RD	SILTSTONE & SS		
	21					BN & GY	COMPETENT SS		
950									
	25								2-3 gpm
	28								Large fracture; lost return brief 14
	31								Yield 5 gpm
	34								Yield 10 gpm; 40 ppm HNU
									Fracture: 35'-36'
	40								40-43 Fractures; FAST DRILLING
1009									44-45 weathered, FAST DRILLING
	48					RD	SILTSTONE		
	49								Fractures

REMARKS

BORING HN-10 I

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 10I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	51					RD	F.G. SS		
									54-60 Competent
									ROCK; SLOW DRILLING
	62								Fracture
1025	63								40 ppm on HNU
	68								Bit Jumpy
	71								71-73: fractures
	73							73:	Slow, hard drilling
	80					GY	SS		30-40 ppm HNU
1045									
	88								Fracture
	90								90-91 Fracture; Lost some returns
	92								30-40 ppm HNU water?
	96								Lost return briefly
	98								Fractured

REMARKS _____

BORING HN-10I

PAGE 2 OF 3

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 10I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	101					RD	Siltstone		
	103								30-40 ppm HNU
	112					RD	Siltstone		TOTAL YIELD 18-20 gpm
									30-40 ppm HNU Constant

REMARKS _____

BORING HN-10

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-10D
PROJECT NO.: 0159 — DATE: 11-15-93 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR ROD (Ft.)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1					LT. BN	SILTY SAND WITH		
							rock fragments		
	7					BN-GY	f.-m. gr. SS		ARKOSIC
	10					GY-BN	f. gr. SS		DRY; arkosic
									8 ppm HNU
	13			8" at 12 ft					fracture
	21					GY	M. gr. SS		arkosic
1121	25					BN	f.-m. gr. SS		
1128	29								Pick-up 0.5 gpm
	31					RD-BN	Siltstone/f. gr. SS		
	34					RD-BN	Siltstone		
	38					RD-BN	Siltstone/f. gr. SS		Some iron oxide stains
1148	40								Gain 1 gpm
	41								Fracture; gain 1-2 gpm
	42					BN	f. gr. SS		
	44					RUST RD	MUDSTONE		Yield 7-8 gpm
	47					RD. BN	SILTSTONE		
	50					RD. BN	SILTSTONE		Fracture

REMARKS

BORING HN-10D

PAGE 1 OF 5

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 10D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	52								Gain 0.5 gpm ?
	54								Yield 9 gpm
	56					RD.BN	Siltstone		large frag.
	61					RUST RD.BN	Mudstone		
1220	65					PK & GY-BN	f. gr. SS		
	68								Gain 1 gpm
1231	73					PK-GY	f. gr. SS		Yield increase
									to 20-22 gpm
	78								Gain ~2 gpm
	80								
1344	81					BN-GY	f. gr. SS		
1349	85					BN & GN-GY	Mudstone		
	86					TN, GY, & LT. GN	f. gr. SS		
	88					RD & LT. BN	Mudstone, Siltstone, & f. gr. SS		
	93					RD.BN	f. gr. SS		
	95					RD.BN & GN	Shale		very soft
	97					PK.GY	f. gr. SS		
	99					RUST RD	Mudstone & Siltstone		

REMARKS _____

BORING HN-10 ✓

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 10D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1414	111					RD, BN	Siltstone		Gain H_2O
									TOTAL ~ 30 gpm
									Gain ~ 2 gpm
	118					PK, BN & GY	f. gr. SS		
	122								~ 33 gpm total
	123					RUST RD, BN	Mudstone/Siltstone		
	135					RD, BN	Siltstone/f. gr. SS		Pick-up 2-3 gpm at 136?
1448	137					GY	Siltstone/f. gr. SS		
					~~X~~	RUST RD	Mudstone		
1457									
	143					PK-GY	f. gr. SS		
	148					RUST RD	Mudstone/Siltstone		
	150								Rough Drilling; Gain 2 GPM?

REMARKS _____

BORING HN-10D

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN10D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

	SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	1509	153								TOTAL YIELD ~ 35 gpm
		155					RD.BN	SILTSTONE		
		158								NO HNU > BK
	1522	162					PK.GY	f. gr. SS		
		167					PK + LT-GY	f. gr. SS		
	1548	173					LT. GY	f. gr - SS (arkosic)		
11/12										
↑										
↓										
11/15	0934	183					LT.GY	f. gr. SS		
		188					LT.GY	f. gr - SS		
		190					RD.BN	SILTSTONE		
		192								GAIN 1-2 gpm?
										10 PPM HNU
	0955	196					PK-GY	f. gr. SS		
		199					RD.BN	MUDSTONE/SILTSTONE		25 PPM HNU

REMARKS _____

BORING HN-10

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* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 10D

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1008									
	207					PK.GY	f. gr. SS		
									40 ppm HNU
1019	213					PK.GY	f-m. gr. SS		
					X	RD.BN	SILTSTONE		
	218					PK.GY	f. gr. SS		
					X	RD.BN	SILTSTONE		
1036									
	226								Fracture
	228					RD.BN	SILTSTONE		
	235				X	PK.GY RD.BN	f. gr. SS SILTSTONE		Gain ~2 gpm
	236								Gain ~2-3 gpm
	238				X	PK.GY RD.BN	f. gr. SS SILTSTONE		
1101									
	241				X	PK.GY RD.BN	f. gr. SS SILTSTONE		
	244					RD.BN	SILTSTONE		
	247				X	PK.GY RD.BN	f. gr. SS SILTSTONE		
	249					RD.BN	SILTSTONE		
1126	253					PK.GY	f. gr. SS		Yield 50-60 gpm

REMARKS _____

BORING HN-10D

PAGE 5 OF 5

* See Legend on Back

BORING LOG — HALLIBURTON NUS

PROJECT: NAWC Warminster — BORING NO.: HN-35 I
PROJECT NO.: 1412 — DATE: 8/2/94 — DRILLER: Raab
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA: —
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1012	0.0					gray	pavement crushed stone		
						gray BRN	silty sand		moist
1020	5.0					red-BRN gy-BRN	clayey silt silty sand and weathered silty fgr sandstone		
	10.0					red-gy	v. fgr sandstone, micaceous		dry, dusty
1033	13.0								damp
							vfgr - fgr sandstone		no dust
1048	15.0								
1058	18.0								
	20.0								
1305	22.0								
	23.0					BRN-GY	silty fgr sandstone		dry, dusty
1306	25.0								
1308	28.0								dry, dusty
1310	30.0					red-gy	vfgr - fgr sandstone micaceous		EOR
	33.0								
1319	37.0					red-gy	fgr sandstone		dry
	40.0								
	42.0			*		gy-brn	fgr sandstone		wet, cuttings
									stean
1327	46.0								mud. start add water
						red-brn	siltstone/mudstone, w/ green mineral		soft
	50.0					gray	fgr-mgr sandstone		yield ~5gpm

REMARKS I.R. T-4 rig. 12" air hammer to 18'; 8" steel casing to 18'; 8" air hammer to 105'

* HN-35S also constructed within this borehole

* See Legend on Back

BORING HN-35S

PAGE 1 OF

BORING LOG — **HALLIBURTON NU**

PROJECT: N+WC Warminster — BORING NO.: HN-35 I
PROJECT NO.: 1412 — DATE: — DRILLER: Raab
ELEVATION: — FIELD GEOLOGIST:
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
						red-brn	mudstone		yield drops
1348	55.0								EOR
						red-gy	vfgr-fgr sandstone, micaceous some calcite		mud
1402	60.0								
						red-brn	vfgr sandstone		
				*?					possible yield inc of 1-2 gpm
1408	65.0					rust-red	mudstone		mud
1409	67.0								
1410	70.0								
1411	72.0						same as above		mud
1413	75.0								mud, very little return
1414	77.0					red-brn	vfgr sandstone		
1415	80.0								EOR start next rod at 14:
1425	82.0						same as above		
									damp
1426	85.0								
1427	87.0					gray	vfgr-fgr sandstone		damp
1429	90.0								
									mud
1431	94.0			*		gray	fgr sandstone		wet mud
									some flow
1433	97.0								yield 4-5 gpm
	100.0					red-brn and gy	siltstone		mud

REMARKS

BORING HN-35S,

PAGE 2 OF 3

* See Legend on Back

BORING LOG

HALLIBURTON NL

PROJECT: NAWC Warminster

BORING NO.: HN-35I

PROJECT NO.: 1412

DATE: 8/2/94

DRILLER: Raab

ELEVATION:

FIELD GEOLOGIST: D. Whalen

WATER LEVEL DATA :

(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	101.0								
1436	103.0								mud
1437	105.0					red-brn	vfgr sandstone, micaceous		EOR
									total yield ~5gr

REMARKS

BORING HN-35S

PAGE 3 OF

* See Legend on Back

BORING LOG — **HALLIBURTON NU**

PROJECT: NAWC Warminster — BORING NO.: HN-35 D
PROJECT NO.: 1412 — DATE: 5/17/94 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1252	0					gray	pavement crushed stone		
	4					BRN	clayey silt		
						red-BRN	silty clay and weathered siltstone / vfgr sandstone		
1257 1301					soft	red-BRN	siltstone / mudstone		
	10					purple	vfgr - fgr sandstone, micaceous		harder
1303									dry
							same as above		
1305	17								dry slow drilling
1309	20								blow out some wat when start drilling
1333						gray BRN	fgr - mgr sandstone		no dust
									slightly damp
1336 1337	27								EOR water in the hole
	30			*					some steam, no retu ~1gpm
						red gray	vfgr - fgr sandstone		no HNU reading
						purple	fgr sandstone		lift up bit, clean out resume drilling @ 1346
									dry
									dry, dusty
	40								
						gray BRN	fgr sandstone		dry
1350	45								
						gray-BRN	slightly finer grained		dry
1352	50								no dust

REMARKS I.R. T-4 rig. 10" air hammer to 19.5', 6" steel casing to 19.5', 6" air hammer to 152'

HN-35

BORING

PAGE 1 OF 4

* See Legend on Back

BORING LOG — **HALLIBURTON NU**

PROJECT: NAWC Warminster — BORING NO.: HN-35D
PROJECT NO.: 1412 — DATE: 5/17/94 — DRILLER: Raab
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1354	52					gray-BRN	v fgr sandstone		very little return EcR
1359									no water in hole when start next rod
	55					lt. BRN gray	fgr-mgr sandstone		dry
						BRN	v fgr sandstone		
	60								
1405	64								
1406	67					BRN	siltstone / mudstone		dry
	70					rust red	mudstone		dusty
1410	73								
							same as above		
									dusty
1413 1420	77								EcR mud
	80								no dust dry
1423	83								dry
1424									
						gray-Brown	fgr sandstone		dusty
1427									dry
1429	90								
1430						gray BRN	v fgr-fgr sandstone		dry
1432	94								poss. fracture
	100								poss. fracture

REMARKS

BORING HN-35

PAGE 2 OF 4

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC Warminster — BORING NO.: HN-35D
PROJECT NO.: 1412 — DATE: 5/17/94 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1439	102			*					fast drilling, mud poss. fracture
1447									EOR yield ~3gpm a[illegible] flowing out hole
1448	106					brn-gray	vfgr sandstone		
1451	110								Q ~3gpm (mud)
							same as above		Swart to add wat[illegible]
	114								
1454	117			*					Q increases to ~8.9[illegible]
	120								
1456						gray	mgr sandstone, some angular quartz grains		Q ~17gpm
1459 1504	127								EOR yield: ~12gp[illegible]
						gray	fgr sandstone, some calcite		
1507	132						as above with some red mudstone, vfgr sandstone		Q ~12-15 gpm
	137						as above, with some green mineral		
1513	142								
						red BRN	vfgr-fgr sandstone, some calcite		
1515	147								
	150					rust red	siltstone		

REMARKS

BORING HN-35D

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* See Legend on Back

BORING LOG

HALLIBURTON NI S

PROJECT: NAWC Warminster

BORING NO.: HN-35D

PROJECT NO.: 1412

DATE: 5/17/94

DRILLER: Raab

ELEVATION:

FIELD GEOLOGIST: D. Whalen

WATER LEVEL DATA :

(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1517	152					rust red	siltstone		

REMARKS Blow out hole until 1614 - cave-in problem; blow out crumbly red fgr sandstone, red-gray fgr congl., piece of greenish gray mgr sandstone; TD = 150.5'

BORING HN-35

PAGE 4 OF 1

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC Warminster — BORING NO.: HN-36I1
PROJECT NO.: 1412 — DATE: 5/18/94 — DRILLER: East
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA: —
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1151	0					BRN	silty loam		
						lt BRN	sandy silty clay		moist
						BRN	silty sand		
1154 1157	7					tan	fgr-mgr sandstone, weathered		add rod dry
1159	10					lt. BRN	fgr sandstone		
						gray-BRN	fgr sandstone		
						red-BRN	siltstone / vfgr sandstone		dry
1204	17				soft	red-BRN	siltstone / mudstone		
1205 1209	20								
1210	22					red gray	vfgr-fgr sandstone		harder, dry
						brn-gray	fgr sandstone		dry
1214	27								dry
	30								
1217	32					red gray	fgr sandstone		dry
1517									damp
1519	37								
1521	40								some dust
1523	42					brn-gray	vfgr-fgr sandstone		dry
									dry
1527	47					red BN	fgr sandstone		
1530	50					red gray	vfgr sandstone		dry

REMARKS: I.R. T-4 rig: 10" air hammer to 32' set 6" steel casing to 32' 6" air hammer to 177.

BORING HN-36I1

PAGE 1 OF 4

* See Legend on Back

BORING LOG — **HALLIBURTON NU**

PROJECT: NAWC Warminster — BORING NO.: HN-36I
PROJECT NO.: 1412 — DATE: — DRILLER:
ELEVATION: — FIELD GEOLOGIST:
WATER LEVEL DATA: —
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1531	52					vld gray	vfgr - fgr sandstone		EOR
1535									dry
1538	55								
						pink gray	vfgr - fgr sandstone		dry
1541	60								
									dusty
							same as above		
	65								poss. fracture
1545						brown gray	fgr sandstone		
1546	70								no dust
1547									slightly moist
1549 1557	77					pink-gray	fgr sandstone, micaceous		EOR water in hole when
1558	80								start next rod
1600									mud
	85								
1601						green-gray	fgr-mgr sandstone		damp
1602	90			*					thick slurry no HNU reading
1605	92								Q ~ 3gpm
					soft	rld Brown	siltstone/mudstone		mud
									very little return
1608	97								mud
1610	100								

REMARKS

BORING HN-36I

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN-36I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1611	102					red-brown	v fgr sandstone		EOR
1625									
									Q ≈ 3-4 gpm
1629	107					red-brown	v fgr - fgr sandstone		
	110								
1631							same as above		
	115								
1634	117						same as above		Q = 4-5 gpm
	120								
1636	122					red-gray	fgr sandstone		Q = 4-5 gpm
1639 1643	127						same as above		EOR
1644	130								Q = 5 gpm
						red gray	fgr sandstone, micaceous		
									yield drops
1647	135								
	140			----	soft	vvst red	mudstone		
									Q ≈ 4 gpm
1651	145			----		red brn	fgr sandstone		
	150			----		pink gray			

REMARKS _____

BORING HN-36I

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* See Legend on Back

· BORING LOG

HALLIBURTON NUS

PROJECT: _____ BORING NO.: HN-36I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	152								EOR
1709	160					gray	fgr sandstone		Q ≈ 5gpm
1710									
						red Brn	siltstone, mudstone		
1712	167					red Brn	vfgr sandstone		Q ≈ 5gpm
	170								
1714	172						same as above		lignite film on water
1716	177						same as above		lignite film total yield ≈ 5g

REMARKS _____

BORING HN-36I

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* See Legend on Back

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions) 7/14/94, 1308, Cloudy, 85°. RAN.

DATE: 7/14/94
FIELD GEOLOGIST P. NIMMER

BORING NO. HN-36D, HN-36I2*
DRILLER: RAAB

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY (SAMPLE LENGTH)	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	UNIFIED SOIL CLASSIFICATION	REMARKS
1308	0.0			SP		TAN	GRADED SAND w/ RX FRAGS	SP	POSSIBLE ROAD BASE
	4.0			ML		BRN	SILT and CLAY	ML	
1313	6.0								EOR @ 6'
1320	10.0					TAN	GRADED SAND w/SILT + CLAY SOME RX FRAGS		DRY - FAST
1323	12.0					TAN	FG to MG SS		
				WEIRTON TOP=12					Soft @ 14
1328	15.0					GRY/BRN	FG SS w/ RED MUDSTONE		BIT Gets clogged @ 15
1400	18.0			FGSS					Stop @ 18' to set Casing.
	20.0			6" CSG to 18' FGSS/SILTSTONE			FG SS /SILTSTONE		DRY - DUSTY
						PINK	FG SS		DRY
				FGSS					Slower Drilling
1403	25.0					PINK	AS ABOVE		
1406	26.0					PINK	FG SS		EOL @ 26. WATER while
1411	30.0					PINK	AS ABOVE		Blowing - VERY DRY - DUSTY
1415	35.0					PINK	AS ABOVE		SOFTER - quiet - less. FX
									FASTER
1417	40.0					PINK PURPLE	FG SS		DRY - Less DUST
1420	45.0					PURPLE	AS ABOVE		DRY
									LARGER RX FRAGS
1422	50.0					PINK	FGSS		RAN starting

REMARKS T-4 RIG w/ 10" AIR HAMMER to 18 FT. 6" ø HAMMER TO 151 FT. 6" ø STEEL CASING to 18 FT. CASING STICKS UP 2.3 FT. HOLE NOT LOGGED BY USGS.
* HN-36 I2 also constructed within this borehole.

BORING HN-36D

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 7/14/94
FIELD GEOLOGIST P.NIMMER

BORING NO. HN-36D
DRILLER: RAAB

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	UNIFIED SOIL CLASS.	REMARKS
1424	51.0								EOR @ 51
1428	55.0					Grey-Red	FG SS		Less Dust
1430	60.0						AS ABOVE		Dry
1431	62.0					Pink	FG to MG SS		Mud @ 62
				FG to MG SS					Q = ~3 GPM
1433	65.0					Pink	AS ABOVE		HNU = 5 PPM
									STEADY RAIN
1436	70.0					Grey-Pink	AS ABOVE		Q = 5-7 GPM
									Q increasing
1439	75.0					Pink	AS ABOVE		Q = 10 GPM
1444	77.0			MG SS		Grey-Green	MG SS		EOR @ 76
	80.0								
	81.0			FG to MG SS		Dark Grey	FG to MG SS		Quiet Drilling
1448	84.0								Softer, more mud
	85.0			VFG SS		Red-Brn	VFG SS		Just mud
	89.0								Quiet @ 89 No flow, just mud
	92.0								No Returns @ 92
	94.0			FG SS		Dark Gray	FG SS w/ calcite in fracturing	?	Mud @ 94
1454	95.0								Q ≅ 3 GPM - Hard Rain
	97.0								Q to 5-7 GPM
1455	100.0			FG to VFG SS		Red-Brn	FG to VFG SS		Q down to 3-5 GPM

REMARKS

BORING HN-36P

PAGE 2 . 3

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA:
(Date, Time & Conditions)

DATE: 7/14/94
FIELD GEOLOGIST: P. NIMMER

BORING NO.: HW-360
DRILLER: RAAB

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION		REMARKS
1501	101.0			FG to VFG SS					EOR @ 101
	101.0					Purple-Purple	AS ABOVE		Q to 5 @ 104
1504	105.0								
1505	107.0			*					Q to 7-10 GPM
	110.0					RED-BRN	VFG SS w/calcite		Mod. Fr
1508	112.0			*					Increasing Q
1509	113.0								Q = 10-12
	115.0			FG SS		BRN	FG SS w/calcite		
									CLOUD BURST - U. HEAVY RAIN
1513	120.0						AS ABOVE		Q = 12 GPM
1604	126.0								EOR. Stop for lightning
	128.0					GRY	FG SS		
1606	129.0			VFG SS		RED-BRN	VFG SS / NUMOSTON?		Q = 7-10 GPM
									FASTER
MOB	135.0			Sand		RED-BRN	AS ABOVE		
									Q increasing 10-12
1610	140.0					GRY-BRN	VFG SS to FG SS		LESS Q. MOSTLY MUD
	142.0			FG SS					MORE Q 7-10 GPM
1612	145.0			*		GRY-BRN	FG SS w/ carbonate		Q = 12-15 GPM
				Sand					Lignite film on water
1614	150.0			collar		GRY-BRN	FG SS micaceous		Q = 12-15 GPM

TD = 151

REMARKS: BLEW hole for 10 MIN. WATER DID NOT clear. well MAKING 10-12 GPM total. GOOD WATER bearing zones from 105 to 115 AND 140 to 150.

BORING HW-360

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BORING LOG — **HALLIBURTON NUS**

PROJECT: HAWC Warminster — BORING NO.: HN-37 I, D *
PROJECT NO.: 1412 — DATE: 5/19 and 5/20/94 — DRILLER:
ELEVATION: — FIELD GEOLOGIST:
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1614	0					tan	silty clay		damp
1618						lt. brn	clayey silt		
1621	5			----		brn	clayey silty sand		damp addred
1624									
	10					BRN-gray	vfgr-fgr sandstone		loud hammering
									steam
				*		gray-brn	vfgr-fgr sandstone micaceous		~4gpm large pieces of rock
1633	15								7-10gpm 10-12gpm
1640 1642							same as above		
5/19 5/20 1042	20								
						purple	vfgr-fgr sandstone		@~10gpm
1056	26								EOR no HNU rdg.
1058						tan	vfgr-fgr sandstone		
	30								
						light brn	fgr-mgr sandstone mostly quartz		
1102	36						gray vfgr sandstone, red-brn siltstone, and tan fgr sandstone		
	40								
1106						purple	vfgr sandstone, micaceous		poss. fracture
						red-brn	siltstone/mudstone with green mineral		
	46								
						red-brn	vfgr sandstone, some calcite		
	50								

REMARKS I.R. T-4 rig 10" air hammer to 18'. set 6" steel casing to 18', 6" air hammer to 159'
* HN-37 I & HN-37D constructed within same borehole.

* See Legend on Back

BORING HN-37I,D

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN-37 I
PROJECT NO.: _____ DATE: 5/20/94 DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1111 1114	51								EOR yield 15-18 gpm
1115									
1116	55					red-brn purple	siltstone/mudstone and vfgr sandstone		15-18 gpm
112									
1118	60								
1119						grayish brn	fgr sandstone, rust staining		
1121									
	65					red brn	v fgr sandstone		poss. fracture
1123									
1124	70								
						grayish brn	vfgr - fgr sandstone micaceous		15-18 gpm
1126	73								
1128	75					purple	v fgr - fgr sandstone w/ some red mudstone		EOR 15-18 gpm
1131 1132									
	80								
1133						red brn	siltstone/mudstone		
1136	86			*		grayish brn	fgr sand stone		yield inc. to 25-30 gpm
1139	90								
						gray	fgr sand stone, some greenish fgr sand stone		
1142	94								
							same as above		
1145	100								

REMARKS _____

BORING HN-37I, D

PAGE 2 OF 4

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN-37 I

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1145	101								
1153	104					lt. gray	fgr - mgr sandstone		
1155	106					brn, tan, red	fgr sandstone		
1157									25-30 gpm
	110								
1159						gray	fgr sandstone		
	115					red brn	v fgr sandstone / siltstone, some calcite		
1203	120								Poss. fracture
1205						red-gray	v fgr sandstone		
1206									
1208 1209	125 126								EOR pickup sor water last 1 of rod
1214									vich ~35gpm
	130								
1218						purple	fgr sandstone		
1220	134								~35gpm
1221	136					gray-brn	fgr sandstone		
1223									
1224	140								
						red-brn	v fgr - fgr sandstone, micaceous		
1230	146					purple	v fgr - fgr sandstone, micaceous, some green-gray v fgr sandstone		
1232 1233	150								

REMARKS _____

BORING HN-37I, V

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* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC Warminster — BORING NO.: HN-37I

PROJECT NO.: 1412 — DATE: — DRILLER:

ELEVATION: — FIELD GEOLOGIST:

WATER LEVEL DATA: (Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1233 1239	151					brn-gray	vfgr - fgr sandstone		EOR
1241							w/ some soft white mineral (kaolinite?)		
1245						purple	vfgr - fgr sandstone		
1246	159								
									yield ~ 35gpm

REMARKS

* See Legend on Back

BORING HN-37I,D

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BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC Warminster — BORING NO.: HN-38
PROJECT NO.: 1412 — DATE: 5/23/94 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1024	0								
1027	4								
1032									
1033	9								
						gray	vfgr-fgr sandstone micaceous		damp
1037	17			*					fracture 3-4 gpm
	20					rdt brn	siltstone		
1047						red-BN	siltstone / vfgr sandstone micaceous, soft		
	30			*					Q = 10-15 gpm no HNU reading
1051									fracture
						pink-gray	fgr sandstone and red-BN siltstone / mudstone		fracture
									Q = 25-30 gpm
1055						red gray	fgr sandstone		
	40								large pieces of sandstone fracture
1102						pink gray	fgr sandstone		
1120	44								EOR Q ~ 30 gpm
						pink-gray	fgr sandstone and red-BN siltstone		
1122	50								

REMARKS: I.R. T-3 rig 10" air hammer to 50'; 6" steel casing to 50'; drill out with 6" air hammer to 119'

BORING HN-38

PAGE 1 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC Warminster — BORING NO.: HN-38
PROJECT NO.: 1412 — DATE: 5/23/94 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1358	51					red-BN	siltstone/vf-fgr sandstone		dry, dusty
									dusty
	55								
						red BN	siltstone		dusty
	60								
1403	64					red-BN	siltstone/mudstone		dusty EOR
1404									
1405									
	70			*		pink gray	fgr sandstone		Q ~ 3 gpm no HNU reading
	74					purple	vf-fgr sandstone micaceous		
									lignite film on water
1408	80								
									lignite film
1411	84						same as above		EOR
1413									
						red gray	fgr sandstone		Q ~ 5 gpm
1417	90								
1419	94					red-gray	fgr sandstone		
1423	100								

REMARKS

BORING HN-38

PAGE 2 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC Warminster — BORING NO.: HN-38
PROJECT NO.: 1412 — DATE: 5/23/94 — DRILLER:
ELEVATION: — FIELD GEOLOGIST:
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY/ CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	101								
1424	104						same as above		EOR yield ~5g
1426									
				*					Q ~30gpm
	110					pink gray	fgr sandstone, micaceous		no HNU reading
1433									
1436	114								
							same as above		
1442	119								total yield ~35gpm

REMARKS

BORING HN-38

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* See Legend on Back

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions) 5/23/94, 1400, clear

DATE: 5/23/20
FIELD GEOLOGIST P. NIMMER

BORING NO. HN-39
DRILLER: RAAB

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
1400	X								
1410	0-5.0			ML		BRN	SILTY CLAY.	ML	
									ADD ROD AT 6 FT DRY
	10.0			TOP = 8'		BRN	FG SS		DRY
1415	11.0					TAN	FG SS		
1421	15.0					TAN	FG to MG SS		MOIST
	17.0								WATER @ 17 - JUST MUD SLOW DRILLING. HNU = 0.0 ppm
				6" CSG TO 18.5'					
1525	21.0					WHITE-GTN	MG SS		DRILLER HAMMERS CASING TO ATTEMPT TO STOP RETURNS FROM COMING UP OUTSIDE CASING
1530	22.0					RED-BRN	VFG SS		Q = 10 GPM FAST DRILLING. FOR @ 26
	29.0								
	30.0					RED-BRN	MUDSTONE / SILTSTONE		
							CG to MG SS		FAST DRILLING
									HNU = 0.0
	35.0						CG to MG SS		LESS Q, = 3-5 GPM
1538	40.0					REDDISH PURPLE	FG SS		HNU = 0.0 Q = 3-5 GPM - MOSTLY MUD
1542	45.0						AS ABOVE		
									FEW RETURNS
	50.0								NO RETURNS

REMARKS Ingersoll-Rand T-4 R16 w/ 10" AIR HAMMER to 19 ft. 6" AIR HAMMER to 19 ft. 6" Steel CASING to 18.5 ft. Hole also Logged by USGS. Stickup of 2.5 ft of Casing ABOVE GROUND SURFACE.

BORING HN-39

PAGE 1 . 3

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.:
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE:
FIELD GEOLOGIST P. NIMMER

BORING NO. HN-39
DRILLER: RAAB

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	UNIFIED SOIL CLASSIFICATION	REMARKS
1545	51.0								EOR @ 51
									Q= 3-5 @ 53
	55.0					Brn	FG SS		
	60.0					Dark-gray	FG SS		Q= 3-5 gpm
									FAST Drilling
									LESS Q - NO MUD
	66.0					Red	MUDSTONE		Dry
1555	70.0						AS ABOVE		
1600	76.0								EOR @ 76 FG
							AS ABOVE		NO Return
	80.0					RED BRN	"		Dry
									water @ 84
1604	84.0								Q= 3-5 GPM
	85.0					Red-Purple	MUDSTONE / SILTSTONE		
									FAST DRILLING
	89.0 90.0					Red-Purple	FG SS		Q= 5-7 @ 89 HWH=0.0
	93.0								Q= 8-10 @ 93
1612	95.0					Gray-GREEN	MG SS TO FG SS		Q= 10-12 GPM
	100.0						AS ABOVE		Similar Q rate

REMARKS

BORING HN-39

PAGE 2 . 3

BORING LOG

Halliburton NUS

PROJECT: 14/2
PROJECT NO.:
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 5/23/94
FIELD GEOLOGIST P. Nimmer

BORING NO. HN-39
DRILLER: RAMS

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CODE	REMARKS
1617	101.0					RED	FG SS		EOR @ 101
	105.0								Q=13-15 GPM
1621	110.0					RED-BRN	FG SS		Q= ~15 GPM @ 112
1624	115.0						FG SS		Q=15-15 GPM
	120.0						AS ABOVE		Q=15-15 GPM
	126.0								EOR @ 126
	129.0					GRAY	FG SS		
1639	131.0						AS ABOVE		
	135.0								Less Q = 7-10 GPM
	135.0						AS ABOVE		Increasing @ 134
									Q=12-15 GPM @ 136
	140.0					RED-BRN	FG SS		Similar Q
									FASTER Drilling
	145.0					RED	FG SS		Q=15-18 GPM @ 145
1644	150.0					DARK RED	AS ABOVE		

REMARKS Blew hole for 10 min. Well making ~15 GPM.

BORING HN-39

PAGE 3 of 3

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions) 5/27/94, 1022, Cloudy, strong winds, 55°. WELL LOCATED IN FRONT of GATE 40A.

DATE: 5/27/94
FIELD GEOLOGIST P. Nimmer

BORING NO. HN-40 S
DRILLER: RAAB

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
1022	0.0					BRN	SANDY SILT w/some CLAY		MOIST
1026	4.0								ROD ROD @ 4.0
	6.0						SANDY SILT w/SS FRAGS		DRY
						RBN	FG SS		DRY
				TOR=9'					
1030	13.0					GRY	FG to MG CC		
1031	~~14~~ 15.0					BRN	FG SS		DRY
1032	16.0					Purple BRN	FG SS		
	20.0					BRN to RED	SILTSTONE / RED MUDSTONE		Very soft @ 20 - FAST Drilling
1041	23.0				V. SOFT	RED	MUDSTONE		EOR @ 23
	30.0			6" CSC TO ~~34~~ 31		RED	AS ABOVE		
1045	31.0				MED. HARD	GRY-WHITE	FG SS		DRY - Very dusty
1130	32.0					GRY PINK	AS ABOVE		
1146	37.0					BRN	VFG to FG SS		MOIST - NO DUST
1142	42.0						AS ABOVE		
1145	43.0				SOFT	RED-BRN	MUDSTONE		DRY EOR @ 43
	45.0					RED-BRN	AS ABOVE		MOIST
									FAST Drilling

REMARKS Ingersoll-Rand T-3 RIG w/ 10" AIR HAMMER TO ~~32~~ 31 ft.
6" AIR HAMMER TO ft. 6" STEEL CASING TO ~~32~~ 31 ft.
CASING STICKS UP ~~2.8~~ 1.5 ft. HOLE NOT LOGGED BY USGS.

BORING HN-40S

PAGE 1 of 2

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 5/27/94
FIELD GEOLOGIST P. NIMMER

BORING NO. HN-40S
DRILLER: RAAB

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODE	REMARKS
	51.0					RED-BRN	VFG SS /SILTSTONE		MOIST
1050	54.0								MUD @ 54'
									CUTTINGS DRY AGAIN
	57.0								MORE MUD, THEN DRY
1152	60.0						VFG SS		SOME Q @ 60' < 5 GPM
1156	63.0								INCREASING Q @ 63' EOR @ 63
	65.0					BRN	FG SS		Q = 5-7 GPM @ 64 Q = 10-13 GPM @ 65
1159	68.0								Q = 15-18 GPM @ 68
				TD=68					HNU = 0.0 @ 68
							TOTAL DEPTH = 68 ft		

REMARKS BLEW HOLE for 15 MIN. WELL MAKING 18-20 GPM.
WATER CLEARED SLIGHTLY AFTER 10 MIN.
(*) GOOD Potential SCREENING INTERVAL FROM 58 to 68 ft.

BORING HN-40S

PAGE 2 . 2

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions) 5/25/94, 0940, CLEAR, 70°. Well on New Town Road near Inertial Guidance Bld, NE of Gate 40A.

BORING NO. HN-40I
DATE: 5/25/94
DRILLER: RAAB
FIELD GEOLOGIST P. NIMMER

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODE	REMARKS
0940	0.0								
				SM		BRN	SANDY SILT	SM	DRY
						TAN	SANDY SILT	SM	DRY
0949	11.0			TOR = 9'		BRN	FG SS		DRY
						PURPLE	FG SS		DRY
0952	16.0					BRN	AS ABOVE		MOIST
	16.0					RED-PURPLE	MUDSTONE		VERY SOFT 16' to 28'
									FAST Drilling
0957	23.0					RED-purple	AS ABOVE		FOR @ 23'
1001	28.0					BLK	FG TO VFG SS		Slower drilling
1004	29.0								water @ 29'
1054	31.0			6" CSG TO 30'			AS ABOVE		MOIST
	35.0					GREY	FG SS		DRY. water @ 33.5'
1057	35.0					RED-BLK	FG SS w/ orange oxidation patches on cuttings		Q = 5-7 GPM
	37.0								Q = 7-10 GPM
	40.0					RED	MUDSTONE LAYERS ?		VERY SOFT - Lost returns
1102	43.0					RED-BRN	VFG SS		FOR @ 43
									Less Q, 3-5 GPM
	46.0								Just mud @ 48'
	49.0								Q = 7-10 @ 49'

REMARKS INGERSOLL-RAND T-3 BIG w/ 10" AIR HAMMER TO 30 Feet. 6" AIR HAMMER to 133 ft. 6" Steel CASING to 30 ft. CASING sticks-up 2.5 ft. Hole ALSO LOGGED BY 4565.

BORING HN-40I

PAGE 1 . 3

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 5/25/94
FIELD GEOLOGIST P. NIMMER

BORING NO. HN-40 I
DRILLER: RAAB

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODE	REMARKS
1106	51.0				MED. HARD	RED-BRN	FG to VFG SS		Q FLUCTUATING
1107	55.0					RED-BRN	AS ABOVE		Q=5-7 GPM
									Q=7-10 GPM
1109	60.0					RED-BRN	AS ABOVE		HNU=0.0
	61.0					GRY/BLK	FG TO VFG SS		
1114	63.0								EOR @ 63
	65.0					GRY-BLK	AS ABOVE w/MICA FLAKES		Q=7-10 GPM
									Slowly increasing Q
	70.0					RED and GRY	FG to MG SS. White mineral present on cuttings surface		Q=10-12 GPM
									HNU=0.0
1121	75.0					GRY-GREEN	FG TO MG SS		Q=12-15 GPM
	79.0					RED-BRN	VFG SS		Soft
							MUDSTONE/SILTSTONE interbeds?		
1128	83.0								EOR @ 83'
1129	85.0					GRY-BLK	FG SS		Q=12-15 GPM
1133	90.0					RED-BRN	VFG SS / SILTSTONE		Less Q, mostly mud
									FAST Drilling
	95.0								Q=5-7 GPM
1136	97.0								More Q, 12-15 GPM
1137	100.0					PURPLE-BRN	FG SS		HNU=0.0, Q=12-15

REMARKS

BORING HN-40I

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BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 5/24 25/94
FIELD GEOLOGIST P. Nimmer

BORING NO. HN-40F
DRILLER: RAAB

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
1139	101.0						BLACK FLOATER @ 101		FLOATER Gone by 102
1140	103.0								EOR @ 103
	105.0					Red-Red-Brn	VFG SS w/ mudstone interbeds		more mud, Q @ ~10 GPM
1144	110.0						AS ABOVE		More Q, 15-17 GPM
									HNu = 0.0
1147	115.0					Red-Purple	VFG to FG SS		Q = 15-17 GPM
									Less Q @ 119, to 12-15 GPM
1151	120.0					Grey-Blue	FG SS		
									Q ≅ 15 GPM increasing?
1200	125.0								Q up to 15-18 GPM
	125.0					Grey on Black	FG to MG SS		EOR @ 123.0' - HNu = 0.0
	127.0								Q increasing to ~20 GPM @ 125
	130.0					Red-Brn	Mudstone / Siltstone Bed		Poss. FX - lost returns
									softer
1206	133.0								
							TOTAL DEPTH = 133 ft		

REMARKS (*) Good potential screening interval.
Blew hole for 15 min, well making ~20 GPM

BORING HN-40F

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BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions) 5/24/94, 1038, clear 75°

DATE: 5/24/94
FIELD GEOLOGIST: P. NIMMER

BORING NO. HN-340 DEEP
DRILLER: RAAB

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
1038	0.0			ML		Red-Brn	Silty clay	ML	DRY
	9.0			SM		Red-Brn	Sandy silt	SM	DRY
1045	12.0			TOR=11		Purple	FG to VFG SS		DRY
	14.0					Brn	As above		MOIST
	18.0				Soft	Red	Mudstone/Siltstone		softer @ 16 - EASY DRILLING
1110	19.0								DRY
									EOR @ 21'
1111	23.0						As above		
	25.0			6" CSG to 25'		Grey/Blk	FG to MG SS		
									MUD @ 27'
1115	31.0					Pink-Brn	FG SS		Q= 5-7 GPM
	36.0					Red-Brn	FG SS		SLIGHTLY LESS Q, Q= 3-5 GPM
1118	39.0								Q= 7-10 GPM @ 40'
1120	41.0					Red			
	43.0					Red-Purple	VFG SS		Q= 7-10 GPM
	48.0						As above		Q= 10-13 GPM
	50.0				Med. Hard	Red-Brn	VFG SS		MORE MUD, LESS FLOW @ 50

REMARKS Ingersoll-Rand T-3 Rig w/ 10" Air Hammer to 19 ft. washout to 25 ft. 6" Steel casing to 25 ft. 6" Air Hammer 19 to 161 ft. Casing Stick-up 2.1 ft above Ground. Hole also logged by USGS.

BORING HN-40D

PAGE 1 of 4

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 5/24/94
FIELD GEOLOGIST P. NIMMER

BORING NO. HN-40 D
DRILLER: RAAB

SAMPLE NO & TYPE OR ADD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ADD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	52.0								Q= 13-15 GPM. HNU=0.6
1127	56.0					RED-BRN	VFG SS		FAST DRILLING
	58.0						AS ABOVE		Q=15 GPM
1132	60.0					BRN-GREY	MG to FG SS		EOR @ 61
	63.0						AS ABOVE w/ PATCHES OF RED OXIDE PATCHES ON CUTINGS		Q= 15 GPM
1136	66.0					BRN	AS ABOVE		
1136	68.0								Q= 15-18 GPM
	74.0					GREY-BRN	MG to CG SS		
1140	78.0					RED-BRN	SILTSTONE		
1142	81.0								EOR @ 81
1144	83.0				MED. HARD	GREY	FG SS		
	86.0					RED-BRN	VFG SS		
1146	90.0					GREY			
	91.0					GREY-BRN	FG to VFG SS. BLACK FLOATING FILM @ 93'		Q= 18-20 GPM
	95.0					GREY-BRN	FG to MG SS		
	98.0					GREY-BRN	FG SS.		Q= 18-20 GPM

REMARKS

BORING HN-40D

PAGE 2 . 4

BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.:
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 5/24/94
FIELD GEOLOGIST: P. NIMMER

BORING NO.: HN-40D
DRILLER: RAAB

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODE	REMARKS
1154	101.0								EOR @ 101
	102.0					RED			
	106.0					RED-BRN	FG to VFG SS w/ white MIN. ON Cuttings		FX ZONE ?
	108.0					RED-BRN			MORE Q, up to 20-23 GPM
	111.0					PURPLE-BRN	FG SS		Q = ~ 25 GPM
1201	115.0						AS ABOVE		
	118.0					PURPLE-RED	FG to VFG SS		
1208	119.0								EOR @ 121'
	125.0					GREY	FG SS		
	126.0					RED-BRN	VFG SS		FAST DRILLING
	131.0					RED-BRN	FG to VFG SS		MORE Q, up to 30 GPM
	133.0								
1217	135.0						FG to MG SS		Q ≅ 30 GPM
	140.0					PURPLE BRN	FG to MG SS		
1224	141.0								EOR @ 141
1227	145.0					GREEN-GREY	FG to MG SS		Q = 30 to 33 GPM
	150.0						BLACK FLOATER @ 149'		

REMARKS (*) = GOOD SCREENING INTERVAL FROM 145 to TOTAL DEPTH.

BORING HN-40D

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BORING LOG

Halliburton NUS

PROJECT: WARMINSTER
PROJECT NO.: 1412
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 5/24/94
FIELD GEOLOGIST: P. Nimmer

BORING NO.: HN-40 D
DRILLER: RAAB

SAMPLE NO. & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY (SAMPLE LENGTH)	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODE	REMARKS
	151.0					GRY-GRN	FG to MG SS		FLOATER CONTINUES Q= 35-38 GPM
	155.0			- - - -		GREEN-GRN	FG SS		FLOATER STOPPED
				Natural					FAST Drilling
	160.0			collapse to 154'		GRY-WHITE	VFG SS / SILTSTONE		
1237	161.0					RED	mudstone / siltstone ?		Sudden color change at bottom of Hole.
				TD = 161'					
							total DEPTH = 161 FE		
							NATURAL COLLAPSE to 154 ft		

REMARKS: Blew hole for 10 MIN. well making 35 + 6PM.
(8) Good Potential Screen interval From 145 ft to 161 ft.
WATER CLEARED IN ~5 MIN.

BORING HN-40 D

PAGE 4 . 4

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-49S
PROJECT NO.: 1412 — DATE: 11/1/94 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA: —
(Date, Time & Conditions)

SAMPLE NO. & TYPE / Time	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1102	2					LT. BRN	SILTY CLAY		DAMP
	4					BRN	SANDY SILT		
	6					RD-BRN	weathered SILTSTONE		DAMP
1111	9								DRY
	12					PINK, BRN-GY	v.f.-f.gr. sandstone		Micaceous; DRY.
1115	14					BRN	f. gr. sandstone		DRY, DUSTY
	16					BRN-GY	f-gr. sandstone		crumbly; rust-stained
	18								DRY, DUSTY
1123	19						v.f. gr. sandstone		harder drilling
	20			6" at 19'		PURPLE, BN-GY	f. gr. sandstone		DRY
1247	24								DRY, DUSTY
	27								DRY
	30					RED-Brown	SILTSTONE		DRY, DUSTY
	32					GY	SILTSTONE		DRY
	34								DUSTY
1315	37					GY	v.f.-f.gr. sandstone		less dust at 37.5 stop drilling: DAMP?
	40								
	42					BRN-GY	v.f.-f. gr. sandstone		possible fx at 41
1328	45								stop drilling to blow out hole = trickle
						BRN-GY	f. gr. sandstone		rust-stained
1331	52								DUSTY

REMARKS I.R. T-4 drilling rig; 10" air hammer to 19'; 6" steel casing to 19'; drill out with 6" hammer to 52'

BORING HN-49S

PAGE 1 OF 1

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER BORING NO.: HN-49I
PROJECT NO.: 1412 DATE: 10/27/94 DRILLER: RAAB
ELEVATION: FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1241	2					LT. BN	CLAYEY SILT		DAMP
	4					MED. BN	SANDY SILT		
	6					BN	SILTY, V.f-gr. SAND, weathered sandstone		MICACEOUS, DAMP
	8					BN	weathered, f. gr. sandstone		
1248	10					RED-BN	weathered SILTSTONE		DRY
1253	16					LT. BN	V.f. - f. gr. sandstone		DRY, DUSTY
	18					RED-GRAY	f. gr. sandstone		DRY
	20								
	22					BRN-GRAY	f. gr. sandstone		DRY, DUSTY
1337	25					RED. GRAY	V.f. - f. gr. sandstone		MICACEOUS, DRY, NO H2O OR EOR
	30								
						RED-BRN	SILTSTONE/MUDSTONE		DRY
						Green-GRAY	SILTSTONE/MUDSTONE		DRY
1344	37								
						LT. GRAY	f. gr. sandstone		DRY, DUSTY
	41								
	43					PINK-GRAY	f. gr. sandstone		DRY, DUSTY
	44					Purple	f. gr. sandstone		
	47					beige	f. gr. sandstone		DRY, DUSTY
1349	50								

REMARKS I.R. T-4 drilling rig; 10" air hammer to 20'; 6" steel casing to 20'; drill out with 6" air hammer to 102'

BORING HN-49I

PAGE 1 OF 2

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 49I
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	52					beige	f. gr. sandstone		DRY, DUSTY
1353	54					LT. BN.	f. gr. sandstone		DRY, DUSTY, RUST-STAINED
	57								DRY, DUSTY
	60					GRAY-BN	f. gr. sandstone		Possible FX
									DRY, DUSTY
1357	66					LT. BN.	f. gr. sandstone, coarser grained		Less DUST at 65, STOP Drilling — blow out hole; < 1 gpm
1409	70					LT. BN-GRAY	f. gr. sandstone		DRIPPING MUD
	74					RED-GRAY	f. gr. sandstone		MOIST CUTTINGS
1418	77								EOR, some water in hole
	80								DRIPPING MUD
	82						LITHOLOGY AS ABOVE		DAMP
						LT. BN, GRAY	f. gr. sandstone, COARSER		SOME DUST
1423	86								
						RED-GRAY	f. gr. sandstone		DAMP, NO DUST
	90								SOME DUST
1433	91								STOP DRILLING TO check YIELD ≈ 1 GPM
	94						LITHOLOGY AS ABOVE		MUD
	95								MOIST CUTTINGS
	100					RED-BROWN	SILTSTONE/MUDSTONE		DAMP
1438	102								EOR; YIELD ~ 2-3 gpm

REMARKS _____

BORING HN-49I

PAGE 2 OF 2

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: NAWC WARMINSTER — BORING NO.: HN-49 D
PROJECT NO.: 1412 — DATE: 10/25/94 — DRILLER: RAAB
ELEVATION: — FIELD GEOLOGIST: D. Whalen
WATER LEVEL DATA (Date, Time & Conditions):

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 5" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	2					MD-BRN TAN	CLAYEY SILT		DAMP
	4					RD-BRN	CLAYEY & SANDY SILT		DRY TO MOIST
1037	6					RD-BRN	v.f.gr. Sand & SILT		MICACEOUS; DAMP
	10				Soft	RD-BRN	Weathered SILTSTONE & MUDSTONE		DRY
1045	14			TOR at 12'		PRP	v.f.gr. to f.gr Sandstone		DRY
	16					RD-BRN	f.gr. sandstone		RUST STAINED; DRY - DUSTY
1053	18					GY-BRN	f. gr. sandstone		
	22			6" at 19'		RD-GY	f.gr. sandstone		RUST STAINED; DRY
					Soft	BRN	f. gr. sandstone		Soft
	25					RD-GY	v.f.-f.gr. Sandstone		DRY, DUSTY
	27				hard	PRP	v.f.-f.gr. Sandstone		
	30								
					Soft		SILTSTONE/MUDSTONE		DRY, DUSTY
1134	34				Soft	Green-GRAY	MUD STONE		DRY, DUSTY
1137	40					LT. GY	f. gr. Sandstone		DRY, DUSTY
	42					RD-GY	v.f. gr. Sandstone		Soft; no DUST; possible FX
	45					RD-GY	v.f.-f.gr. sandstone		DRY, DUSTY
1142	50					TAN	f. gr. sandstone		RUST-STAINED

REMARKS: I.R. T-4 drilling rig; 10" air hammer to 19'; Install 6" steel casing to 19'; drill out with 6" air hammer to 152'.

BORING HN-49

PAGE 1 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 49D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1144	52					RD-GY	f. gr. sandstone		RUST-STAINED; DRY-DUSTY
	54					LT. BRN & GY	f. gr. sandstone		RUST-STAINED; BLOW OUT MIST AFTER EOR
									DRY, DUSTY
	57					RD-BRN	SILTSTONE		Possible Fx
1153	60					TAN	f. gr. sandstone		MORE RUST STAINING
	62					BRN-GY	f. gr. sandstone		DRY, DUSTY
	64					beige	f. gr. sandstone		
1157	66								DRY, DUSTY
						GY-BRN	f. gr. sandstone		RUST STAINS
	70								
1202	72								
						RD-BRN	v.f. gr. sandstone		DRY; Micaceous
	77								EOR; BLOW OUT SOME WATER; << 1 gpm
1211	80								NO DUST
	82					GY	f. gr. sandstone		MOIST
									SOME DUST
	85					LT. GY.	f. gr. sandstone		DAMP
1217	87					PK-GY	f. gr. sandstone		DAMP; SOME DUST
	92					LT. GY	f. gr. sandstone		DRY
						RD-BRN	v.f. gr. sandstone		DAMP; NO DUST
1224	95					RD-GY	v.f.-f. gr. sandstone		NO DUST
	97				Soft	RD-BRN	SILTSTONE		SOFT
	100								DRY

REMARKS _____

BORING HN-49D

PAGE 2 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN 49D
PROJECT NO.: _____ DATE: _____ DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	102					RD-BRN	Siltstone		Yield < 1 gpm
									at EOR
1238	105					RD-BRN	v.f.-f.gr. sandstone		DAMP, no DUST
	110						Lithology as above		
	112					RD-GY	f.gr. sandstone		DAMP, no DUST
	115					RD-BRN	Siltstone/mudstone		DUSTY, DRY
1248	122					RD-BRN	Siltstone		DRY, DUSTY
						& green			
	127			*		Green-GY	f.gr. sandstone		Pick up 3-4 gpm from 122-127
1303	130				&	GY RD-BN	f.gr. sandstone v.f.gr. sandstone		Yield ~ 5 gpm
	132					RD-BRN	Siltstone		MUD; less Q
1305	135								Yield 3-5 gpm
	137					RD-BRN & GRN	Siltstone - v.f.gr. sandstone		
	139								Lignitic film to 141
	142					Green-Gray	f.gr. sandstone		Yield ~ 5 gpm
	145						Lithology as above		
	147					GY	f.gr. sandstone		
1315	152					GY	f.gr. sandstone		Yield ~ 5 gpm

REMARKS _____

BORING HN-49

PAGE 3 OF 3

* See Legend on Back

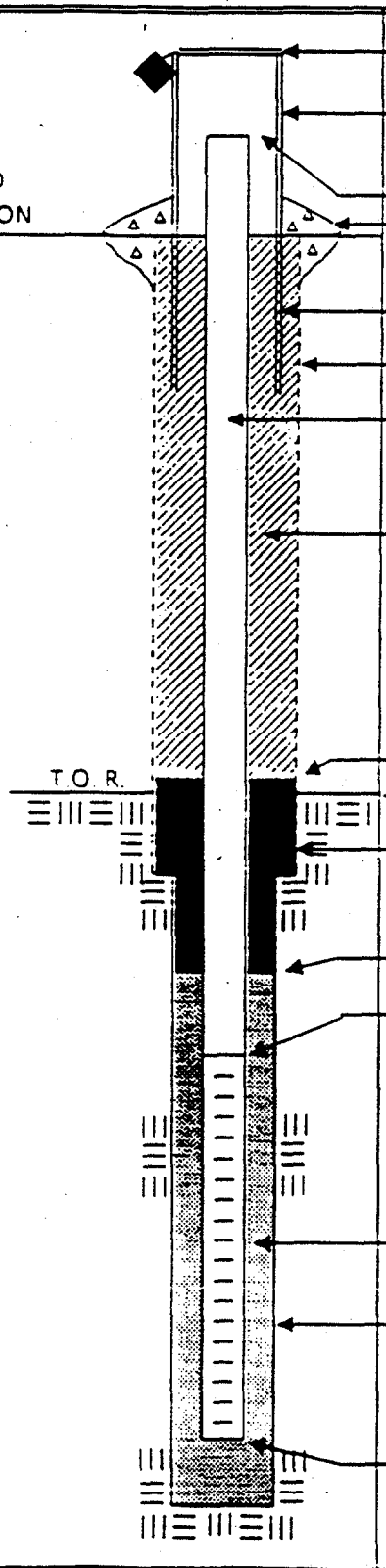
APPENDIX B
WELL CONSTRUCTION DIAGRAMS

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-01I

BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-01I
DATE 12/10/93
DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite
ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 7
TYPE OF SEAL: Bentonite
ELEVATION / DEPTH TOP OF SAND: 68.5
ELEVATION / DEPTH TOP OF SCREEN: 74.5
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 15'
I.D. SCREEN: 4"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 8"
CORE / REAM:
ELEVATION / DEPTH BOTTOM SCREEN: 89.5
ELEVATION / DEPTH BOTTOM OF HOLE: 104
BACKFill with bentonite to 93'

NUS CORPORATION
A Halliburton Company

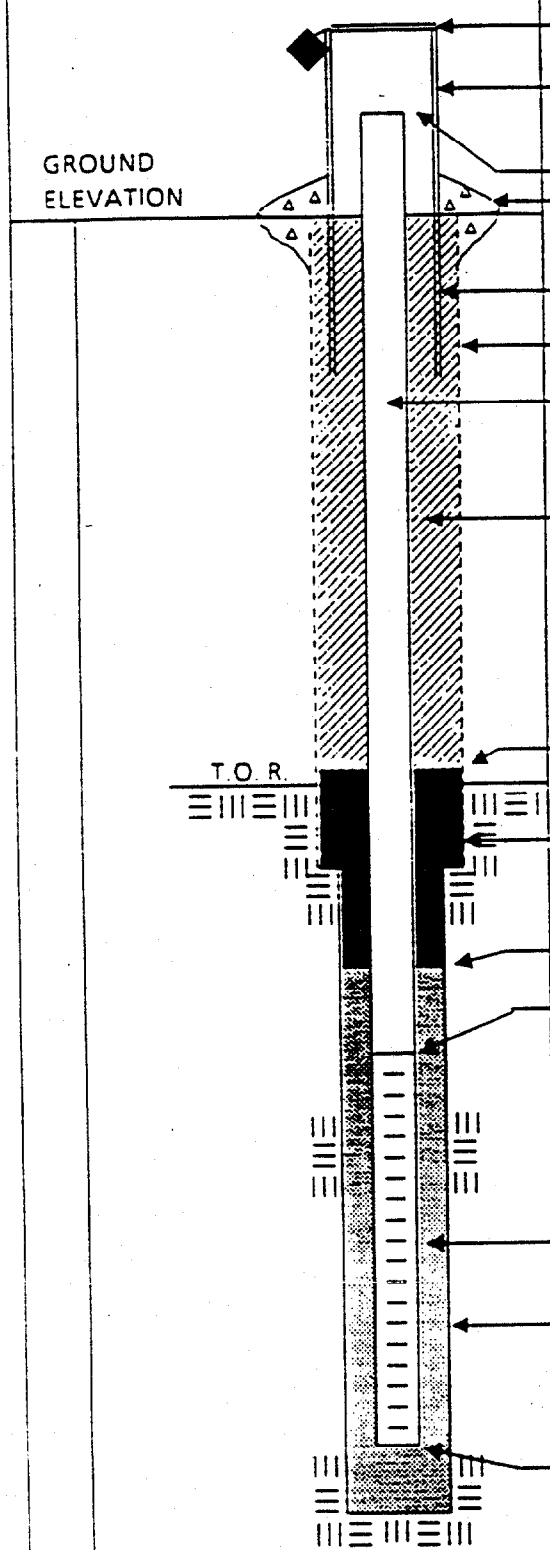
BORING NO.: HN-01D

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER LOCATION
PROJECT NO. BORING HN-01D
ELEVATION DATE 12/10/93
FIELD GEOLOGIST D. Whalen

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 7

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 108.5

ELEVATION / DEPTH TOP OF SCREEN: 113

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" X 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 123

ELEVATION / DEPTH BOTTOM OF HOLE: 154.5

BACKFILL w/ Bentonite TO 127'

NUS CORPORATION
A Halliburton Company

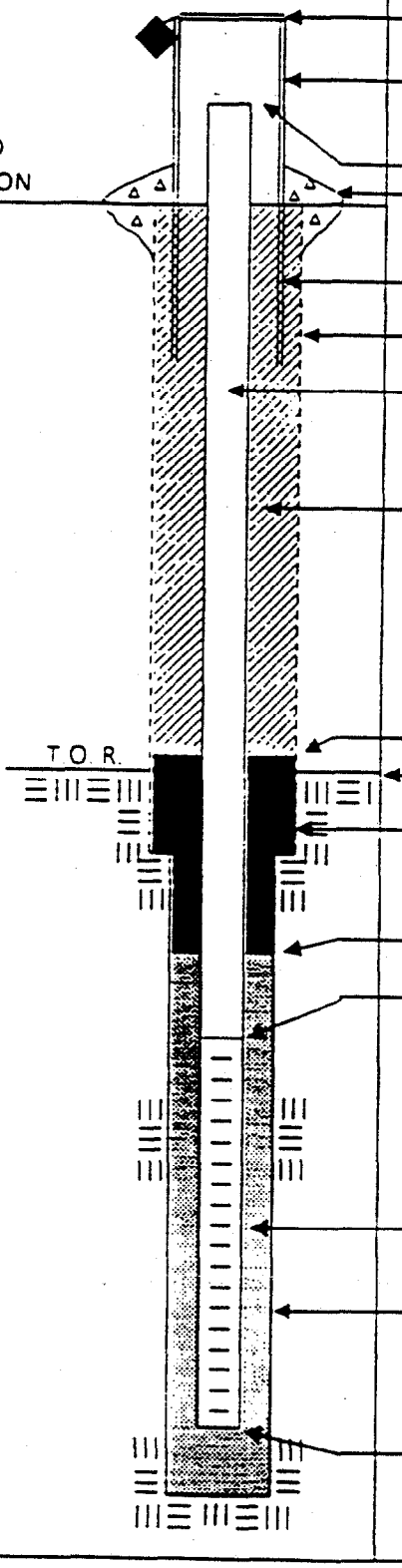
BORING NO.: HN-02I

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-02I
DATE 12/6/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 9
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 85
ELEVATION / DEPTH TOP OF SCREEN: 87
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 10'
I.D. SCREEN: 4"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 8"
CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 97
ELEVATION / DEPTH BOTTOM OF HOLE: 104

NUS CORPORATION
A Halliburton Company

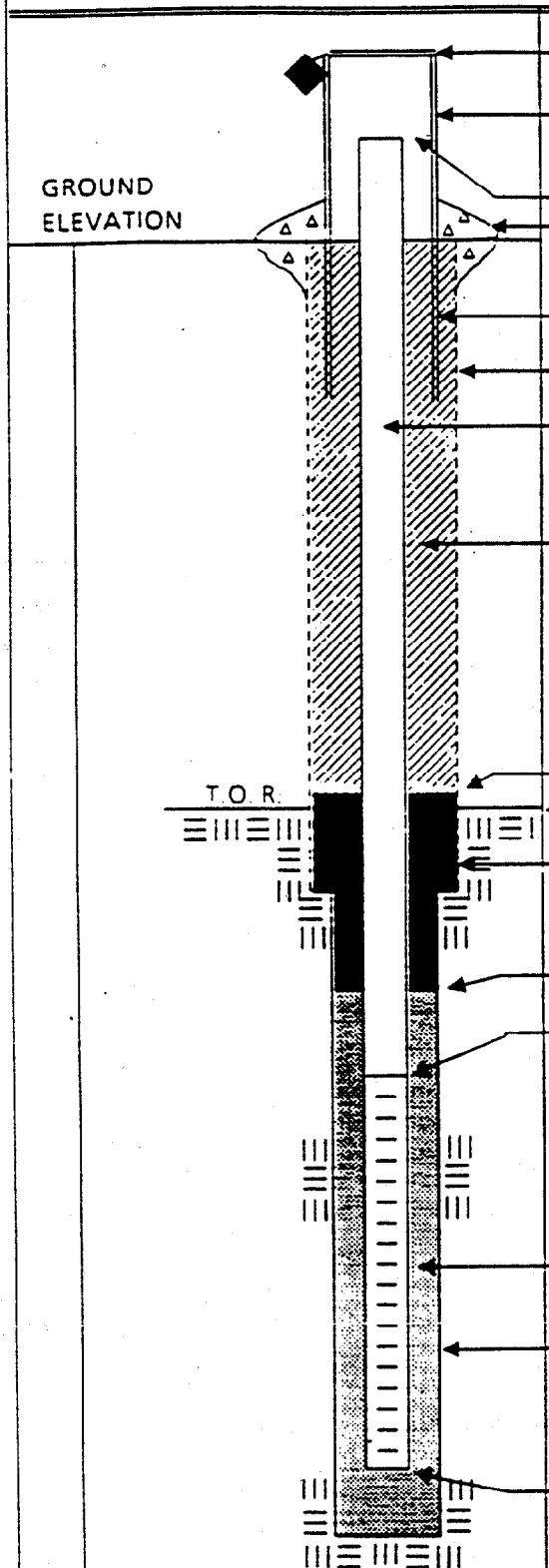
BORING NO.: HN-02D

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER LOCATION
PROJECT NO. BORING HN-02D
ELEVATION DATE 12/3/93
FIELD GEOLOGIST D. Whalen

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 9

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 116

ELEVATION / DEPTH TOP OF SCREEN: 123

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 133

ELEVATION / DEPTH BOTTOM OF HOLE: 153

BACKFill w/ bentonite TO 136'

NUS CORPORATION
A Halliburton Company

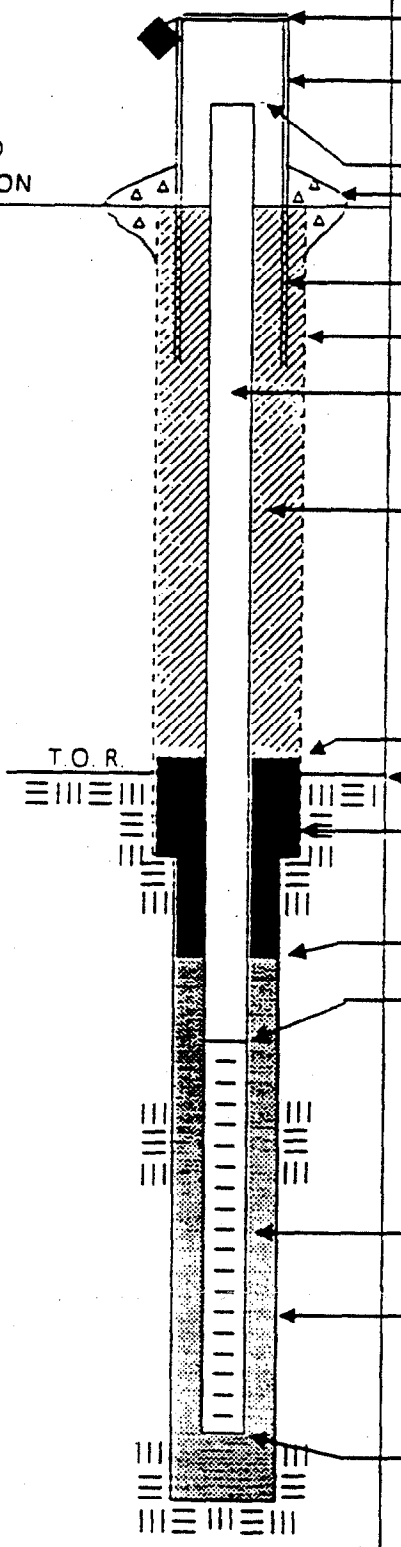
BORING NO.: HN-03I

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-03I
DATE 12/27/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 3
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 81
ELEVATION / DEPTH TOP OF SCREEN: 85
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" X 10'
I.D. SCREEN: 4"
TYPE OF SAND PACK: NO. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 8"
CORE / REAM:
ELEVATION / DEPTH BOTTOM SCREEN: 95
ELEVATION / DEPTH BOTTOM OF HOLE: 102

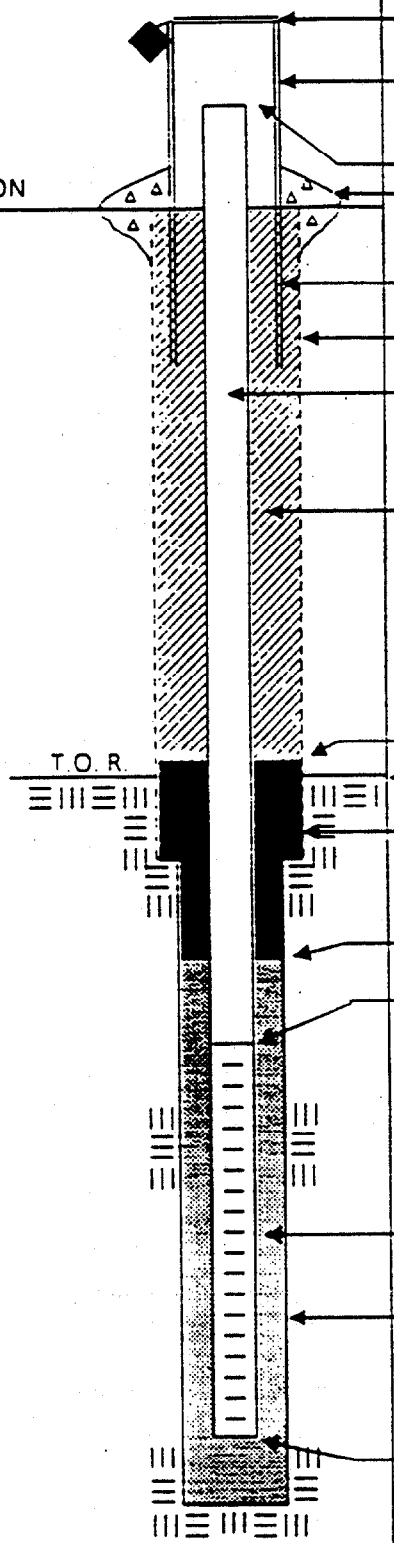
NUS CORPORATION
A Halliburton Company

BORING NO.: HN-03D

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER LOCATION
PROJECT NO. BORING HN-03D
ELEVATION DATE 12/27/93
FIELD GEOLOGIST D. Whalen

DRILLER RAAB
DRILLING METHOD Air Hammer
DEVELOPMENT METHOD Sub. Pump



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 3
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 115
ELEVATION / DEPTH TOP OF SCREEN: 130
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 5'
I.D. SCREEN: 4"
TYPE OF SAND PACK: No. 2 Morie Equiv.
DIAMETER OF HOLE IN BEDROCK: 8"
CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 135
ELEVATION / DEPTH BOTTOM OF HOLE: 162

Backfill w/ bentonite to 140'

NUS CORPORATION
A Halliburton Company

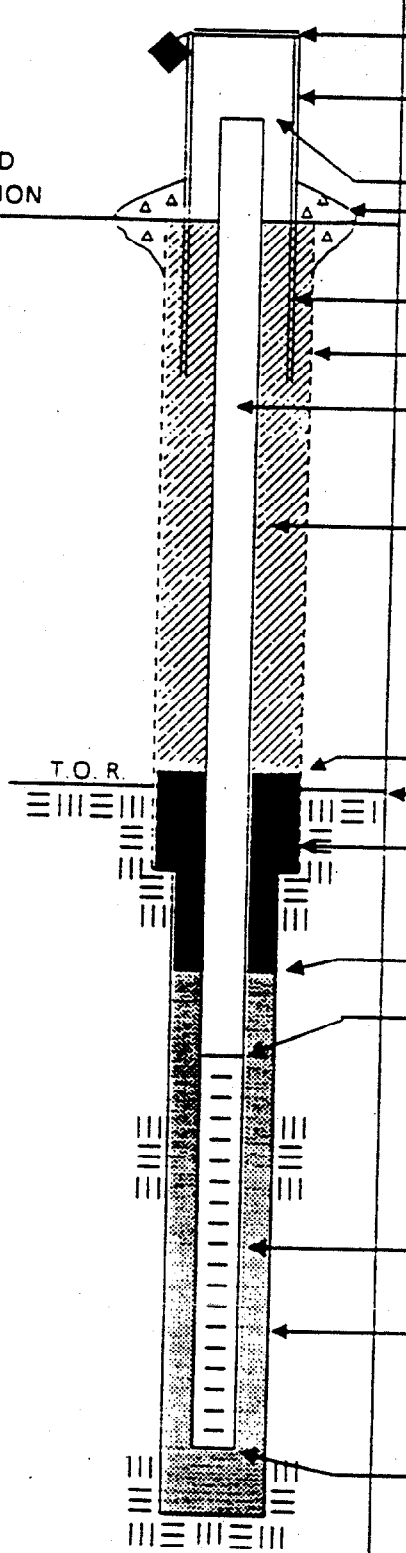
BORING NO.: HN-04 S

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-04 S
DATE 12/17/93

DRILLER RAAB
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Sub. Pump



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 6

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 20

ELEVATION / DEPTH TOP OF SCREEN: 25

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 35

ELEVATION / DEPTH BOTTOM OF HOLE: 37

NUS CORPORATION
A Halliburton Company

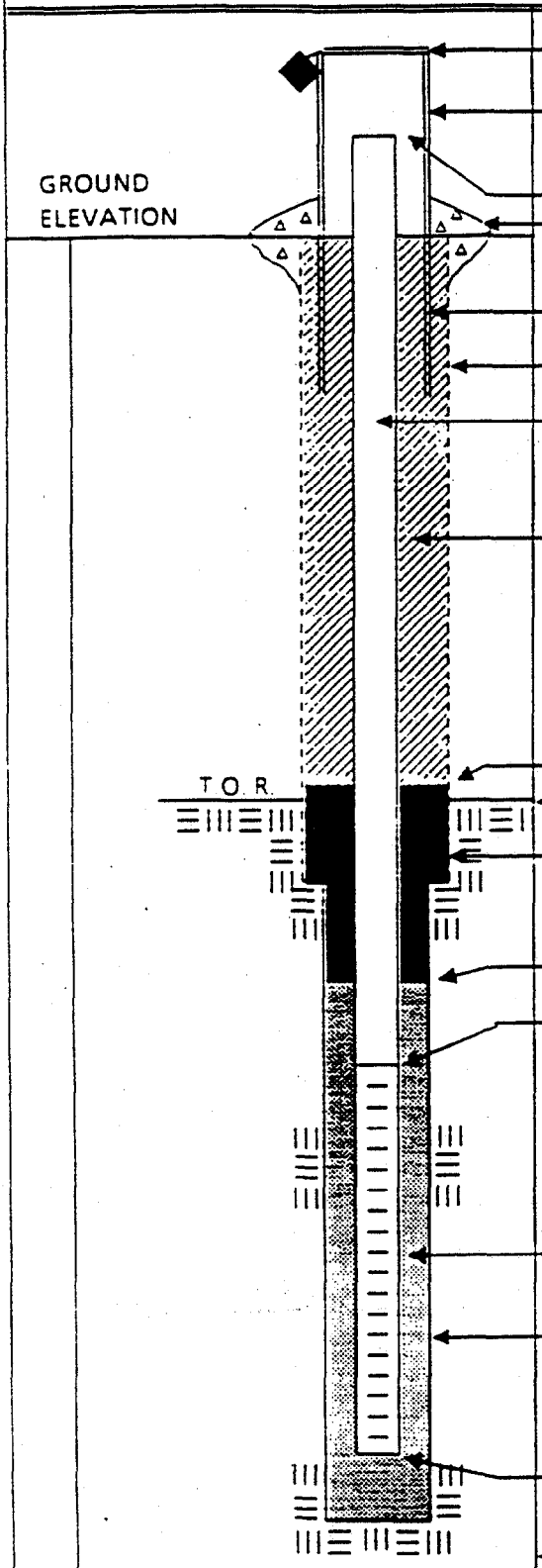
BORING NO.: HN-04I

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-04I
DATE 12/22/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 6

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 55

ELEVATION / DEPTH TOP OF SCREEN: 60

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 70

ELEVATION / DEPTH BOTTOM OF HOLE: 104

Backfill w/ bentonite to 73

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-04 D

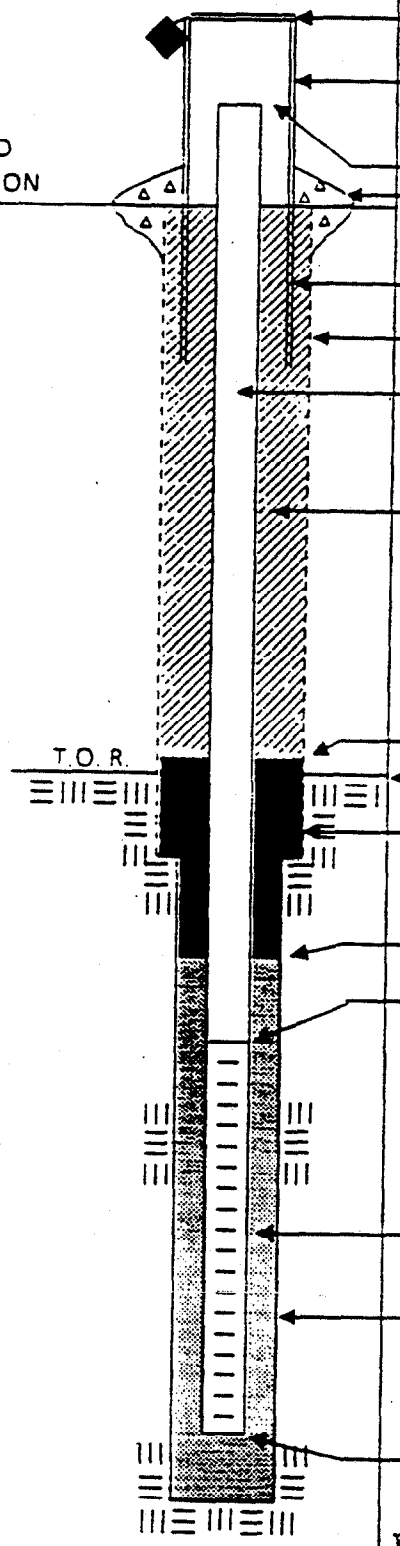
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-04 D
DATE 12/17/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 6

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 105

ELEVATION / DEPTH TOP OF SCREEN: 108

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" X 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 118

ELEVATION / DEPTH BOTTOM OF HOLE: 179

Backfill w/ bentonite to 124'

BORING NO.: HN-05S

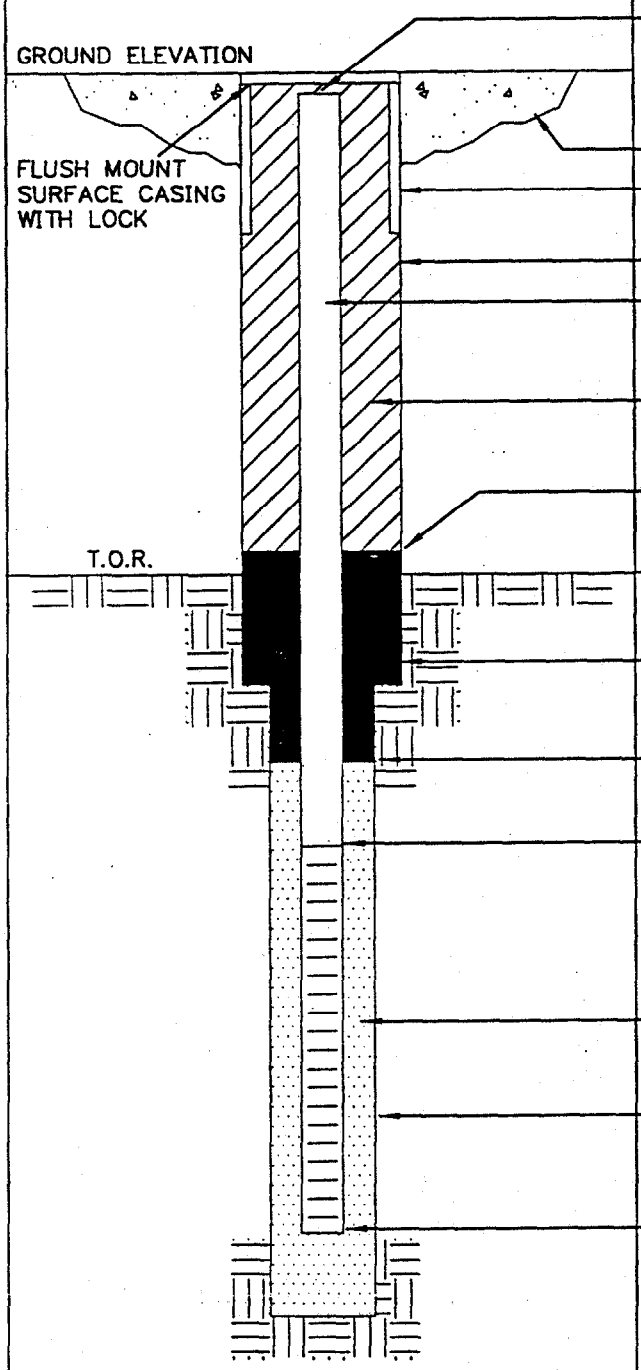
Halliburton NUS CORPORATION

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. WHALEN

LOCATION
BORING HN-05S
DATE 12/7/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement
TYPE OF PROTECTIVE CASING: STEEL
I.D. OF PROTECTIVE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: SCHED 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION/DEPTH TOP OF SEAL:

ELEVATION/DEPTH TOP OF BEDROCK: 7

TYPE OF SEAL: Bentonite

ELEVATION/DEPTH TOP OF SAND: 36

ELEVATION/DEPTH TOP OF SCREEN 41
TYPE OF SCREEN: SCHED 40 PVC
SLOT SIZE x LENGTH: 0.020" X 10'
I.D. SCREEN: 4"

TYPE OF SAND PACK: NO. 2 MORIE EQUIV.

DIAMETER OF HOLE IN BEDROCK: 8"

ELEVATION/DEPTH BOTTOM SCREEN: 51
ELEVATION/DEPTH BOTTOM HOLE: 55

ACAD: C:\JEFF.DWG 06/14/94 TD

BORING NO.: HN-05I

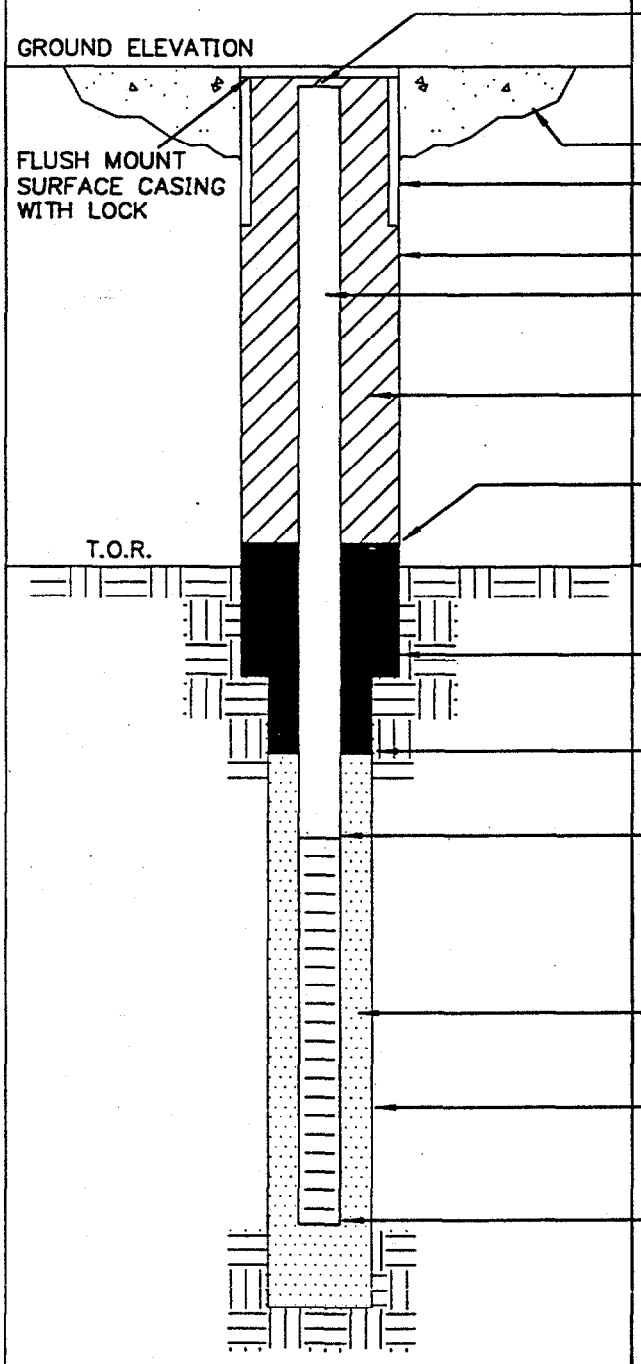
Halliburton NUS CORPORATION

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. WHALEN

LOCATION
BORING HN-05 I
DATE 12/8/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement

TYPE OF PROTECTIVE CASING: STEEL
I.D. OF PROTECTIVE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: SCHED 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION/DEPTH TOP OF SEAL:

ELEVATION/DEPTH TOP OF BEDROCK: 7

TYPE OF SEAL: Bentonite

ELEVATION/DEPTH TOP OF SAND: 70

ELEVATION/DEPTH TOP OF SCREEN: 74
TYPE OF SCREEN: SCHED 40 PVC
SLOT SIZE x LENGTH: 0.020" X 10'
I.D. SCREEN: 4"

TYPE OF SAND PACK: NO. 2 MORIE EQUIV.

DIAMETER OF HOLE IN BEDROCK: 8"

ELEVATION/DEPTH BOTTOM SCREEN: 84
ELEVATION/DEPTH BOTTOM HOLE: 154

Backfill w/ bentonite TO 88'

ACAD: C:JEFF.DWG 06/14/94 TD

BORING NO.: HN-05D

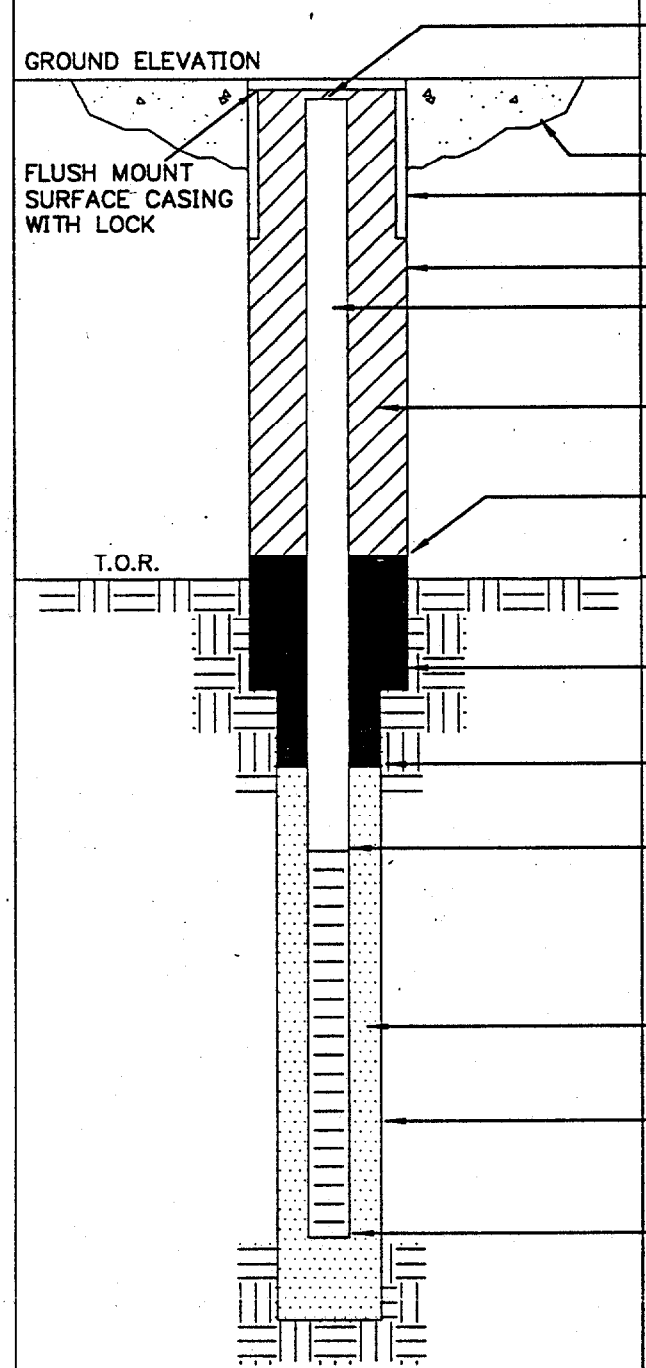
Halliburton NUS CORPORATION

BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. WHALEN

LOCATION
BORING HN-05D
DATE 12/7/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement

TYPE OF PROTECTIVE CASING: Steel
I.D. OF PROTECTIVE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION/DEPTH TOP OF SEAL:

ELEVATION/DEPTH TOP OF BEDROCK: 7

TYPE OF SEAL: Bentonite

ELEVATION/DEPTH TOP OF SAND: 180

ELEVATION/DEPTH TOP OF SCREEN 183
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" X 15'
I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie Equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

ELEVATION/DEPTH BOTTOM SCREEN: 198
ELEVATION/DEPTH BOTTOM HOLE: 204

ACAD: C:JEFF.DWG 06/14/94 TD

NUS CORPORATION
A Halliburton Company

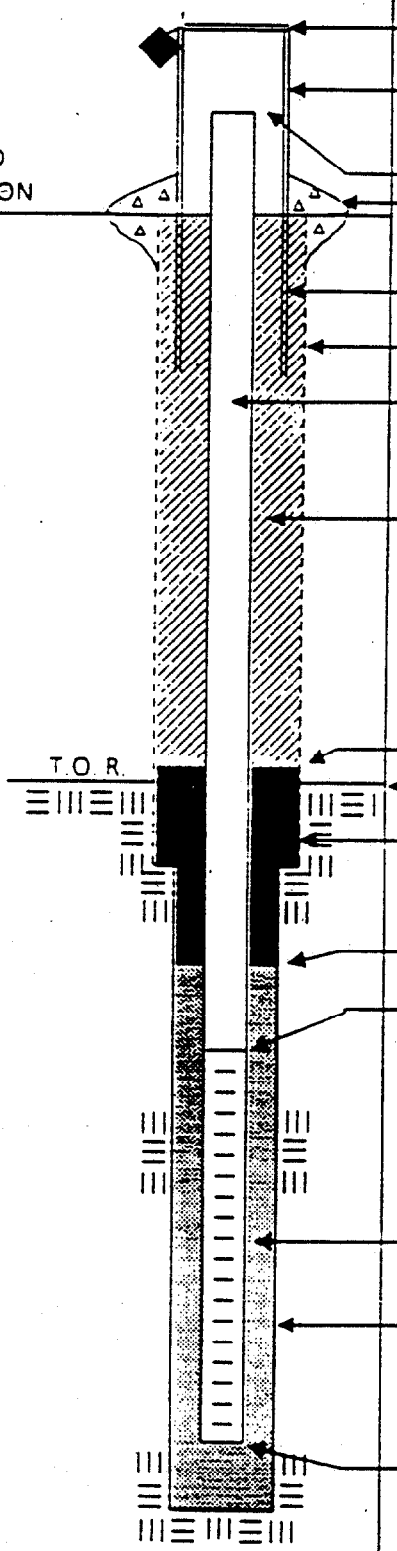
BORING NO.: HN-06S

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-06S
DATE 12/9/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB. PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 8

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 30

ELEVATION / DEPTH TOP OF SCREEN: 36

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 15'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie Equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 51

ELEVATION / DEPTH BOTTOM OF HOLE: 53

NUS CORPORATION
A Halliburton Company

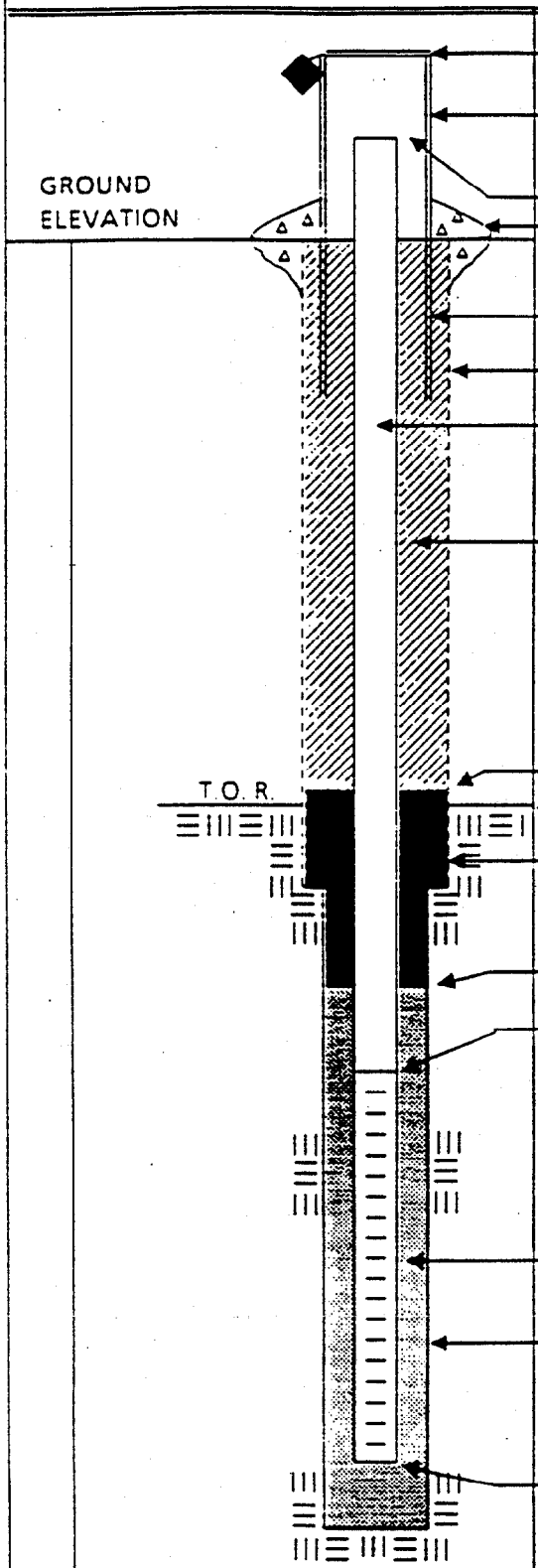
BORING NO.: HN-06I

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT: NAWC Warminster
PROJECT NO.:
ELEVATION:
FIELD GEOLOGIST: D. Whalen
LOCATION:
BORING: HN-06I
DATE: 12/9/93

DRILLER: RAAB
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 8

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 80

ELEVATION / DEPTH TOP OF SCREEN: 85

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 15'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 100

ELEVATION / DEPTH BOTTOM OF HOLE: 103

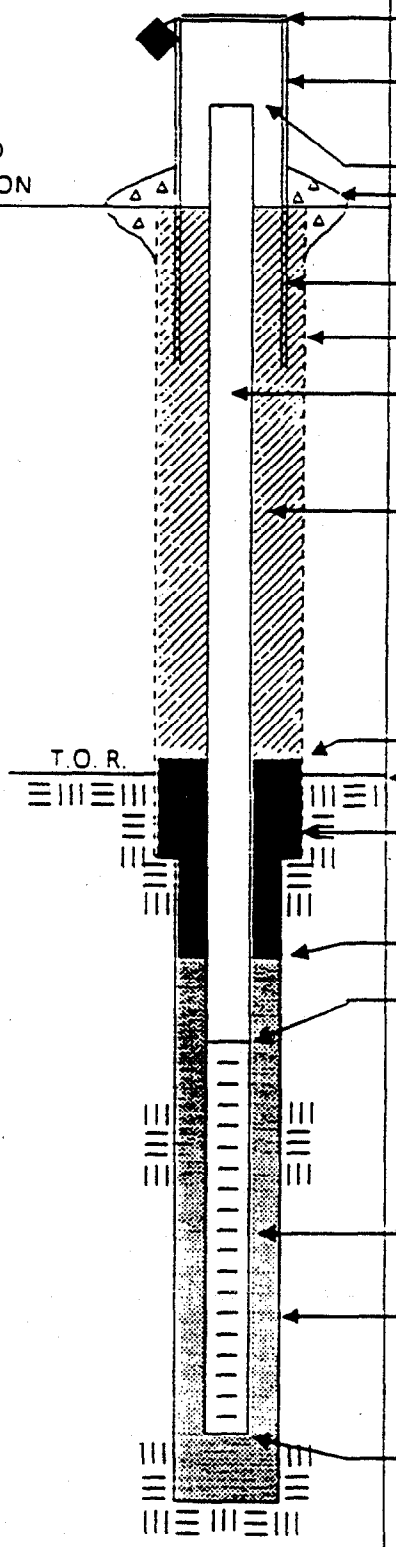
NUS CORPORATION
A Halliburton Company

BORING NO.: HN-06D

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT Naw Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-06D
DATE 12/13/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 8
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 134
ELEVATION / DEPTH TOP OF SCREEN: 136
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 15'
I.D. SCREEN: 4"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 8"
CORE / REAM:
ELEVATION / DEPTH BOTTOM SCREEN: 151
ELEVATION / DEPTH BOTTOM OF HOLE: 154

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-07S

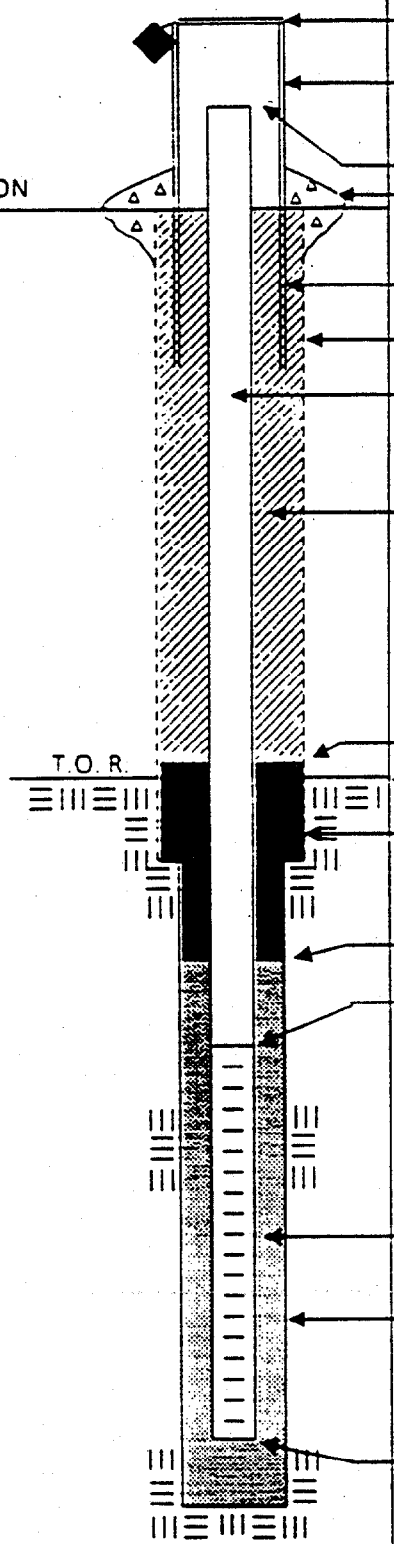
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT: NAWC Warminster
PROJECT NO.:
ELEVATION:
FIELD GEOLOGIST: D. Whalen

LOCATION:
BORING: HN-07S
DATE: 12/9/93

DRILLER: RAAB
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 5

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 29

ELEVATION / DEPTH TOP OF SCREEN: 35

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 45

ELEVATION / DEPTH BOTTOM OF HOLE: 45

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-07I

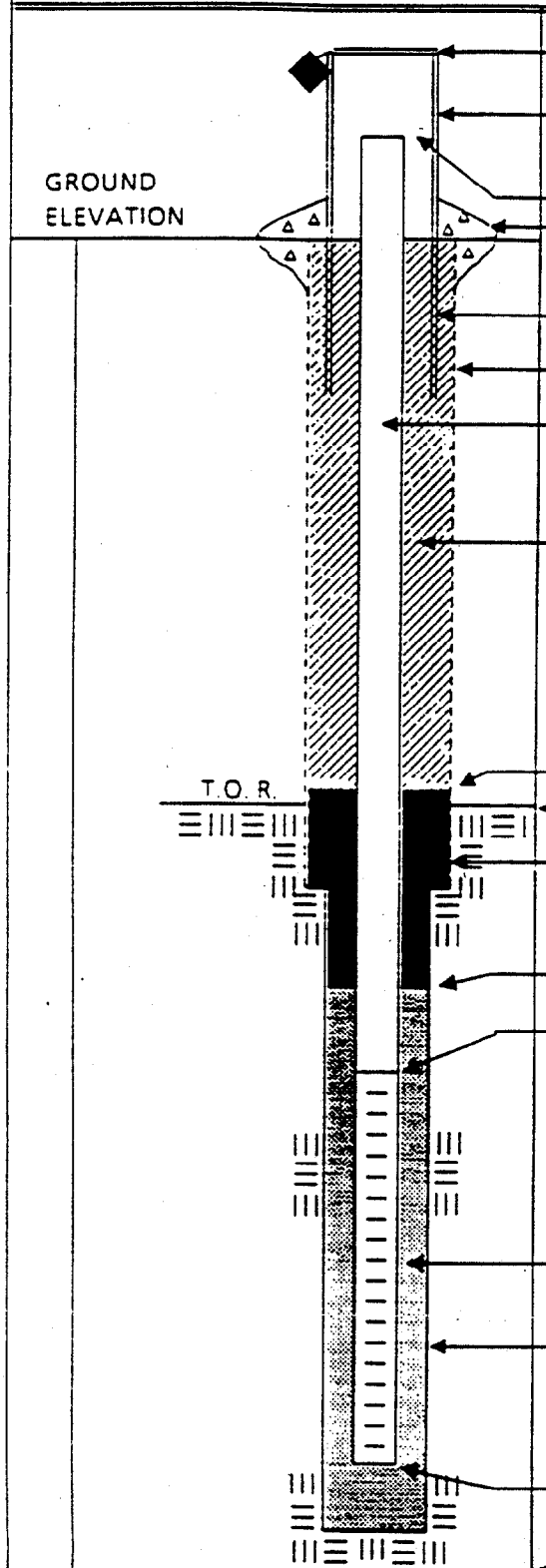
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-07I
DATE 12/9/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 5

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 64

ELEVATION / DEPTH TOP OF SCREEN: 69

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 79

ELEVATION / DEPTH BOTTOM OF HOLE: 103

Backfill w/ bentonite to 85'

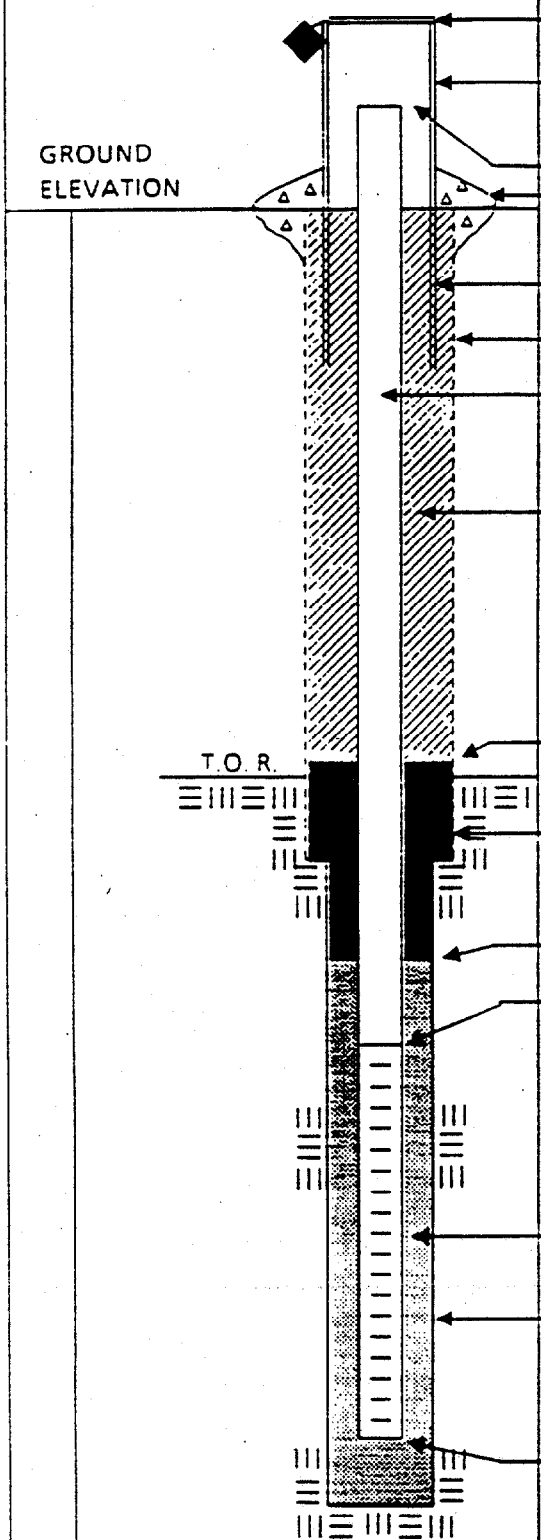
NUS CORPORATION
A Halliburton Company

BORING NO.: HN-07D

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-07D
DATE 3/23/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 5
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 144
ELEVATION / DEPTH TOP OF SCREEN: 149
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" X 10'
I.D. SCREEN: 4"
TYPE OF SAND PACK: NO. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 8"
CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 159
ELEVATION / DEPTH BOTTOM OF HOLE: 204
Backfill w/ bentonite to 165'

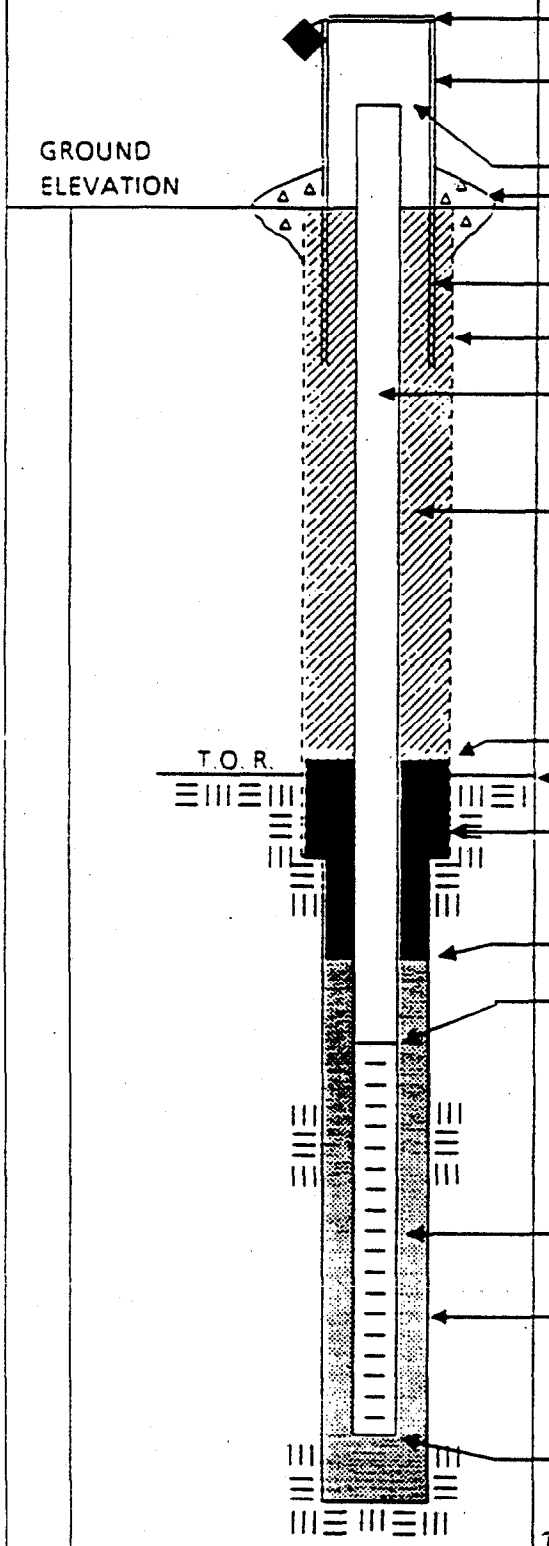
NUS CORPORATION
A Halliburton Company

BORING NO.: HN-08S

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-08S
DATE 12/8/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 8
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 24
ELEVATION / DEPTH TOP OF SCREEN: 29
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 15'
I.D. SCREEN: 4"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 8"
CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 44
ELEVATION / DEPTH BOTTOM OF HOLE: 54

Backfill w/ bentonite to 48'

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-08I

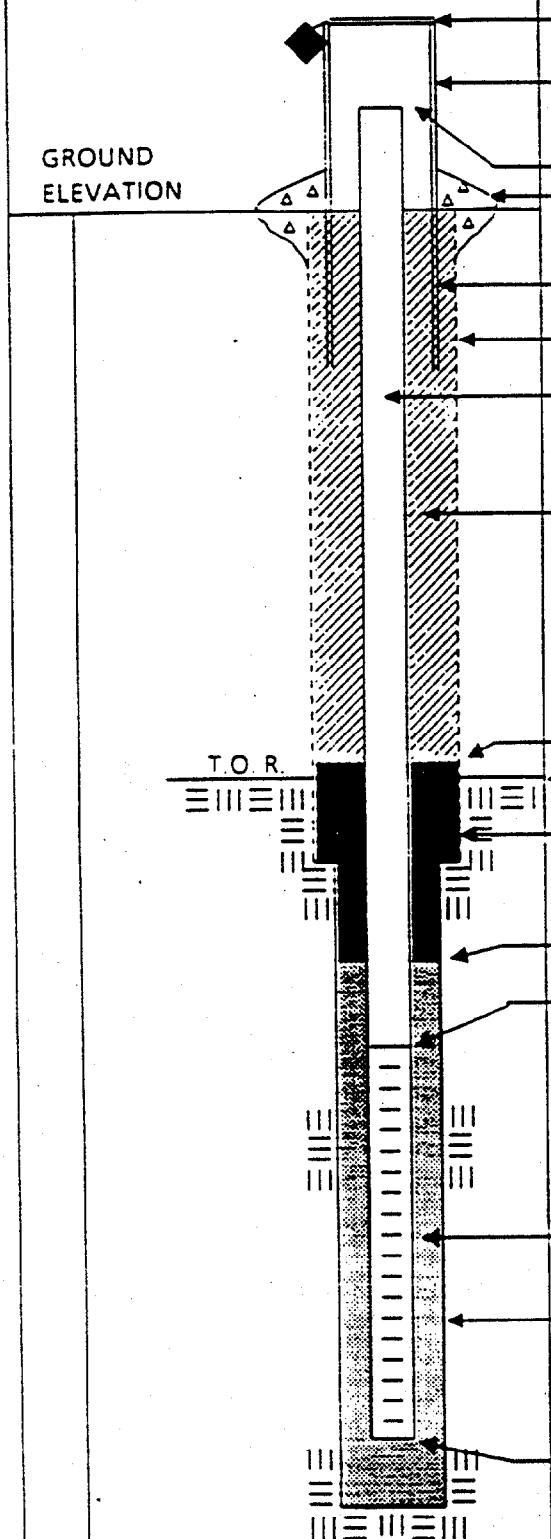
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-08I
DATE 12/8/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 8

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 60

ELEVATION / DEPTH TOP OF SCREEN: 65

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 75

ELEVATION / DEPTH BOTTOM OF HOLE: 78

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-08D

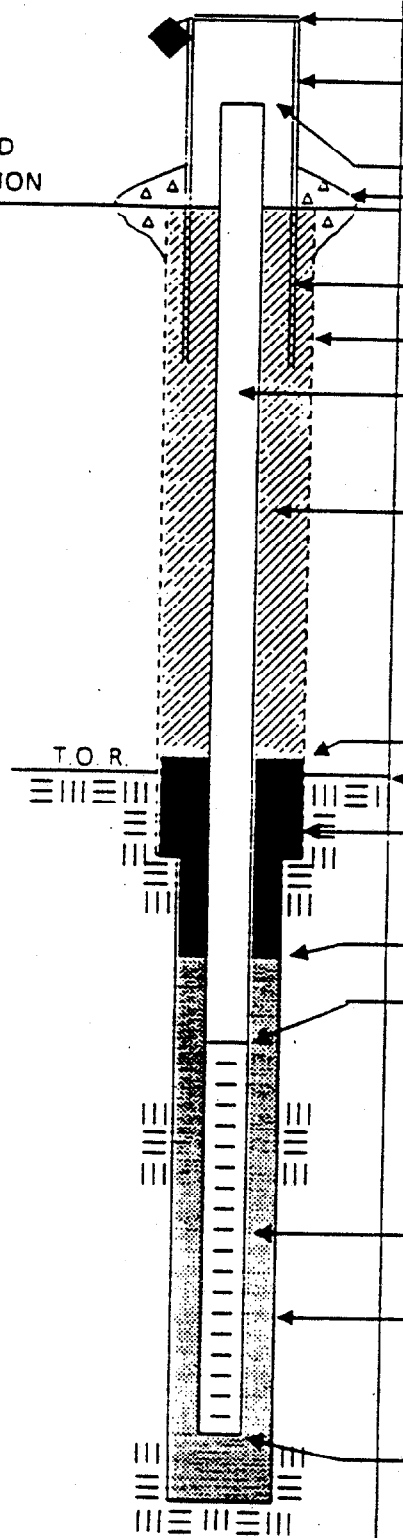
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-08D
DATE 12/16/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 8

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 157

ELEVATION / DEPTH TOP OF SCREEN: 162

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 15'

I.D. SCREEN: 4"

TYPE OF SAND PACK: NO. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 177

ELEVATION / DEPTH BOTTOM OF HOLE: 178

NUS CORPORATION
A Halliburton Company

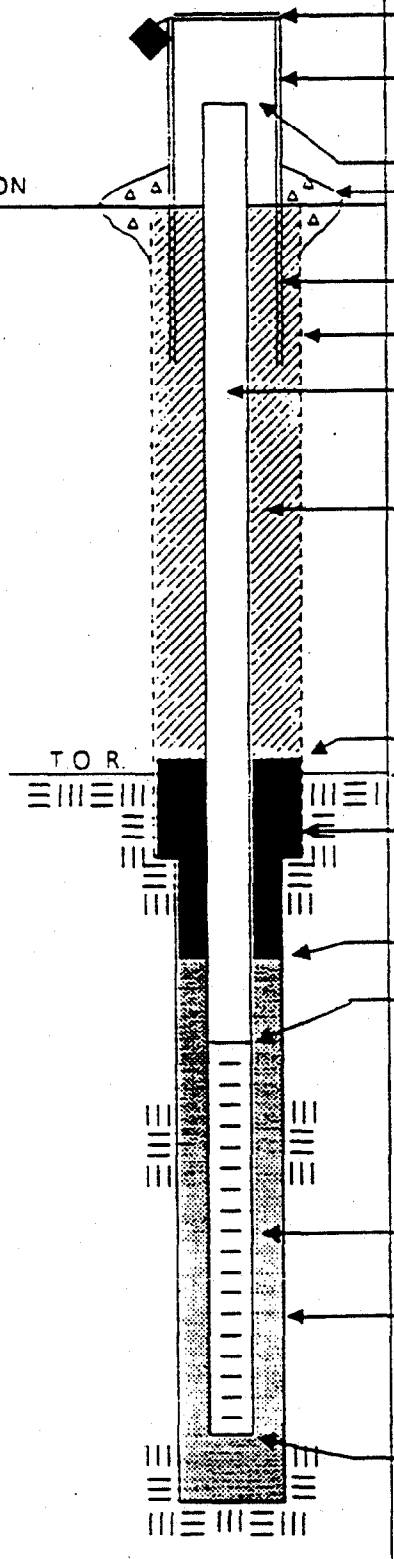
BORING NO.: HN-09 S

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-09 S
DATE 12/22/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: SCHED 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 8

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 29

ELEVATION / DEPTH TOP OF SCREEN: 36

TYPE OF SCREEN: SCHED 40 PVC

SLOT SIZE x LENGTH: 0.020" X 15'

I.D. SCREEN: 4"

TYPE OF SAND PACK: NO. 2 MORIE equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 51

ELEVATION / DEPTH BOTTOM OF HOLE: 52

NUS CORPORATION
A Halliburton Company

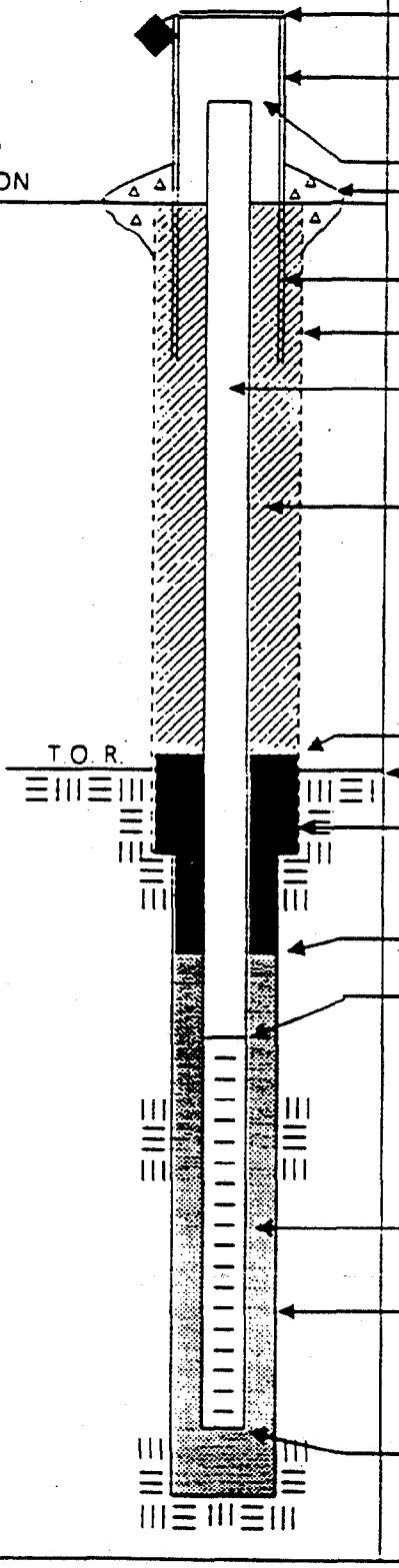
BORING NO.: HN-09I

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-09I
DATE 12/22/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8"
DIAMETER OF HOLE: 12"
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 8
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 75
ELEVATION / DEPTH TOP OF SCREEN: 80
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 15'
I.D. SCREEN: 4"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 8"
CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 95
ELEVATION / DEPTH BOTTOM OF HOLE: 103

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-09D

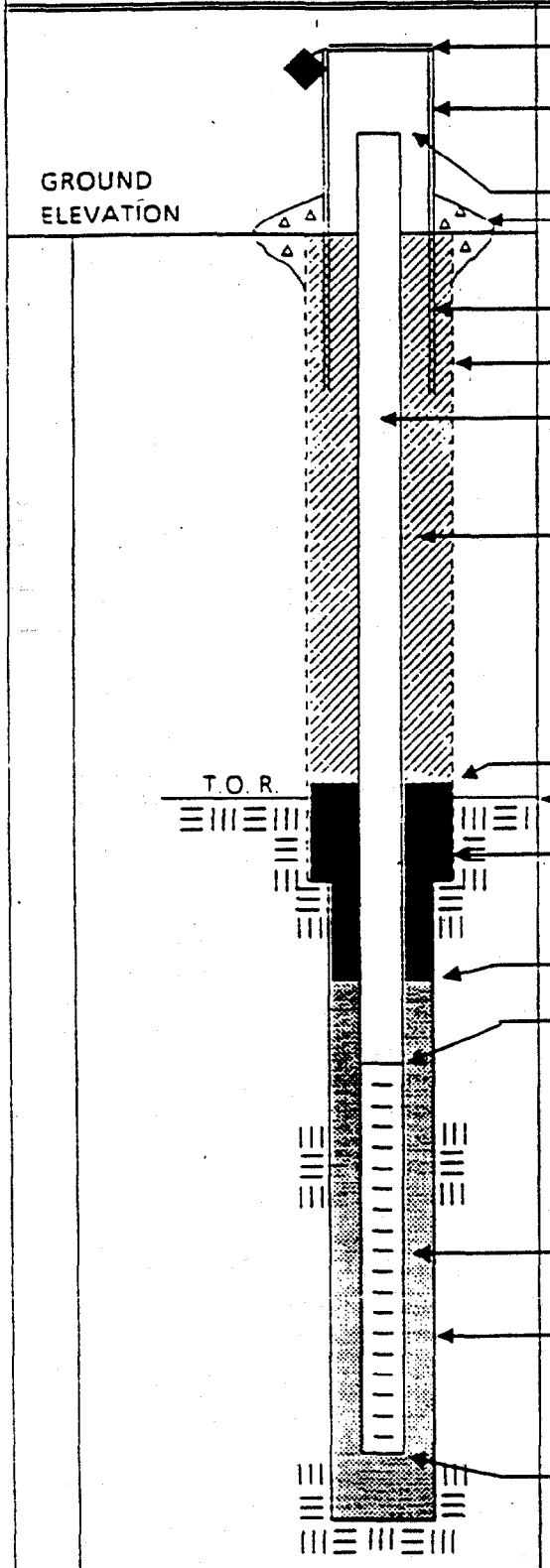
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-09D
DATE 12/14/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 8

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 138

ELEVATION / DEPTH TOP OF SCREEN: 143

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 15'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 158

ELEVATION / DEPTH BOTTOM OF HOLE: 202

Backfill w/ Bentonite to 161'

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-10S

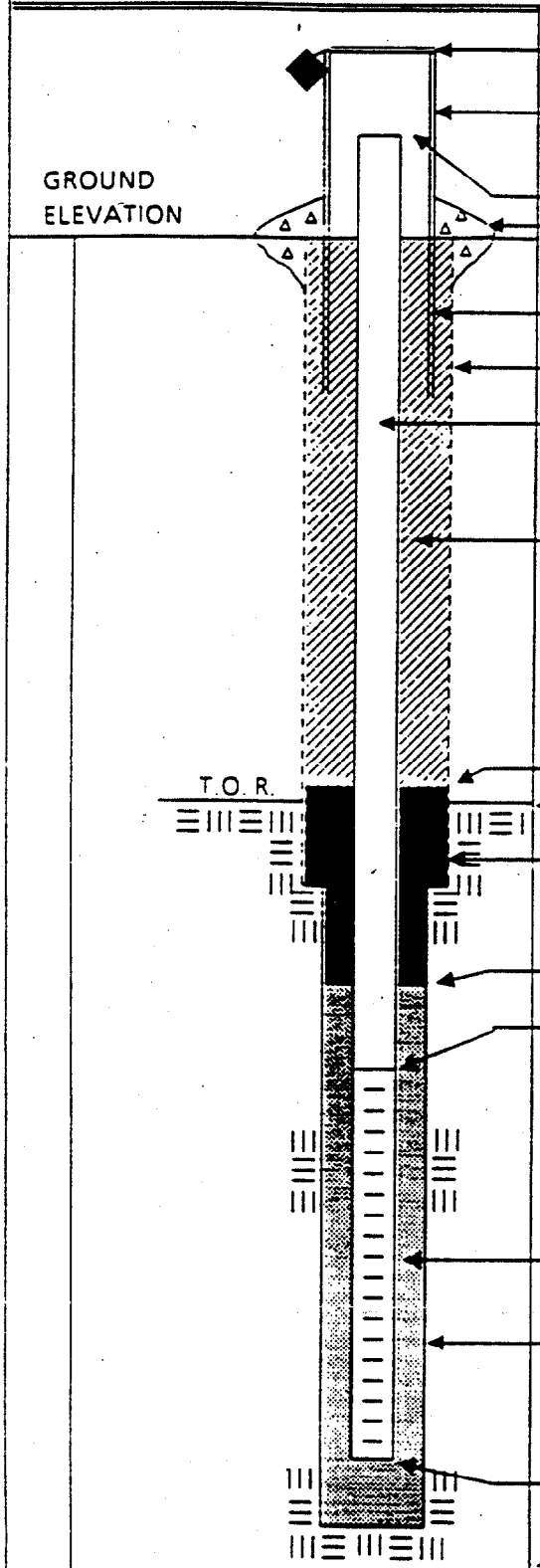
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-10S
DATE 12/20/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: SCHED 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 6

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 26

ELEVATION / DEPTH TOP OF SCREEN: 28

TYPE OF SCREEN: SCHED 40 PVC

SLOT SIZE x LENGTH: 0.020" X 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: NO. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 38

ELEVATION / DEPTH BOTTOM OF HOLE: 54

Backfill w/ Bentonite to 40'

NUS CORPORATION
A Halliburton Company

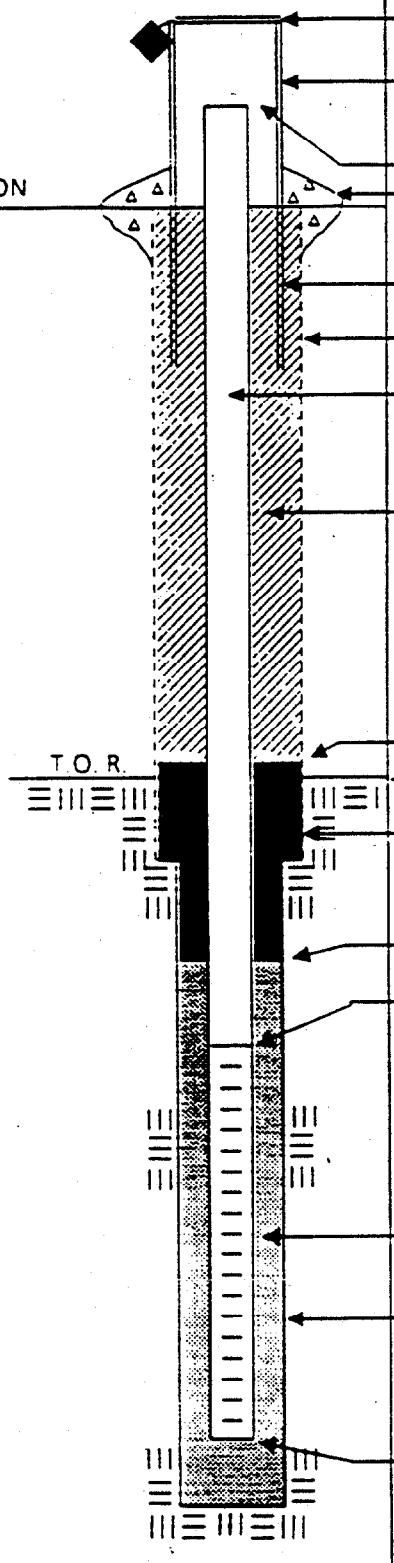
BORING NO.: HN-10I

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-10I
DATE 12/20/93

DRILLER RAAB
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Sub Pump



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 6

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 80

ELEVATION / DEPTH TOP OF SCREEN: 82

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 15'

I.D. SCREEN: 4"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 97

ELEVATION / DEPTH BOTTOM OF HOLE: 112

Backfill w/ bentonite to 101'

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-10D

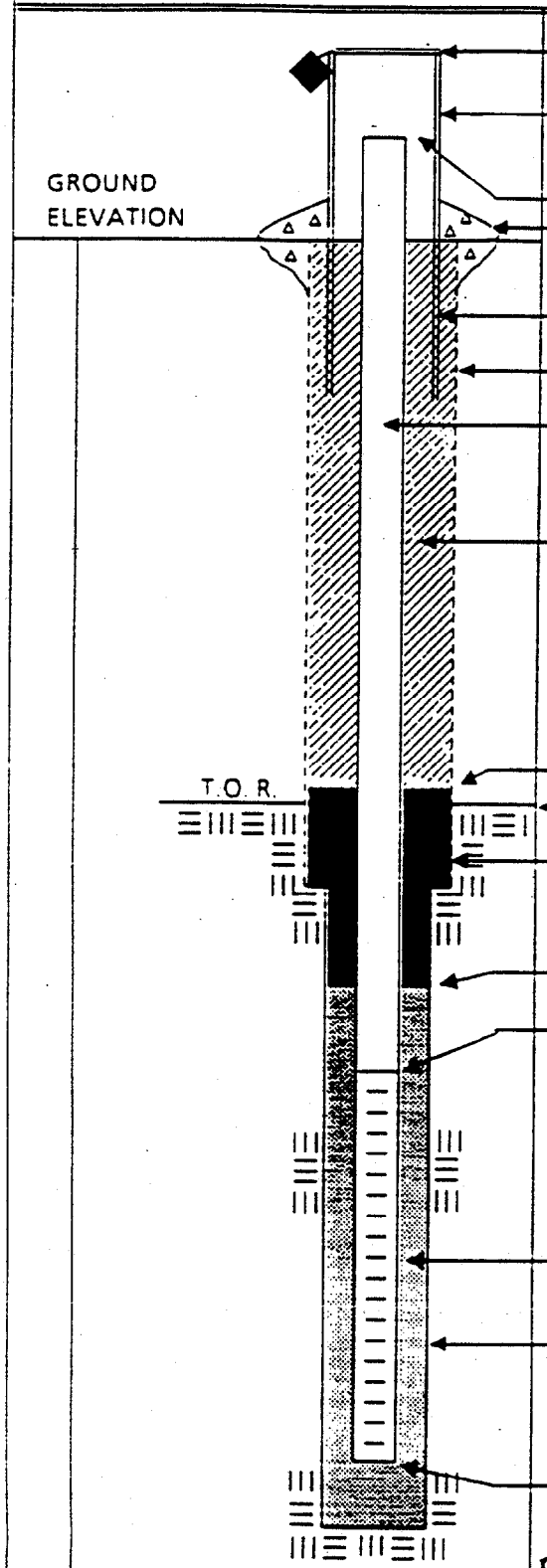
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-10D
DATE 12/20/93

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8"

DIAMETER OF HOLE: 12"

RISER PIPE I.D.: 4"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 6

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 225

ELEVATION / DEPTH TOP OF SCREEN: 229

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 4"

TYPE OF SAND PACK: NO. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 8"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 239

ELEVATION / DEPTH BOTTOM OF HOLE: 254

Backfill w/ bentonite to 245'

Halliburton NUS CORPORATION

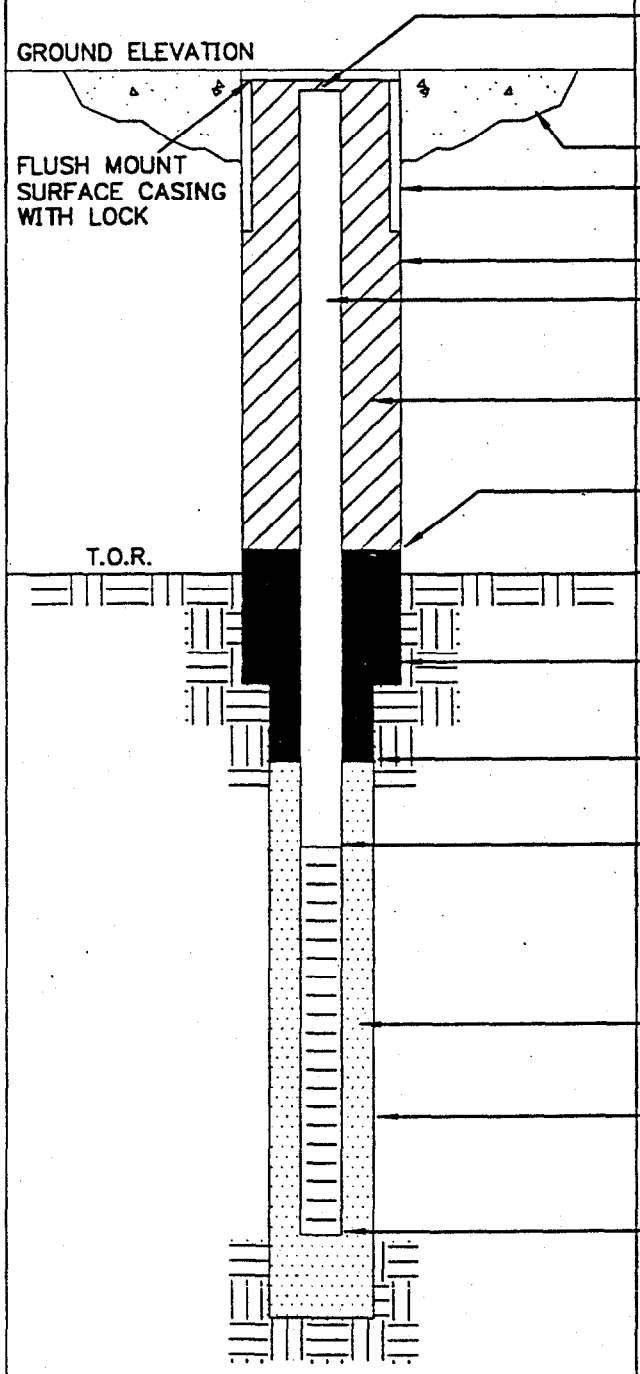
BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

BORING NO.: HN-35S
HN35S & I constructed in same borehole

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-35S
DATE

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement

TYPE OF PROTECTIVE CASING: Steel
I.D. OF PROTECTIVE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION/DEPTH TOP OF SEAL:

ELEVATION/DEPTH TOP OF BEDROCK: 7

TYPE OF SEAL: Bentonite

ELEVATION/DEPTH TOP OF SAND: 35

ELEVATION/DEPTH TOP OF SCREEN: 38
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" X 10'
I.D. SCREEN: 2"

TYPE OF SAND PACK: Pea Gravel

DIAMETER OF HOLE IN BEDROCK: 6"

ELEVATION/DEPTH BOTTOM SCREEN: 48
ELEVATION/DEPTH BOTTOM HOLE: 106

Sand pack extends to 52'
Bentonite seal to 87'
HN-35I constructed below.

ACAD: C:JEFF.DWG 06/14/94 TD

Halliburton NUS CORPORATION

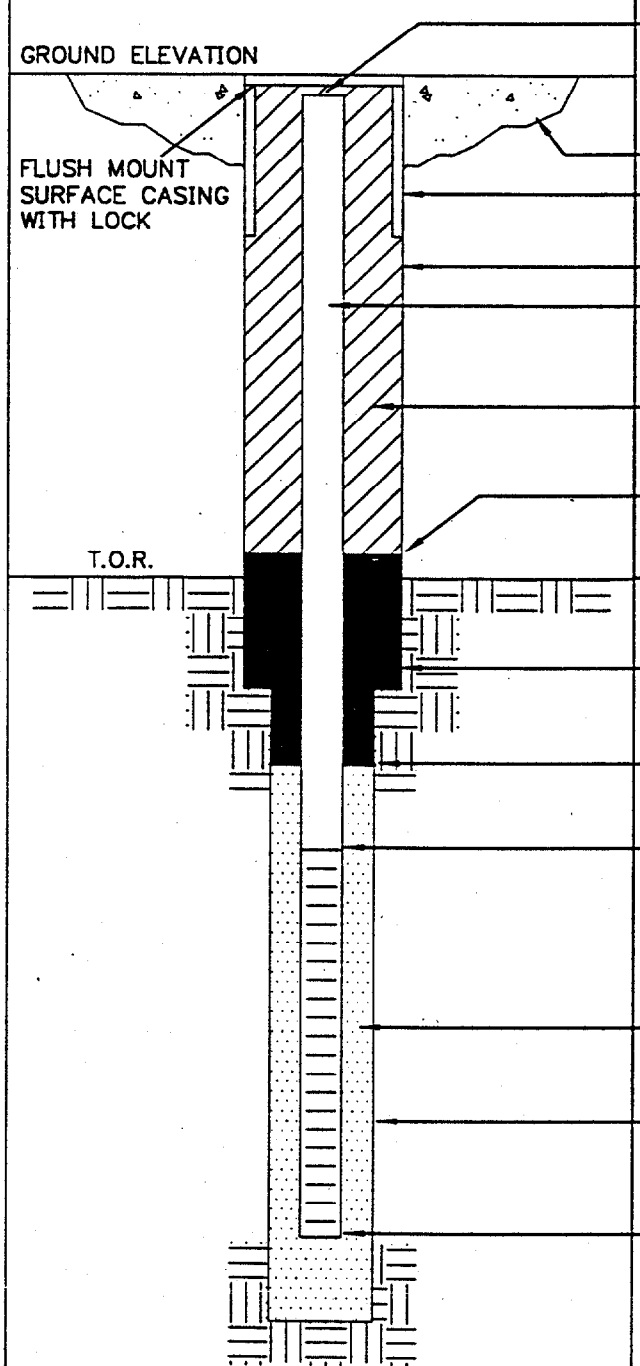
BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

BORING NO.: HN-35I
HN-35S & I constructed in same borehole

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-35I
DATE

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement

TYPE OF PROTECTIVE CASING: Steel
I.D. OF PROTECTIVE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION/DEPTH TOP OF SEAL: 87

ELEVATION/DEPTH TOP OF BEDROCK: 7

TYPE OF SEAL: Bentonite

ELEVATION/DEPTH TOP OF SAND: 87

ELEVATION/DEPTH TOP OF SCREEN: 91
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" X 10'
I.D. SCREEN: 2"

TYPE OF SAND PACK: Pea Gravel

DIAMETER OF HOLE IN BEDROCK: 6"

ELEVATION/DEPTH BOTTOM SCREEN: 101
ELEVATION/DEPTH BOTTOM HOLE: 106

ACAD: C:JEFF.DWG 06/14/94 TD

BORING NO.: HN-35D

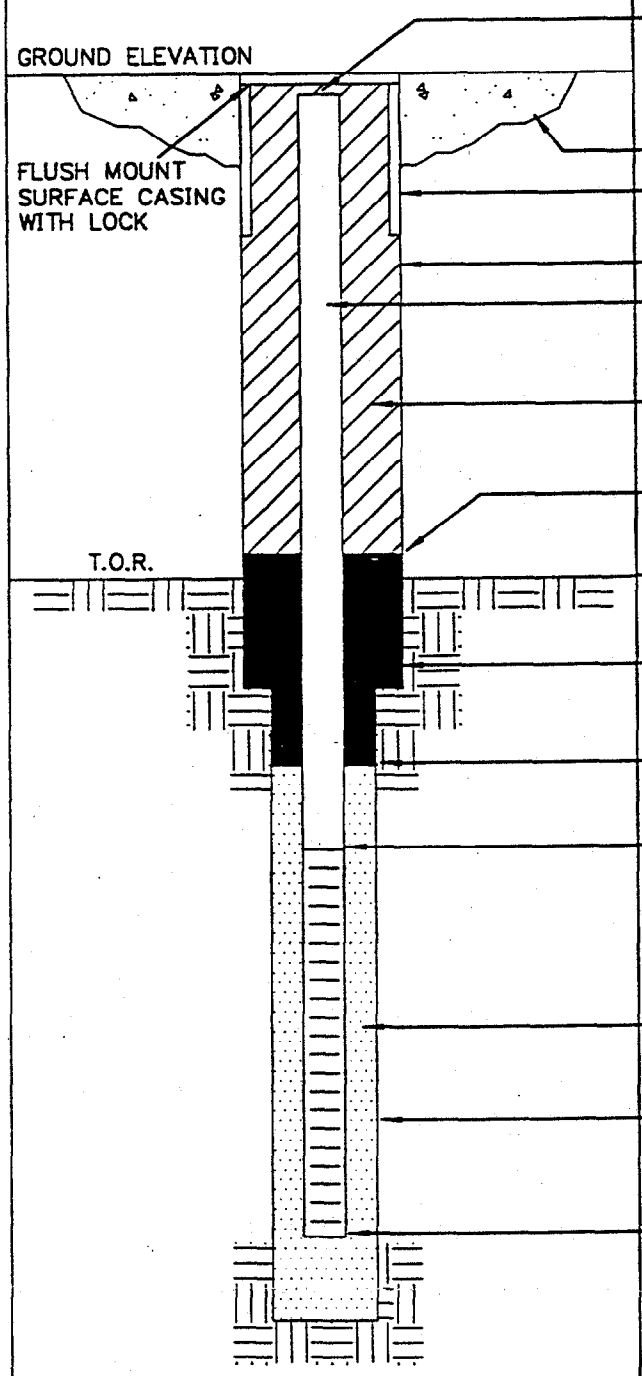
Halliburton NUS CORPORATION

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST P. NIMMER

LOCATION
BORING HN-35D
DATE 7/12/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Cement

TYPE OF PROTECTIVE CASING: Steel
I.D. OF PROTECTIVE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION/DEPTH TOP OF SEAL:

ELEVATION/DEPTH TOP OF BEDROCK: 7

TYPE OF SEAL: Bentonite

ELEVATION/DEPTH TOP OF SAND: 115

ELEVATION/DEPTH TOP OF SCREEN 120
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 10'
I.D. SCREEN: 2"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK:

ELEVATION/DEPTH BOTTOM SCREEN: 130
ELEVATION/DEPTH BOTTOM HOLE: 152

Backfill w/ Bentonite to 135'

ACAD: C:\JEFF.DWG 06/14/94 TD

NUS CORPORATION
A Halliburton Company

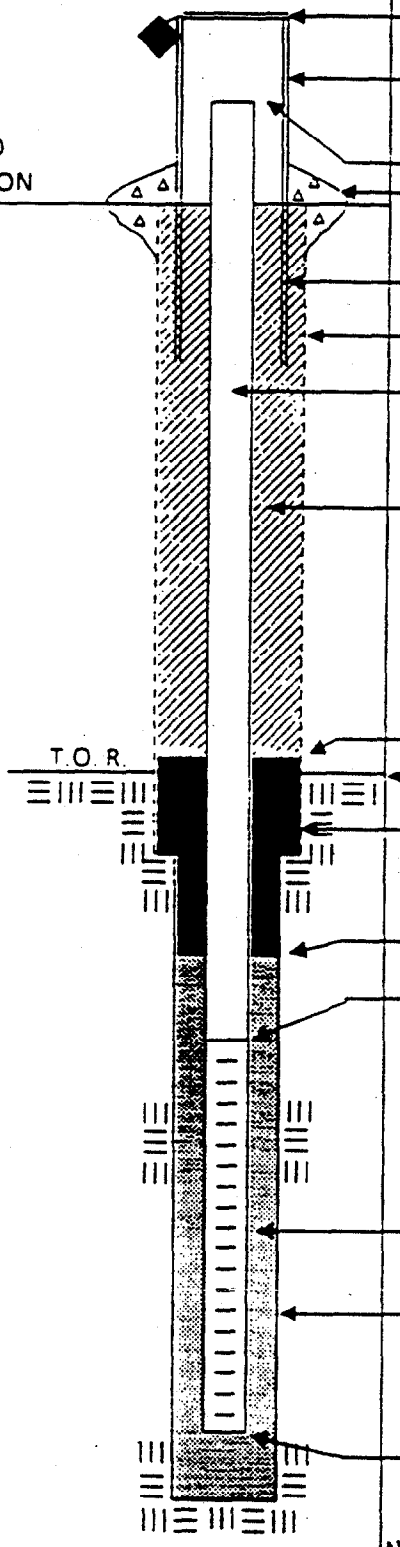
BORING NO.: HN-36I1

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST P. NIMMER
LOCATION
BORING HN-36I1
DATE 7/13/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING: 6"
DIAMETER OF HOLE: 10"
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: SCHED 40 PVC
TYPE OF BACKFILL: BENTONITE
ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 8
TYPE OF SEAL: BENTONITE
ELEVATION / DEPTH TOP OF SAND: 82
ELEVATION / DEPTH TOP OF SCREEN: 86
TYPE OF SCREEN: SCHED 40 PVC
SLOT SIZE x LENGTH: 0.020" x 10'
I.D. SCREEN: 2"
TYPE OF SAND PACK: NO. 2 MORIE EQUIV.
DIAMETER OF HOLE IN BEDROCK: 6"
CORE / REAM:
ELEVATION / DEPTH BOTTOM SCREEN: 96
ELEVATION / DEPTH BOTTOM OF HOLE: 177

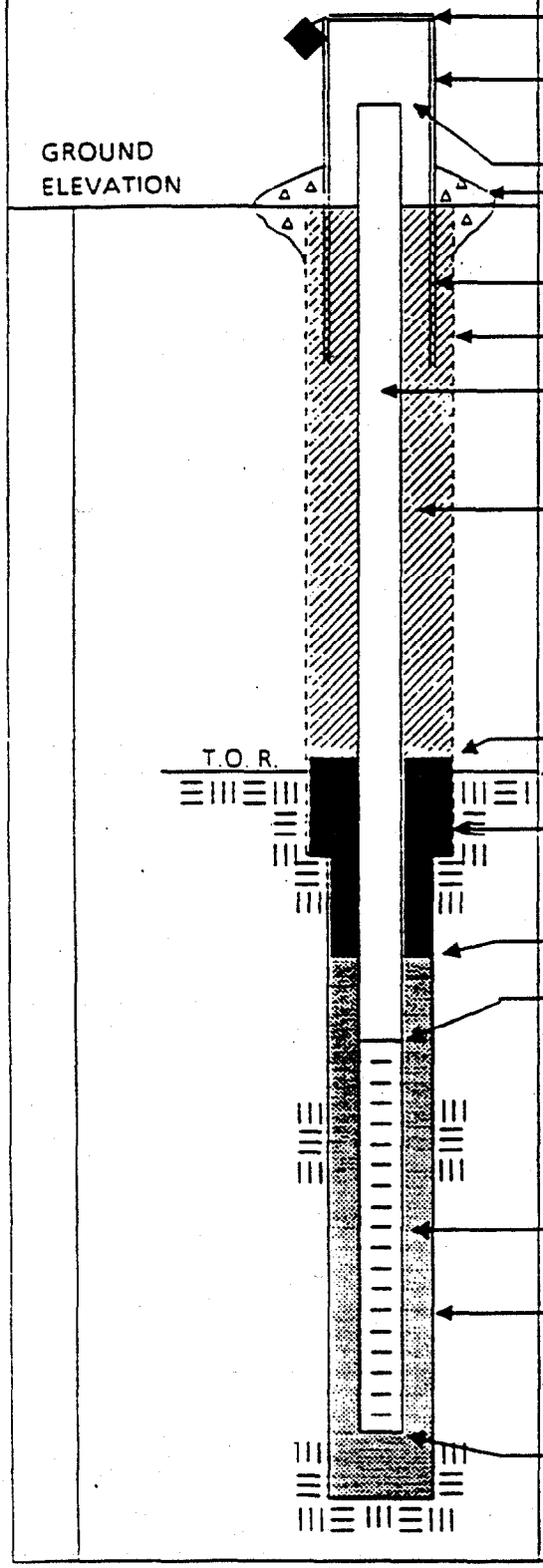
NATURAL COLLAPSE 103-177, BENTONITE SEAL 100-103

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-36I2
HN-36I2 & HN-36D constructed in same borehole

BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT: Naval Warminster
PROJECT NO.:
ELEVATION:
FIELD GEOLOGIST: P. Nimmer
LOCATION:
BORING: HN-36I2
DATE: 6/17/94
DRILLER: RAAB
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING: 6"
DIAMETER OF HOLE: 10"
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: SCHED 40 PVC
TYPE OF BACKFILL: Bentonite
ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 8
TYPE OF SEAL: Bentonite
ELEVATION / DEPTH TOP OF SAND: 101
ELEVATION / DEPTH TOP OF SCREEN: 104
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 10'
I.D. SCREEN: 2"
TYPE OF SAND PACK: NO. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 6"
CORE / REAM:
ELEVATION / DEPTH BOTTOM SCREEN: 114
ELEVATION / DEPTH BOTTOM OF HOLE: 151
SAND PACK extends to 115'

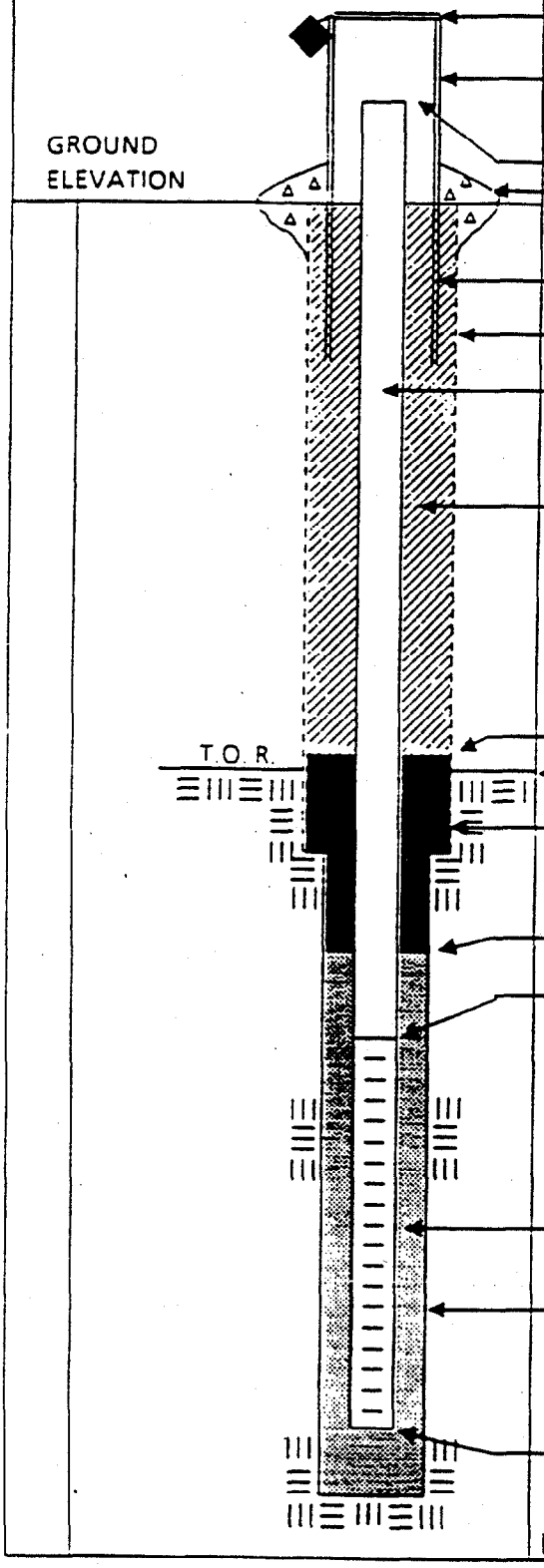
NUS CORPORATION
A Halliburton Company

BORING NO.: HN-36D
HN-36I2 & HN-36D constructed in same borehole

BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST P. Nimmer
LOCATION
BORING HN-36D
DATE 6/17/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING: 6"
DIAMETER OF HOLE: 10"
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite
ELEVATION / DEPTH TOP OF SEAL: 133
ELEVATION / DEPTH TOP OF BEDROCK: 8
TYPE OF SEAL: Bentonite
ELEVATION / DEPTH TOP OF SAND: 133
ELEVATION / DEPTH TOP OF SCREEN: 135
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 10'
I.D. SCREEN: 2"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 6"
CORE / REAM:
ELEVATION / DEPTH BOTTOM SCREEN: 145
ELEVATION / DEPTH BOTTOM OF HOLE: 151
Natural collapse 147 - 151

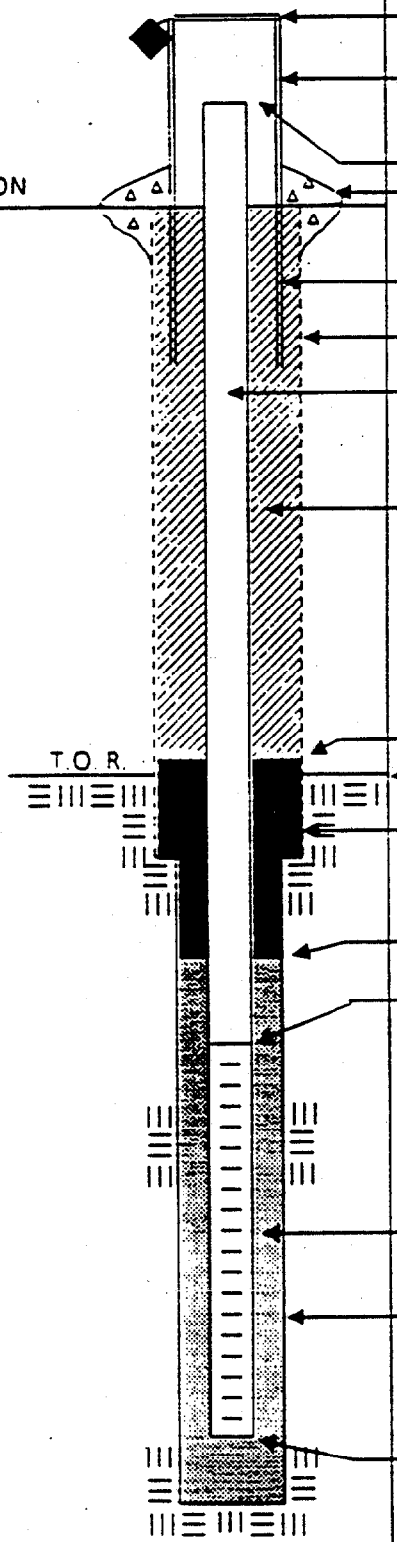
NUS CORPORATION
A Halliburton Company

BORING NO.: HN-37S
HN-37S & HN-37I constructed in same borehole

BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST P. Nimmer
LOCATION
BORING HN-37S
DATE 6/17/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Bentonite
I.D. OF SURFACE CASING: 6"
DIAMETER OF HOLE: 10"
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 9
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 75
ELEVATION / DEPTH TOP OF SCREEN: 80
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 20'
I.D. SCREEN: 2"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 6"
CORE / REAM:
ELEVATION / DEPTH BOTTOM SCREEN: 100
ELEVATION / DEPTH BOTTOM OF HOLE: 159

SAND PACK EXTENDS TO 103'

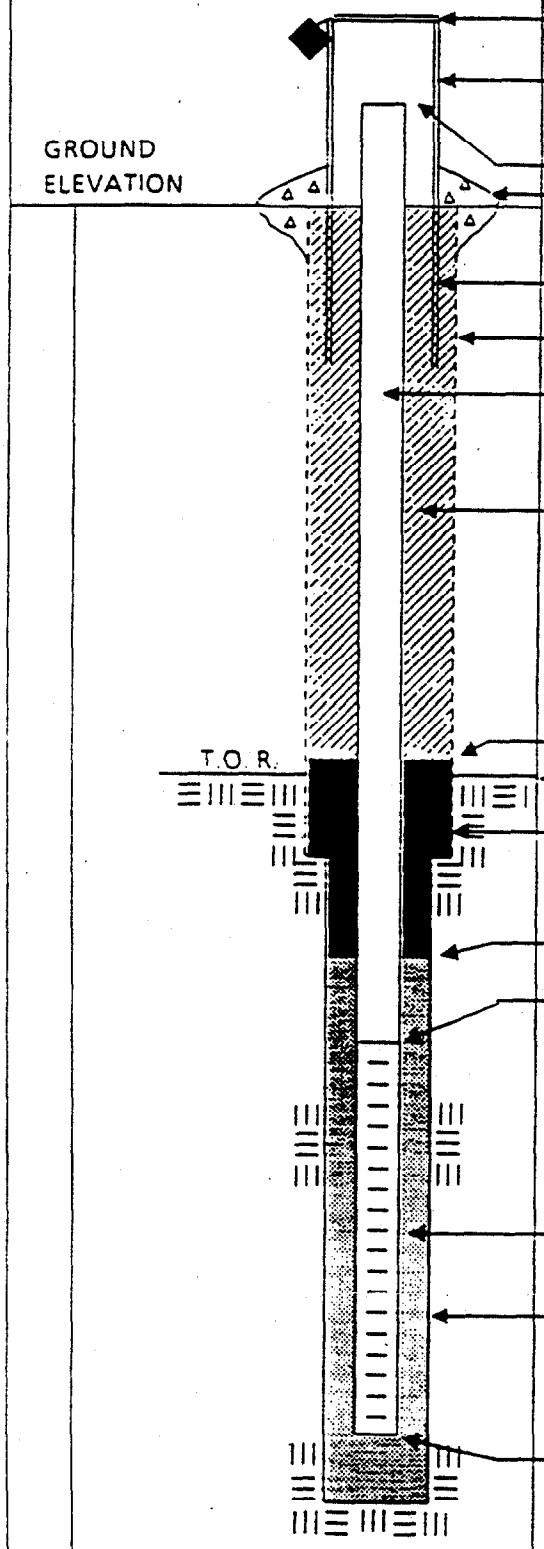
NUS CORPORATION
A Halliburton Company

BORING NO.: HN-37I
HN-37S + HN-37. Constructed in same borehole

BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST P. Nimmer
LOCATION
BORING HN-37I
DATE 6/17/94

DRILLER RAAB
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Sub Pump



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Bentonite
I.D. OF SURFACE CASING: 6"
DIAMETER OF HOLE: 10"
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL: 103
ELEVATION / DEPTH TOP OF BEDROCK: 9
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 116
ELEVATION / DEPTH TOP OF SCREEN: 119
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 15'
I.D. SCREEN: 2"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK:
CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 134
ELEVATION / DEPTH BOTTOM OF HOLE: 159
Backfill w/ bentonite to 141

NUS CORPORATION
A Halliburton Company

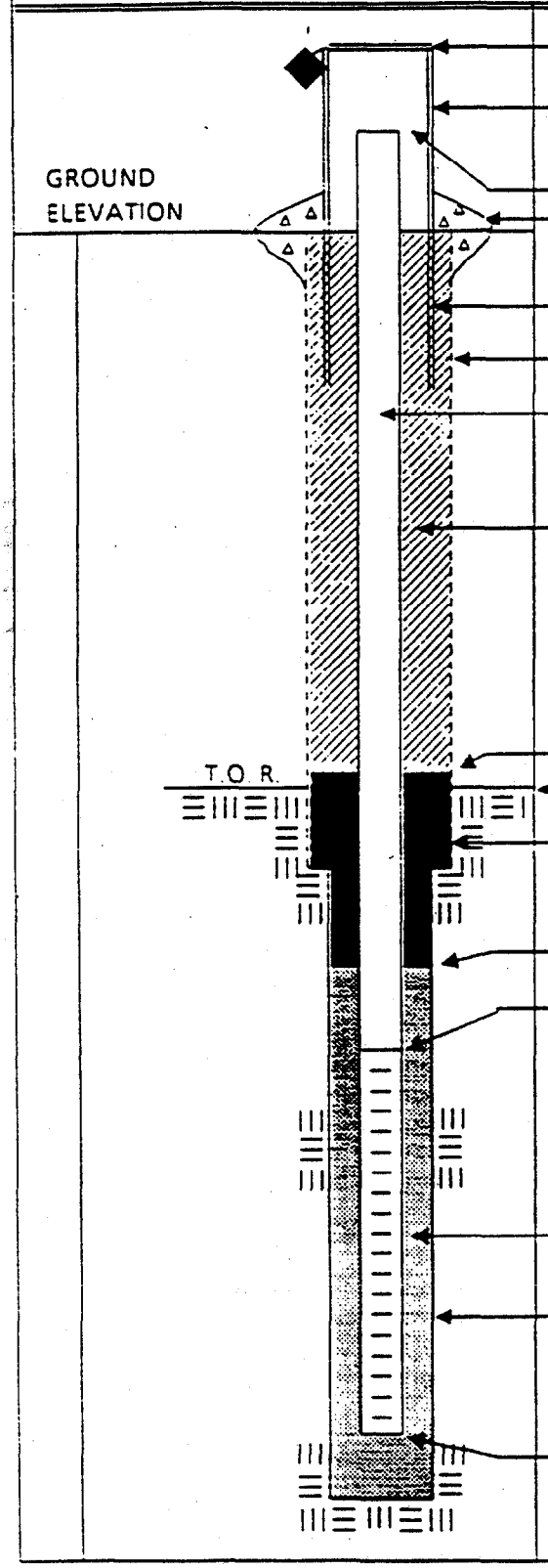
BORING NO.: HN-38

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-38
DATE 6/16/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Bentonite

I.D. OF SURFACE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 8

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 97

ELEVATION / DEPTH TOP OF SCREEN: 101

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 2"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 6"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 111

ELEVATION / DEPTH BOTTOM OF HOLE: 119

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-39

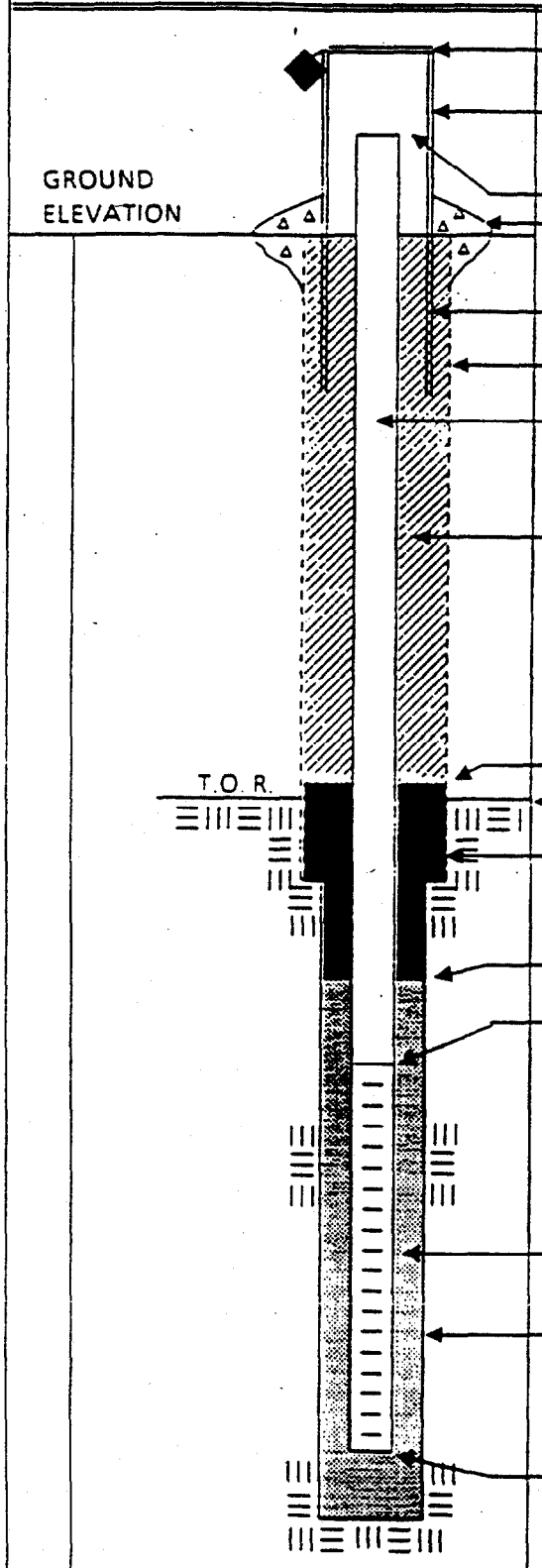
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST P. Nimmer

LOCATION
BORING HN-39
DATE 6/17/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Bentonite

I.D. OF SURFACE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 8

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 125

ELEVATION / DEPTH TOP OF SCREEN: 129

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 20'

I.D. SCREEN: 2"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 6"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 149

ELEVATION / DEPTH BOTTOM OF HOLE: 150

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-40S

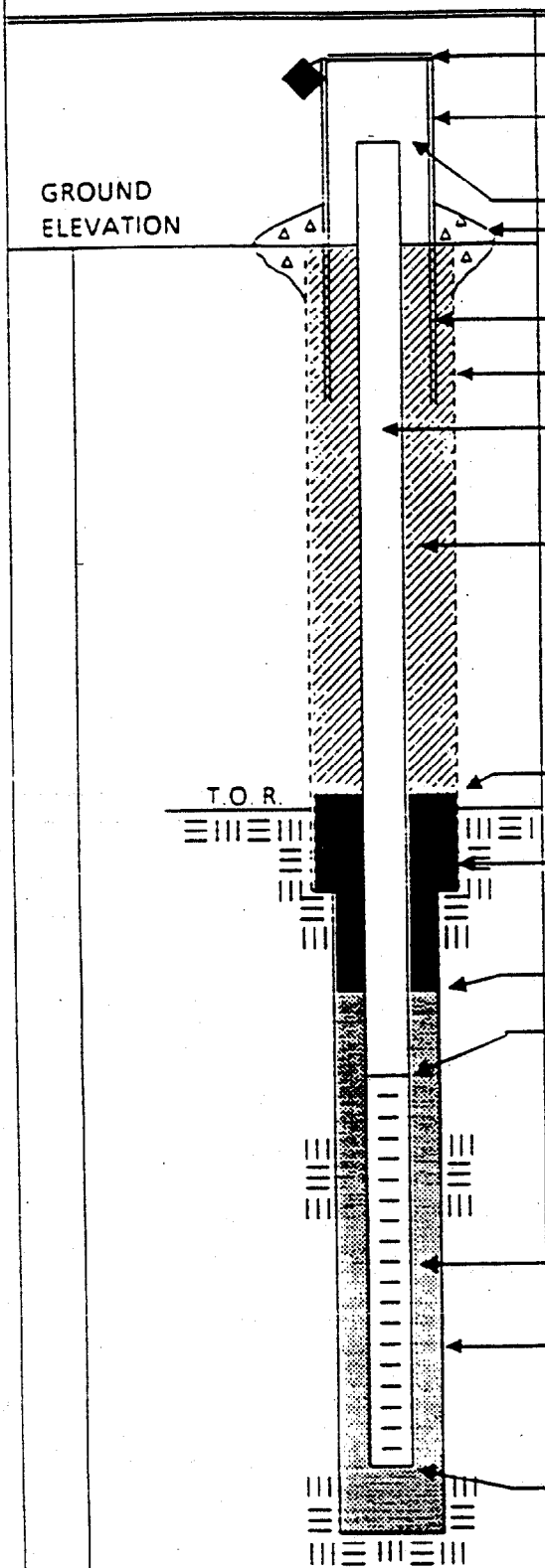
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC WARMINSTER
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-40S
DATE 6/9/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Bentonite

I.D. OF SURFACE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 9

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 55

ELEVATION / DEPTH TOP OF SCREEN: 59

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" X 10'

I.D. SCREEN: 2"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 6"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 69

ELEVATION / DEPTH BOTTOM OF HOLE: 69

NUS CORPORATION
A Halliburton Company

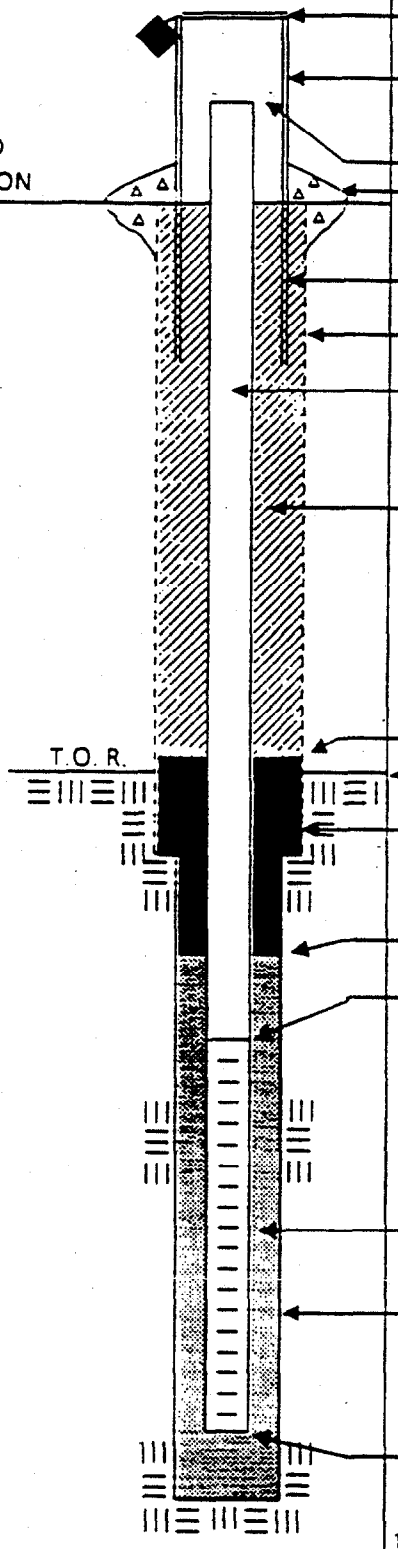
BORING NO.: HN-40I

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST P. Nimmer

LOCATION
BORING HN-40I
DATE 6/17/94

DRILLER
DRILLING METHOD
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Bentonite
I.D. OF SURFACE CASING: 6"
DIAMETER OF HOLE: 10"
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 9
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 88
ELEVATION / DEPTH TOP OF SCREEN: 94
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 15'
I.D. SCREEN: 2"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 6"
CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 109
ELEVATION / DEPTH BOTTOM OF HOLE: 133
Backfill w/ bentonite to 114'

NUS CORPORATION
A Halliburton Company

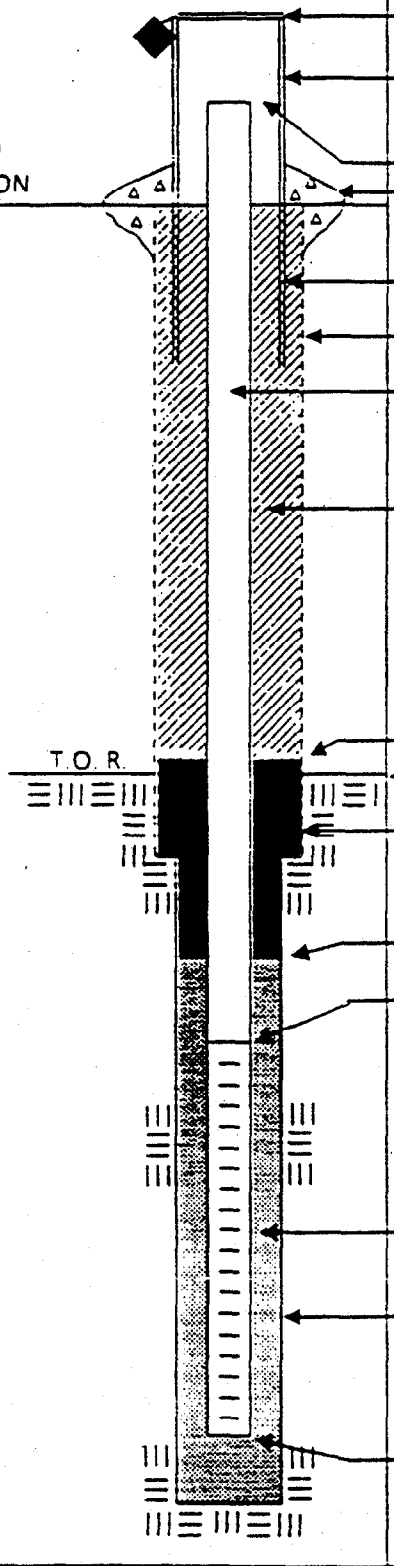
BORING NO.: HN-40D

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST P. Nimmer

LOCATION
BORING HN-40D
DATE 6/16/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Bentonite

I.D. OF SURFACE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 9

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 120

ELEVATION / DEPTH TOP OF SCREEN: 123

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 20'

I.D. SCREEN: 2"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 6"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 143

ELEVATION / DEPTH BOTTOM OF HOLE: 161

BACKFILL w/ Bentonite to 148'

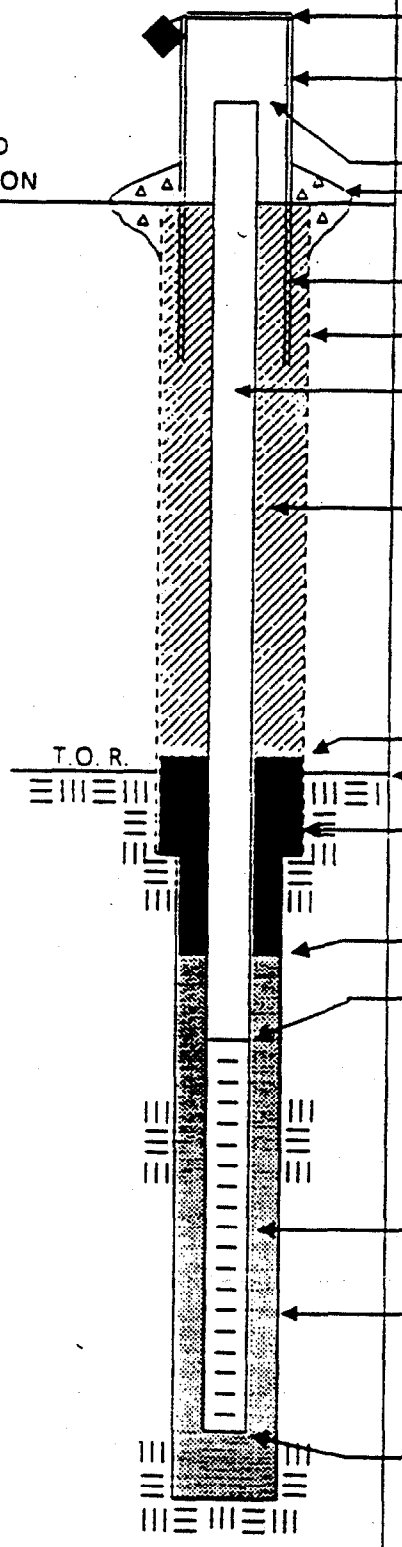
NUS CORPORATION
A Halliburton Company

BORING NO.: HN-49S

BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen
LOCATION
BORING HN-49S
DATE

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:
STICK UP OF CASING ABOVE GROUND SURFACE:
ELEVATION TOP OF RISER:
TYPE OF SURFACE SEAL: Bentonite
I.D. OF SURFACE CASING: 6"
DIAMETER OF HOLE: 10"
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: Sched 40 PVC
TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:
ELEVATION / DEPTH TOP OF BEDROCK: 12
TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 36
ELEVATION / DEPTH TOP OF SCREEN: 40
TYPE OF SCREEN: Sched 40 PVC
SLOT SIZE x LENGTH: 0.020" x 10'
I.D. SCREEN: 2"
TYPE OF SAND PACK: No. 2 Morie equiv.
DIAMETER OF HOLE IN BEDROCK: 6"
CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 50
ELEVATION / DEPTH BOTTOM OF HOLE: 51

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-49I

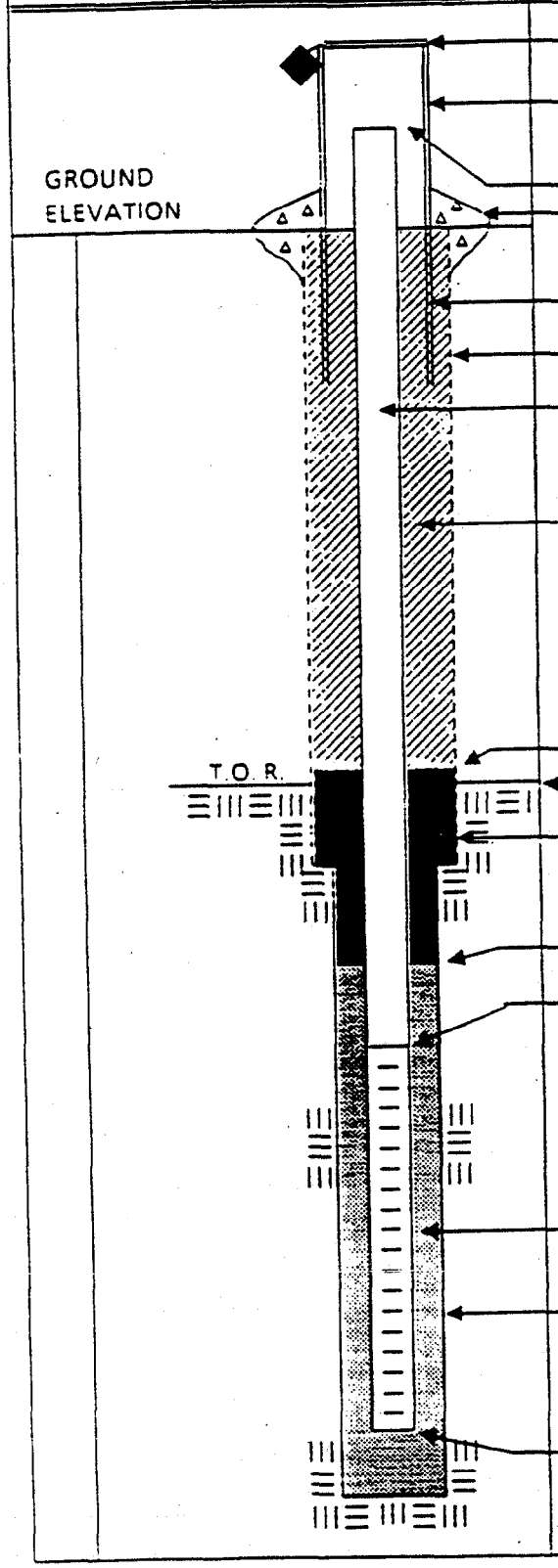
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-49I
DATE

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Bentonite

I.D. OF SURFACE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 12

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 55

ELEVATION / DEPTH TOP OF SCREEN: 60

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 2"

TYPE OF SAND PACK: No. 2 Morie equiv.

DIAMETER OF HOLE IN BEDROCK: 6"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 70

ELEVATION / DEPTH BOTTOM OF HOLE: 100

Backfill w/ bentonite to 75'

NUS CORPORATION
A Halliburton Company

BORING NO.: HN-49D

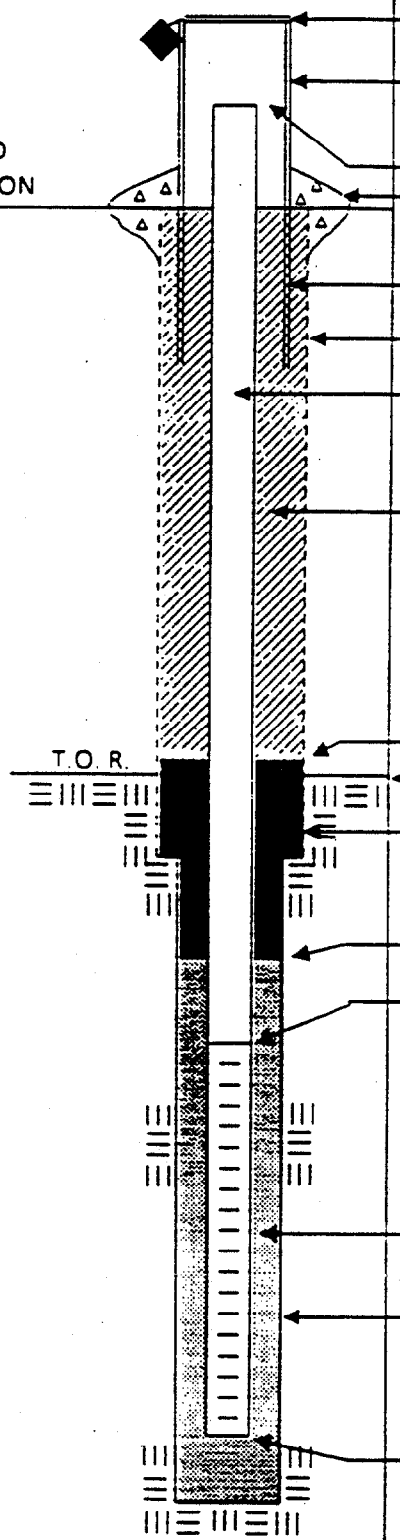
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT NAWC Warminster
PROJECT NO.
ELEVATION
FIELD GEOLOGIST D. Whalen

LOCATION
BORING HN-49D
DATE 10/26/94

DRILLER RAAB
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD SUB PUMP



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Bentonite

I.D. OF SURFACE CASING: 6"

DIAMETER OF HOLE: 10"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Sched 40 PVC

TYPE OF BACKFILL: Bentonite

ELEVATION / DEPTH TOP OF SEAL:

ELEVATION / DEPTH TOP OF BEDROCK: 12

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 118

ELEVATION / DEPTH TOP OF SCREEN: 121

TYPE OF SCREEN: Sched 40 PVC

SLOT SIZE x LENGTH: 0.020" x 10'

I.D. SCREEN: 2"

TYPE OF SAND PACK: No. 2 Morie Equiv.

DIAMETER OF HOLE IN BEDROCK: 6"

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 131

ELEVATION / DEPTH BOTTOM OF HOLE: 152

BACKFILL w/ bentonite TO 135'

APPENDIX C
ANALYTICAL RESULTS

GROUNDWATER

Volatile Organics

CTO 0134 WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS VOLATILE ORGANICS (ug/L)
LOW-CONCENTRATION

CLIENT ID:			FB-1		RB-1		TB-1		TB-2		W-MW-AD	
LABORATORY ID:			940059-14		940059-01		940059-02		940059-16		940059-03	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1		1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	1	U	1	U	4	
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CT0 0134 WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS VOLATILE ORGANICS (ug/L)
LOW-CONCENTRATION

CLIENT ID:			W-MW-AI		W-MW-AS		W-MW-BI		W-MW-BS		W-MW-DD	
LABORATORY ID:			940059-04		940059-05		940059-06		940059-07		940059-08	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1		1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	3		3		1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	2		1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	7		1	U	1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CT0 0134 WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS VOLATILE ORGANICS (ug/L)
LOW-CONCENTRATION

CLIENT ID:			W-MW-DG17		W-MW-DG18		W-MW-DG19		W-MW-DI		W-MW-DS	
LABORATORY ID:			940059-09		940059-10		940059-11		940059-12		940059-13	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	5		1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	2		1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1		1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	12		4		1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CT0 0134 WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS VOLATILE ORGANICS (ug/L)
LOW-CONCENTRATION

CLIENT ID:			W-MW-HD		W-MW-HI		W-MW-HS		W-MW-ID	
LABORATORY ID:			940059-17		940059-18		940059-19		940059-20	
ANALYTE	CRQL	MDL								
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1		1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1		1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U
TOLUENE	1	1	18		1	U	9		5	
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0	

TCL AQUEOUS VOLATILE ORGANICS (µg/L) add

CLIENT ID:	1995		TB-0206	DG-21	DG-21-DU	HN-02-I	TB-0207
LABORATORY ID:	CR 139		950073-01	950073-02	950073-03	950073-04	950073-05
ANALYTE	CRQL	MDL/IDL					
CHLOROMETHANE	10	1	10 U	10 U	10 U	10 U	10 U
BROMOMETHANE	10	1	10 U	10 U	10 U	10 U	10 U
VINYL CHLORIDE	10	1	10 U	10 U	10 U	10 U	10 U
CHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
METHYLENE CHLORIDE	10	2	10 U	10 U	10 U	10 U	3 J
ACETONE	10	5	14 B	11 B	10 B	10 U	12 B
CARBON DISULFIDE	10	1	10 U	10 U	10 U	10 U	10 U
1,1-DICHLOROETHENE	10	1	10 U	10 U	10 U	10 U	10 U
1,1-DICHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROETHENE (TOTAL)	10	1	10 U	10 U	10 U	1 J	10 U
CHLOROFORM	10	1	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
2-BUTANONE	10	5	10 U	10 U	10 U	10 U	7 BJ
1,1,1-TRICHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
CARBON TETRACHLORIDE	10	1	10 U	10 U	10 U	10 U	10 U
BROMODICHLOROMETHANE	10	1	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROPROPANE	10	1	10 U	10 U	10 U	10 U	10 U
CIS-1,3-DICHLOROPROPENE	10	1	10 U	10 U	10 U	10 U	10 U
TRICHLOROETHENE	10	1	10 U	1 J	1 J	2 J	10 U
DIBROMOCHLOROMETHANE	10	1	10 U	10 U	10 U	10 U	10 U
1,1,2-TRICHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
BENZENE	10	1	10 U	10 U	10 U	10 U	10 U
TRANS-1,3-DICHLOROPROPENE	10	1	10 U	10 U	10 U	10 U	10 U
BROMOFORM	10	1	10 U	10 U	10 U	10 U	10 U
4-METHYL-2-PENTANONE	10	5	10 U	10 U	10 U	10 U	10 U
2-HEXANONE	10	5	10 U	10 U	10 U	10 U	10 U
TETRACHLOROETHENE	10	1	10 U	10 U	10 U	10 U	10 U
1,1,2,2-TETRACHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
TOLUENE	10	1	10 U	10 U	10 U	10 U	10 U
CHLOROBENZENE	10	1	10 U	10 U	10 U	10 U	10 U
ETHYLBENZENE	10	1	10 U	10 U	10 U	10 U	10 U
STYRENE	10	1	10 U	10 U	10 U	10 U	10 U
XYLENE (TOTAL)	10	1	10 U	10 U	10 U	10 U	10 U
DILUTION FACTOR:			1	1	1	1	1

CLEAN CTO 134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS VOLATILE ORGANICS (ug/L)

TCL AQUEOUS VOLATILE ORGANICS (ug/L)

CLIENT ID:			FB-2		FB-3		RB-5		TB-6		W-MW-BD	
LABORATORY ID:			940074-01		940074-23		940074-13		940074-24		940074-04	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	2	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	2	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	2	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	2	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	5	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	170	L	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	2	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	2	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	2	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	2	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	2	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	2	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	2	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	12	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	2	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	2	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	2	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	2	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	2	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	2	U	1	U	2	
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	2	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	2	U	1	U	1	U
BENZENE	1	1	1	U	1	U	2	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	2	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	2	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	12	U	5	U	5	U
2-HEXANONE	5	5	5	UJ	5	U	12	U	5	U	5	UJ
TETRACHLOROETHENE	1	1	1	U	1	U	2	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	2	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	2	U	1	U	1	U
CHLOROBENZENE	1	1	1	U	1	U	2	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	2	U	1	U	1	U
STYRENE	1	1	1	U	1	U	2	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	2	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	2	U	1	U	1	U
1,3-DICHLOROBENZENE	1	1	1	U	1	U	2	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	2	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	2	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	2	UJ	1	UJ	1	UJ
DILUTION FACTOR:			1.0		1.0		2.5		1.0		1.0	

CLEAN CTO 134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS VOLATILE ORGANICS (ug/L)

TCL AQUEOUS VOLATILE ORGANICS (ug/L)

CLIENT ID:			W-MW-CD		W-MW-CI		W-MW-ED		W-MW-EI		W-MW-ES	
LABORATORY ID:			940074-05		940074-06		940074-15		940074-16		940074-17	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	2		1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	2		3		1	U	1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	UJ	5	UJ	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1		1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	3		1	U	5		8		1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CLEAN CTO 134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS VOLATILE ORGANICS (ug/L)

TCL AQUEOUS VOLATILE ORGANICS (ug/L)

CLIENT ID:			W-MW-GD		W-MW-GI		W-MW-JD		W-MW-JI		W-MW-JS	
LABORATORY ID:			940074-07		940074-08		940074-18		940074-19		940074-20	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1		1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	4		8		1	U	1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	4	J	1		1	U	3		1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CLEAN CTO 134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS VOLATILE ORGANICS (ug/L)

CLIENT ID:			TB-4		TB-5		W-MW-05		W-MW-06	
LABORATORY ID:			940074-03		940074-14		940074-11		940074-12	
ANALYTE	CRQL	MDL								
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	UJ	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	1	U	1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ
DILUTION FACTOR:			1.0		1.0		1.0		1.0	

CLEAN CTO #6-159
NAVAL AIR WARFARE CENTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS VOLATILE ORGANICS (µg/L)

CLIENT ID:			W-MW-HN361	W-MW-HN362	W-MW-HN36D
LABORATORY ID:			950039-01	950039-02	950039-03
ANALYTE	CRQL	MDL/IDL			
CHLOROMETHANE	1	1	1 U	1 U	1 U
BROMOMETHANE	1	1	1 U	1 U	1 U
VINYL CHLORIDE	1	1	1 U	1 U	1 U
CHLOROETHANE	1	1	1 U	1 U	1 U
METHYLENE CHLORIDE	2	2	2	3	1 J
ACETONE	5	5	21	15	17
CARBON DISULFIDE	1	1	1 U	1 U	1 U
1,1-DICHLOROETHENE	1	1	1 U	1 U	1 U
1,1-DICHLOROETHANE	1	1	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	1	1	1 U	1 U	1 U
TRANS-1,2-DICHLOROETHENE	1	1	1 U	1 U	1 U
CHLOROFORM	1	1	1 U	1 U	1 U
1,2-DICHLOROETHANE	1	1	1 U	1 U	1 U
2-BUTANONE	5	5	5 U	5 U	5 U
1,1,1-TRICHLOROETHANE	1	1	1 U	1 U	1 U
CARBON TETRACHLORIDE	1	1	1 U	1 U	1 U
BROMODICHLOROMETHANE	1	1	1 U	1 U	1 U
1,2-DICHLOROPROPANE	1	1	1 U	1 U	1 U
CIS-1,3-DICHLOROPROPENE	1	1	1 U	1 U	1 U
TRICHLOROETHENE	1	1	1 U	1 U	1 U
DIBROMOCHLOROMETHANE	1	1	1 U	1 U	1 U
1,1,2-TRICHLOROETHANE	1	1	1 U	1 U	1 U
BENZENE	1	1	2	1	20
TRANS-1,3-DICHLOROPROPENE	1	1	1 U	1 U	1 U
BROMOFORM	1	1	1 U	1 U	1 U
4-METHYL-2-PENTANONE	5	5	5 U	5 U	5 U
2-HEXANONE	5	5	5 U	5 U	5 U
TETRACHLOROETHENE	1	1	1 U	1 U	1 U
1,1,2,2-TETRACHLOROETHANE	1	1	1 U	1 U	1 U
TOLUENE	1	1	1 U	1 U	1
CHLOROBENZENE	1	1	1 U	1 U	1 U
ETHYLBENZENE	1	1	1 U	1 U	1 U
STYRENE	1	1	1 U	1 U	1 U
XYLENE (TOTAL)	1	1	1 U	1 U	1 U
1,2-DIBROMOETHANE	1	1	1 U	1 U	1 U
1,3-DICHLOROBENZENE	1	1	1 U	1 U	1 U
1,4-DICHLOROBENZENE	1	1	1 U	1 U	1 U
1,2-DICHLOROBENZENE	1	1	1 U	1 U	1 U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1 U	1 U	1 U
BROMOCHLOROMETHANE	1	1	1 U	1 U	1 U
DILUTION FACTOR:			1	1	1

CLEAN CTO 118/CTO 159
NAVAL AIR WARFARE CENTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS VOLATILE ORGANICS (µg/L)

CLIENT ID:			W-FB-0116-01	W-FB-0116-02	W-MWHN37I	W-MW-HN37D	W-TB-0116
LABORATORY ID:			950027-01	950027-02	950027-03	950027-04	950027-05
ANALYTE	CRQL	MDL/IDL					
CHLOROMETHANE	1	1	1 U	1 U	1 U	1 U	1 U
BROMOMETHANE	1	1	1 U	1 U	1 U	1 U	1 U
VINYL CHLORIDE	1	1	1 U	1 U	1 U	1 U	1 U
CHLOROETHANE	1	1	1 U	1 U	1 U	1 U	1 U
METHYLENE CHLORIDE	2	2	2 B	2 B	1 BJ	2 B	2 B
ACETONE	5	5	5 U	4 J	5 U	5 U	5 U
CARBON DISULFIDE	1	1	1 U	1 U	1 U	1 U	1 U
1,1-DICHLOROETHENE	1	1	1 U	1 U	1 U	1 U	1 U
1,1-DICHLOROETHANE	1	1	1 U	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	1	1	1 U	1 U	1 U	1 U	1 U
TRANS-1,2-DICHLOROETHENE	1	1	1 U	1 U	1 U	1 U	1 U
CHLOROFORM	1	1	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE	1	1	1 U	1 U	1 U	1 U	1 U
2-BUTANONE	5	5	5 U	5 U	5 U	5 U	5 U
1,1,1-TRICHLOROETHANE	1	1	1 U	1 U	1 U	1 U	1 U
CARBON TETRACHLORIDE	1	1	1 U	1 U	1 U	1 U	1 U
BROMODICHLOROMETHANE	1	1	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROPROPANE	1	1	1 U	1 U	1 U	1 U	1 U
CIS-1,3-DICHLOROPROPENE	1	1	1 U	1 U	1 U	1 U	1 U
TRICHLOROETHENE	1	1	1 U	1 U	1 U	1 U	1 U
DIBROMOCHLOROMETHANE	1	1	1 U	2	1 U	1 U	1 U
1,1,2-TRICHLOROETHANE	1	1	1 U	1 U	1 U	1 U	1 U
BENZENE	1	1	1 U	1 U	1 U	1 U	1 U
TRANS-1,3-DICHLOROPROPENE	1	1	1 U	1 U	1 U	1 U	1 U
BROMOFORM	1	1	1 U	2	1 U	1 U	1 U
4-METHYL-2-PENTANONE	5	5	5 U	5 U	5 U	5 U	5 U
2-HEXANONE	5	5	5 U	5 U	5 U	5 U	5 U
TETRACHLOROETHENE	1	1	1 U	1 U	1 U	1 U	1 U
1,1,2,2-TETRACHLOROETHANE	1	1	1 U	1 U	1 U	1 U	1 U
TOLUENE	1	1	1 U	1 U	1 U	1 U	1 U
CHLOROBENZENE	1	1	1 U	1 U	1 U	1 U	1 U
ETHYLBENZENE	1	1	1 U	1 U	1 U	1 U	1 U
STYRENE	1	1	1 U	1 U	1 U	1 U	1 U
XYLENE (TOTAL)	1	1	1 U	1 U	1 U	1 U	1 U
1,2-DIBROMOETHANE	1	1	1 U	1 U	1 U	1 U	1 U
1,3-DICHLOROBENZENE	1	1	1 U	1 U	1 U	1 U	1 U
1,4-DICHLOROBENZENE	1	1	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROBENZENE	1	1	1 U	1 U	1 U	1 U	1 U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1 U	1 U	1 U	1 U	1 U
BROMOCHLOROMETHANE	1	1	1 U	1 U	1 U	1 U	1 U
DILUTION FACTOR:			1	1	1	1	1

CTO 159, NAWC WARMINSTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL VOLATILE WATERS (UG/L)

CLIENT ID:			RB-0818		TB-0818		W-MW-HN40D		W-MW-HN40I		W-MW-HN40S	
LABORATORY ID:			940739-01		940739-02		940739-03		940739-04		940739-05	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	B	2	U	1	B	1	B	2	U
ACETONE	5	5	5	J	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	1		1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS VOLATILE ORGANICS (ug/L)

CLIENT ID:			RB-3		TB-3		W-MW-DG20		W-MW-DG25		W-MW-FD	
LABORATORY ID:			940059-25		940059-26		940059-27		940059-28		940059-29	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	2		1		1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	7		4		1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	UJ	5	UJ	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	2		1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	1	U	1	U	10	
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS VOLATILE ORGANICS (ug/L)

CLIENT ID:			W-MW-FI		W-MW-FS		W-MW-GS		W-MW-II		W-MW-IS	
LABORATORY ID:			940059-30		940059-31		940059-32		940059-21		940059-22	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	2		1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U	8	
BROMODICHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	7		4	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	UJ	5	UJ	5	UJ	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	9		1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS VOLATILE ORGANICS (ug/L)

CLIENT ID:			W-MW-KI		W-MW-LD	
LABORATORY ID:			940059-23		940059-24	
ANALYTE	CRQL	MDL				
CHLOROMETHANE	1	1	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U
ACETONE	5	5	5	UR	5	UR
CARBON DISULFIDE	1	1	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U
CHLOROFORM	1	1	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U
BENZENE	1	1	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U
BROMOFORM	1	1	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U
2-HEXANONE	5	5	5	UJ	5	U
TETRACHLOROETHENE	1	1	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U
TOLUENE	1	1	1	U	6	
CHLOROBENZENE	1	1	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U
STYRENE	1	1	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	UJ	1	UJ
1,3-DICHLOROBENZENE	1	1	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U
DILUTION FACTOR:			1.0		1.0	

CTO 116, NAWC WARMINSTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

CLIENT ID:			W-MW-HN38		W-MW-05		W-MW-HN61		W-MW-HN39		W-MW-HN08	
LABORATORY ID:			941106-01		941106-02		941106-03		941106-04		941106-05	
TCL VOLATILE WATERS (UG/L)												
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	3	B	2	U	2	U	2	U	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	3	B	6	B	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
BROMODICHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	1	U	1		1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE (TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

* RESULT FROM DILUTION ANALYSIS

CTO 116, NAWC WARMINSTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL VOLATILE WATERS (UG/L)

CLIENT ID:			W-MW-HN10D		W-MW-HN10I		W-MW-HN10S		W-MW-HN40I		W-MW-HN40S	
LABORATORY ID:			941092-01		941092-02		941092-03		941092-04		941092-05	
ANALYTE	CRQL	MDL										
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	B	2	U	2	B	2	B	2	U
ACETONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
CARBON DISULFIDE	1	1	6		1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	UR	5	UR	5	UR	5	UR	5	UR
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U	1	U
TOLUENE	1	1	1	U	1	U	1	U	1	U	1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U	1	U
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	U	1	U	1	U	1	U	1	U
BROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

* RESULT FROM DILUTION ANALYSIS

CTO 116, NAWC WARMINSTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

CLIENT ID:			W-MW-HN49D		W-MW-HN49I		W-MW-HN49S		W-TB-1216	
LABORATORY ID:			941092-16		941092-17		941092-18		941092-20	
TCL VOLATILE WATERS (UG/L)										
ANALYTE	CRQL	MDL								
CHLOROMETHANE	1	1	1	U	1	U	1	U	1	U
BROMOMETHANE	1	1	1	U	1	U	1	U	1	U
VINYL CHLORIDE	1	1	1	U	1	U	1	U	1	U
CHLOROETHANE	1	1	1	U	1	U	1	U	1	U
METHYLENE CHLORIDE	2	2	2	U	2	U	5	B	2	U
ACETONE	5	5	5	U	5	UR	5	UR	5	U
CARBON DISULFIDE	1	1	1	U	1	U	1	U	1	U
1,1-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
1,1-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
CIS-1,2-DICHLOROETHENE	1	1	2		*30		1	U	1	U
TRANS-1,2-DICHLOROETHENE	1	1	1	U	1	U	1	U	1	U
CHLOROFORM	1	1	1	U	1	U	1	U	1	U
1,2-DICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
2-BUTANONE	5	5	5	U	5	UR	5	UR	5	U
1,1,1-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
CARBON TETRACHLORIDE	1	1	1	U	1	U	1	U	1	U
BROMODICHLORMETHANE	1	1	1	U	1	U	1	U	1	U
1,2-DICHLOROPROPANE	1	1	1	U	1	U	1	U	1	U
CIS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U
TRICHLOROETHENE	1	1	7		*120		1		1	U
DIBROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U
1,1,2-TRICHLOROETHANE	1	1	1	U	1	U	1	U	1	U
BENZENE	1	1	1	U	1	U	1	U	1	U
TRANS-1,3-DICHLOROPROPENE	1	1	1	U	1	U	1	U	1	U
BROMOFORM	1	1	1	U	1	U	1	U	1	U
4-METHYL-2-PENTANONE	5	5	5	U	5	U	5	U	5	U
2-HEXANONE	5	5	5	U	5	U	5	U	5	U
TETRACHLOROETHENE	1	1	1	U	1	U	1	U	1	U
1,1,2,2-TETRACHLOROETHANE	1	1	1	U	1	U	1	U	1	U
TOLUENE	1	1	14		12		1	U	1	U
CHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
ETHYLBENZENE	1	1	1	U	1	U	1	U	1	U
STYRENE	1	1	1	U	1	U	1	U	1	U
XYLENE(TOTAL)	1	1	1	U	1	U	1	U	1	U
1,2-DIBROMOETHANE	1	1	1	U	1	U	1	U	1	U
1,3-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
1,4-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
1,2-DICHLOROBENZENE	1	1	1	U	1	U	1	U	1	U
1,2-DIBROMO-3-CHLOROPROPANE	1	1	1	U	1	U	1	U	1	U
BROMOCHLOROMETHANE	1	1	1	U	1	U	1	U	1	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0	

* RESULT FROM DILUTION ANALYSIS

TCL AQUEOUS VOLATILE ORGANICS (µg/L)

CLIENT ID:			TB-0208	EW-12	EW-14	RB-001	FB-001
LABORATORY ID:			950073-11	950073-12	950073-13	950073-15	950073-16
ANALYTE	CRQL	MDL/IDL					
CHLOROMETHANE	10	1	10 U	10 U	10 U	10 U	10 U
BROMOMETHANE	10	1	10 U	10 U	10 U	10 U	10 U
VINYL CHLORIDE	10	1	10 U	10 U	10 U	10 U	10 U
CHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
METHYLENE CHLORIDE	10	2	2 J	10 U	10 U	10 U	10 U
ACETONE	10	5	10 B	24 B	10 U	13 B	11 B
CARBON DISULFIDE	10	1	1 J	10 U	10 U	10 U	10 U
1,1-DICHLOROETHENE	10	1	10 U	10 U	10 U	10 U	10 U
1,1-DICHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROETHENE (TOTAL)	10	1	10 U	10 U	10 U	10 U	10 U
CHLOROFORM	10	1	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
2-BUTANONE	10	5	10 U	10 U	10 U	7 BJ	7 BJ
1,1,1-TRICHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
CARBON TETRACHLORIDE	10	1	10 U	10 U	10 U	10 U	10 U
BROMODICHLOROMETHANE	10	1	10 U	10 U	10 U	10 U	10 U
1,2-DICHLOROPROPANE	10	1	10 U	10 U	10 U	10 U	10 U
CIS-1,3-DICHLOROPROPENE	10	1	10 U	10 U	10 U	10 U	10 U
TRICHLOROETHENE	10	1	10 U	10 U	2 J	10 U	10 U
DIBROMOCHLOROMETHANE	10	1	10 U	10 U	10 U	10 U	10 U
1,1,2-TRICHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
BENZENE	10	1	10 U	10 U	10 U	10 U	10 U
TRANS-1,3-DICHLOROPROPENE	10	1	10 U	10 U	10 U	10 U	10 U
BROMOFORM	10	1	10 U	10 U	10 U	10 U	10 U
4-METHYL-2-PENTANONE	10	5	10 U	10 U	10 U	10 U	10 U
2-HEXANONE	10	5	10 U	10 U	10 U	10 U	10 U
TETRACHLOROETHENE	10	1	10 U	10 U	10 U	10 U	10 U
1,1,2,2-TETRACHLOROETHANE	10	1	10 U	10 U	10 U	10 U	10 U
TOLUENE	10	1	10 U	10 U	10 U	10 U	10 U
CHLOROBENZENE	10	1	10 U	10 U	10 U	10 U	10 U
ETHYLBENZENE	10	1	10 U	10 U	10 U	10 U	10 U
STYRENE	10	1	10 U	10 U	10 U	10 U	10 U
XYLENE (TOTAL)	10	1	10 U	10 U	10 U	10 U	10 U
DILUTION FACTOR:			1	1	1	1	1

Semivolatile Organics

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS SEMI-VOLATILE ORGANICS (ug/L)

CLIENT ID:			FB-1		RB-1		W-MW-AD		W-MW-AI		W-MW-BI	
LABORATORY ID:			940059-14		940059-01		940059-03		940059-04		940059-06	
ANALYTE	CRQL	MDL										
PHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	1	10	U	10	U	10	U	10	U	10	U
2-CHLOROPHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
1,4-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
2-METHYLPHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
2,2'-OXYBIS(1-CHLOROPROPANE)	10	1	10	U	10	U	10	U	10	U	10	U
4-METHYLPHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
N-NITROSO-DI-n-PROPYLAMINE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROETHANE	10	1	10	U	10	U	10	U	10	U	10	U
NITROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
ISOPHORONE	10	1	10	U	10	U	10	U	10	U	10	U
2-NITROPHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
2,4-DIMETHYLPHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE	10	1	10	U	10	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
NAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
4-CHLOROANILINE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	1	10	U	10	U	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	1	10	U	10	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1	10	UR	10	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	2.5	25	UR	25	U	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
2-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
DIMETHYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
ACENAPHTHYLENE	10	1	10	U	10	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	1	10	U	10	U	10	U	10	U	10	U
3-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
ACENAPHTHENE	10	1	10	U	10	U	10	U	10	U	10	U

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS SEMI-VOLATILE ORGANICS (ug/L)

CLIENT ID:			FB-1		RB-1		W-MW-AD		W-MW-AI		W-MW-BI	
LABORATORY ID:			940059-14		940059-01		940059-03		940059-04		940059-06	
ANALYTE	CRQL	MDL										
2,4-DINITROPHENOL	25	2.5	25	UR	25	U	25	U	25	U	25	U
4-NITROPHENOL	25	2.5	25	UR	25	UJ	25	UJ	25	UJ	25	UJ
DIBENZOFURAN	10	1	10	U	10	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	1	10	U	10	U	10	U	10	U	10	U
DIETHYL PHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
4-CHLOROPHENYL-PHENYL ETHER	10	1	10	U	10	U	10	U	10	U	10	U
FLUORENE	10	1	10	U	10	U	10	U	10	U	10	U
4-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.5	25	UR	25	U	25	U	25	U	25	U
N-NITROSODIPHENYLAMINE	10	1	10	U	10	U	10	U	10	U	10	U
4-BROMOPHENYL-PHENYL ETHER	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
PENTACHLOROPHENOL	25	2.5	25	UR	25	U	25	U	25	U	25	U
PHENANTHRENE	10	1	10	U	10	U	10	U	10	U	10	U
ANTHRACENE	10	1	10	U	10	U	10	U	10	U	10	U
DI-n-BUTYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
FLUORANTHENE	10	1	10	U	10	U	10	U	10	U	10	U
CARBAZOLE	10	1	10	U	10	U	10	U	10	U	10	U
PYRENE	10	1	10	U	10	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	10	1	10	U	1	J	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(a)ANTHRACENE	10	1	10	U	10	U	10	U	10	U	10	U
CHRYSENE	10	1	10	U	10	U	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1	7	B	1	B	2	B	10	U	3	B
DI-n-OCTYLPHTHALATE	10	1	10	UJ	10	U	10	U	10	U	10	U
BENZO(b)FLUORANTHENE	10	1	10	UJ	10	U	10	U	10	U	10	U
BENZO(k)FLUORANTHENE	10	1	10	UJ	10	U	10	U	10	U	10	U
BENZO(a)PYRENE	10	1	10	UJ	10	U	10	U	10	U	10	U
INDENO(1,2,3-cd)PYRENE	10	1	10	UJ	10	U	10	U	10	U	10	U
DIBENZO(a,h)ANTHRACENE	10	1	10	UJ	10	U	10	U	10	U	10	U
BENZO(g,h,i)PERYLENE	10	1	10	UJ	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS SEMI-VOLATILE ORGANICS (ug/L)

CLIENT ID:			FB-2		FB-3		RB-5		W-MW-BD		W-MW-ED	
LABORATORY ID:			940074-01		940074-23		940074-13		940074-04		940074-15	
ANALYTE	CRQL	MDL										
PHENOL	10	1	10	U	10	U	28		10	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	1	10	U	10	U	10	U	10	U	10	U
2-CHLOROPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
1,4-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
2-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
2,2'-OXYBIS(1-CHLOROPROPANE)	10	1	10	U	10	U	10	U	10	U	10	U
4-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
N-NITROSO-DI-n-PROPYLAMINE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROETHANE	10	1	10	U	10	U	10	U	10	U	10	U
NITROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
ISOPHORONE	10	1	10	U	10	U	10	U	10	U	10	U
2-NITROPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
2,4-DIMETHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE	10	1	10	U	10	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
NAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
4-CHLOROANILINE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	1	10	U	10	U	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	1	10	U	10	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
2-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
DIMETHYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
ACENAPHTHYLENE	10	1	10	U	10	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	1	10	U	10	U	10	U	10	U	10	U
3-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
ACENAPHTHENE	10	1	10	U	10	U	10	U	10	U	10	U

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS SEMI-VOLATILE ORGANICS (ug/L)

CLIENT ID:			FB-2		FB-3		RB-5		W-MW-8D		W-MW-ED	
LABORATORY ID:			940074-01		940074-23		940074-13		940074-04		940074-15	
ANALYTE	CRQL	MDL										
2,4-DINITROPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
4-NITROPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
DIBENZOFURAN	10	1	10	U	10	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	1	10	U	10	U	10	U	10	U	10	U
DIETHYL PHTHALATE	10	1	3	J	10	U	4	J	10	U	10	U
4-CHLOROPHENYL-PHENYL ETHER	10	1	10	U	10	U	10	U	10	U	10	U
FLUORENE	10	1	10	U	10	U	10	U	10	U	10	U
4-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
N-NITROSODIPHENYLAMINE	10	1	10	U	10	U	10	U	10	U	10	U
4-BROMOPHENYL-PHENYL ETHER	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
PENTACHLOROPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
PHENANTHRENE	10	1	10	U	10	U	10	U	10	U	10	U
ANTHRACENE	10	1	10	U	10	U	10	U	10	U	10	U
DI-n-BUTYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
FLUORANTHENE	10	1	10	U	10	U	10	U	10	U	10	U
CARBAZOLE	10	1	10	U	10	U	10	U	10	U	10	U
PYRENE	10	1	10	U	10	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	1	10	UJ	10	U	10	UJ	10	UJ	10	UJ
BENZO(a)ANTHRACENE	10	1	10	U	10	U	10	U	10	U	10	U
CHRYSENE	10	1	10	U	10	U	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1	2	B	10	U	1	B	1	B	17	B
DI-n-OCTYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(b)FLUORANTHENE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(k)FLUORANTHENE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(a)PYRENE	10	1	10	U	10	U	10	U	10	U	10	U
INDENO(1,2,3-cd)PYRENE	10	1	10	U	10	U	10	U	10	U	10	U
DIBENZO(a,h)ANTHRACENE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(g,h,i)PERYLENE	10	1	10	U	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS SEMI-VOLATILE ORGANICS (ug/L)

CLIENT ID:			W-MW-EI		W-MW-GD		W-MW-GI		W-MW-OI		W-MW-PD	
LABORATORY ID:			940074-16		940074-07		940074-08		940074-21		940074-22	
ANALYTE	CRQL	MDL										
PHENOL	10	1	10	U	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	1	10	U	10	U	10	U	10	U	10	U
2-CHLOROPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
1,4-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
2-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
2,2'-OXYBIS(1-CHLOROPROPANE)	10	1	10	U	10	U	10	U	10	U	10	U
4-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
N-NITROSO-DI-n-PROPYLAMINE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROETHANE	10	1	10	U	10	U	10	U	10	U	10	U
NITROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
ISOPHORONE	10	1	10	U	10	U	10	U	10	U	10	U
2-NITROPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
2,4-DIMETHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE	10	1	10	U	10	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
NAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
4-CHLOROANILINE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	1	10	U	10	U	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	1	10	U	10	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1	10	U	10	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U	10	U	10	U	10	U
2-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
DIMETHYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
ACENAPHTHYLENE	10	1	10	U	10	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	1	10	U	10	U	10	U	10	U	10	U
3-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
ACENAPHTHENE	10	1	10	U	10	U	10	U	10	U	10	U

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS SEMI-VOLATILE ORGANICS (ug/L)

CLIENT ID:			W-MW-EI		W-MW-GD		W-MW-GI		W-MW-OI		W-MW-PD	
LABORATORY ID:			940074-16		940074-07		940074-08		940074-21		940074-22	
ANALYTE	CRQL	MDL										
2,4-DINITROPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
4-NITROPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
DIBENZOFURAN	10	1	10	U	10	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	1	10	U	10	U	10	U	10	U	10	U
DIETHYL PHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
4-CHLOROPHENYL-PHENYL ETHER	10	1	10	U	10	U	10	U	10	U	10	U
FLUORENE	10	1	10	U	10	U	10	U	10	U	10	U
4-NITROANILINE	25	2.5	25	U	25	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
N-NITROSODIPHENYLAMINE	10	1	10	U	10	U	10	U	10	U	10	U
4-BROMOPHENYL-PHENYL ETHER	10	1	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBENZENE	10	1	10	U	10	U	10	U	10	U	10	U
PENTACHLOROPHENOL	25	2.5	25	U	25	U	25	U	25	U	25	U
PHENANTHRENE	10	1	10	U	10	U	10	U	10	U	10	U
ANTHRACENE	10	1	10	U	10	U	10	U	10	U	10	U
DI-n-BUTYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
FLUORANTHENE	10	1	10	U	10	U	10	U	10	U	10	U
CARBAZOLE	10	1	10	U	10	U	10	U	10	U	10	U
PYRENE	10	1	10	U	10	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	1	10	U	10	UJ	10	UJ	10	UJ	10	UJ
BENZO(a)ANTHRACENE	10	1	10	U	10	U	10	U	10	U	10	U
CHRYSENE	10	1	10	U	10	U	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
DI-n-OCTYLPHTHALATE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(b)FLUORANTHENE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(k)FLUORANTHENE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(a)PYRENE	10	1	10	U	10	U	10	U	10	U	10	U
INDENO(1,2,3-cd)PYRENE	10	1	10	U	10	U	10	U	10	U	10	U
DIBENZO(a,h)ANTHRACENE	10	1	10	U	10	U	10	U	10	U	10	U
BENZO(g,h,i)PERYLENE	10	1	10	U	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS SEMI-VOLATILE ORGANICS (ug/L)

STATION ID:			RB-3		W-MW-II	
LABORATORY ID:			940059-25		940059-21	
ANALYTE	CRQL	MDL				
PHENOL	10	1	10	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	1	10	U	10	U
2-CHLOROPHENOL	10	1	10	U	10	U
1,3-DICHLOROBENZENE	10	1	10	U	10	U
1,4-DICHLOROBENZENE	10	1	10	U	10	U
1,2-DICHLOROBENZENE	10	1	10	U	10	U
2-METHYLPHENOL	10	1	10	U	10	U
2,2'-OXYBIS(1-CHLOROPROPANE)	10	1	10	U	10	U
4-METHYLPHENOL	10	1	10	U	10	U
N-NITROSO-DI-n-PROPYLAMINE	10	1	10	U	10	U
HEXACHLOROETHANE	10	1	10	U	10	U
NITROBENZENE	10	1	10	U	10	U
ISOPHORONE	10	1	10	U	10	U
2-NITROPHENOL	10	1	10	U	10	U
2,4-DIMETHYLPHENOL	10	1	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE	10	1	10	U	10	U
2,4-DICHLOROPHENOL	10	1	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	1	10	U	10	U
NAPHTHALENE	10	1	10	U	10	U
4-CHLOROANILINE	10	1	10	U	10	U
HEXACHLOROBUTADIENE	10	1	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	U	10	U
2-METHYLNAPHTHALENE	10	1	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	1	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	2.5	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U
2-NITROANILINE	25	2.5	25	U	25	U
DIMETHYLPHTHALATE	10	1	10	U	10	U
ACENAPHTHYLENE	10	1	10	U	10	U
2,6-DINITROTOLUENE	10	1	10	U	10	U
3-NITROANILINE	25	2.5	25	U	25	U
ACENAPHTHENE	10	1	10	U	10	U

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS SEMI-VOLATILE ORGANICS (ug/L)

STATION ID:			RB-3		W-MW-II	
LABORATORY ID:			940059-25		940059-21	
ANALYTE	CRQL	MDL				
2,4-DINITROPHENOL	25	2.5	25	U	25	U
4-NITROPHENOL	25	2.5	25	U	25	U
DIBENZOFURAN	10	1	10	U	10	U
2,4-DINITROTOLUENE	10	1	10	U	10	U
DIETHYL PHTHALATE	10	1	10	U	10	U
4-CHLOROPHENYL-PHENYL ETHER	10	1	10	U	10	U
FLUORENE	10	1	10	U	10	U
4-NITROANILINE	25	2.5	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.5	25	U	25	U
N-NITROSODIPHENYLAMINE	10	1	10	U	10	U
4-BROMOPHENYL-PHENYL ETHER	10	1	10	U	10	U
HEXACHLOROBENZENE	10	1	10	U	10	U
PENTACHLOROPHENOL	25	2.5	25	U	25	U
PHENANTHRENE	10	1	10	U	10	U
ANTHRACENE	10	1	10	U	10	U
DI-n-BUTYLPHTHALATE	10	1	10	U	10	U
FLUORANTHENE	10	1	10	U	10	U
CARBAZOLE	10	1	10	U	10	U
PYRENE	10	1	10	U	10	U
BUTYLBENZYLPHTHALATE	10	1	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	1	10	U	10	U
BENZO(a)ANTHRACENE	10	1	10	U	10	U
CHRYSENE	10	1	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1	2	B	10	U
DI-n-OCTYLPHTHALATE	10	1	10	U	10	U
BENZO(b)FLUORANTHENE	10	1	10	U	10	U
BENZO(k)FLUORANTHENE	10	1	10	U	10	U
BENZO(a)PYRENE	10	1	10	U	10	U
INDENO(1,2,3-cd)PYRENE	10	1	10	U	10	U
DIBENZO(a,h)ANTHRACENE	10	1	10	U	10	U
BENZO(g,h,i)PERYLENE	10	1	10	U	10	U
DILUTION FACTOR:			1.0		1.0	

CTO 116, NAWC WARMINSTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

CLIENT ID:			W-MW-HN43S		W-MW-HN49S		W-RB-1215	
LABORATORY ID:			941092-11		941092-18		941092-13	

TCL SEMIVOLATILE WATERS (UG/L)

ANALYTE	CRQL	MDL						
PHENOL	10	1	10	U	10	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	1	10	U	10	U	10	U
2-CHLOROPHENOL	10	1	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	1	10	U	10	U	10	U
1,4-DICHLOROBENZENE	10	1	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	1	10	U	10	U	10	U
2-METHYLPHENOL	10	1	10	U	10	U	10	U
2,2'-OXYBIS(1-CHLOROPROPANE)	10	1	10	U	10	U	10	U
4-METHYLPHENOL	10	1	10	U	10	U	10	U
N-NITROSO-DI-N-PROPYLAMINE	10	1	10	U	10	U	10	U
HEXACHLOROETHANE	10	1	10	U	10	U	10	U
NITROBENZENE	10	1	10	U	10	U	10	U
ISOPHORONE	10	1	10	U	10	U	10	U
2-NITROPHENOL	10	1	10	U	10	U	10	U
2,4-DIMETHYLPHENOL	10	1	10	U	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE	10	1	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	1	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	1	10	U	10	U	10	U
NAPHTHALENE	10	1	10	U	10	U	10	U
4-CHLOROANILINE	10	1	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	1	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	1	10	U	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	1	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	2.5	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U	10	U
2-NITROANILINE	25	2.5	25	U	25	U	25	U
DIMETHYLPHTHALATE	10	1	10	U	10	U	10	U
ACENAPHTHYLENE	10	1	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	1	10	U	10	U	10	U
3-NITROANILINE	25	2.5	25	U	25	U	25	U
ACENAPHTHENE	10	1	10	U	10	U	10	U

CTO 116, NAWC WARMINSTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

CLIENT ID:			W-MW-HN43S		W-MW-HN49S		W-RB-1215	
LABORATORY ID:			941092-11		941092-18		941092-13	

TCL SEMIVOLATILE WATERS (UG/L)

ANALYTE	CRQL	MDL						
2,4-DINITROPHENOL	25	2.5	25	UJ	25	UJ	25	UJ
4-NITROPHENOL	25	2.5	25	U	25	U	25	U
DIBENZOFURAN	10	1	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	1	10	U	10	U	10	U
DIETHYL PHTHALATE	10	1	10	U	10	U	10	U
4-CHLOROPHENYL-PHENYL ETHER	10	1	10	U	10	U	10	U
FLUORENE	10	1	10	U	10	U	10	U
4-NITROANILINE	25	2.5	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.5	25	U	25	U	25	U
N-NITROSODIPHENYLAMINE	10	1	10	U	10	U	10	U
4-BROMOPHENYL-PHENYL ETHER	10	1	10	U	10	U	10	U
HEXACHLOROBENZENE	10	1	10	U	10	U	10	U
PENTACHLOROPHENOL	25	2.5	25	U	25	U	25	U
PHENANTHRENE	10	1	10	U	1	J	10	U
ANTHRACENE	10	1	10	U	10	U	10	U
DI-N-BUTYLPHTHALATE	10	1	10	U	10	U	10	U
FLUORANTHENE	10	1	10	U	10	U	10	U
CARBAZOLE	10	1	10	U	10	U	10	U
PYRENE	10	1	10	U	10	U	10	U
BUTYLBENZYL PHTHALATE	10	1	11		10		10	U
3,3'-DICHLOROBENZIDINE	10	1	10	U	10	UJ	10	U
BENZO(A)ANTHRACENE	10	1	10	U	10	U	10	U
CHRYSENE	10	1	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1	2	J	2	J	10	U
DI-N-OCTYLPHTHALATE	10	1	10	U	10	U	10	U
BENZO(B)FLUORANTHENE	10	1	10	U	10	U	10	U
BENZO(K)FLUORANTHENE	10	1	10	U	10	U	10	U
BENZO(A)PYRENE	10	1	10	U	10	U	10	U
INDENO(1,2,3-CD)PYRENE	10	1	10	U	10	U	10	U
DIBENZO(A,H)ANTHRACENE	10	1	10	U	10	U	10	U
BENZO(G,H,I)PERYLENE	10	1	10	U	10	U	10	U
DILUTION FACTOR:			1.0		1.0		1.0	

Pesticides/PCB's

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS PCB's (ug/L)

CLIENT ID:			FB-1		RB-1		W-MW-AD		W-MW-AI		W-MW-BI	
LABORATORY ID:			940059-14		940059-01		940059-03		940059-04		940059-06	
ANALYTE	CRQL	MDL										
alpha-BHC	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
beta-BHC	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
delta-BHC	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
gamma-BHC (Lindane)	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
Heptachlor	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
Aldrin	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
Heptachlor epoxide	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
Endosulfan I	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
Dieldrin	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
4,4'-DDE	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
Endrin	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
Endosulfan II	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
4,4'-DDD	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
Endosulfan sulfate	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
4,4'-DDT	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
Methoxychlor	0.50	0.10	0.50	U	0.50	U	0.50	UL	0.50	U	0.50	U
Endrin ketone	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
Endrin aldehyde	0.10	0.02	0.10	U	0.10	U	0.10	UL	0.10	U	0.10	U
alpha-Chlordane	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
gamma-Chlordane	0.050	0.010	0.050	U	0.050	U	0.050	UL	0.050	U	0.050	U
Toxaphene	5.0	1.67	5.0	U	5.0	U	5.0	UL	5.0	U	5.0	U
Aroclor-1016	1.0	0.33	1.0	U	1.0	U	1.0	UL	1.0	U	1.0	U
Aroclor-1221	2.0	0.67	2.0	U	2.0	U	2.0	UL	2.0	U	2.0	U
Aroclor-1232	1.0	0.33	1.0	U	1.0	U	1.0	UL	1.0	U	1.0	U
Aroclor-1242	1.0	0.33	1.0	U	1.0	U	1.0	UL	1.0	U	1.0	U
Aroclor-1248	1.0	0.33	1.0	U	1.0	U	1.0	UL	1.0	U	1.0	U
Aroclor-1254	1.0	0.33	1.0	U	1.0	U	1.0	UL	1.0	U	1.0	U
Aroclor-1260	1.0	0.33	1.0	U	1.0	U	1.0	UL	1.0	U	1.0	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS PCB's (ug/L)

CLIENT ID:			FB-2		FB-3		RB-5		W-MW-BD		W-MW-ED	
LABORATORY ID:			940074-01		940074-23		940074-13		940074-04		940074-15	
ANALYTE	CRQL	MDL										
alpha-BHC	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
beta-BHC	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
delta-BHC	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
gamma-BHC (Lindane)	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
Heptachlor	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
Aldrin	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
Heptachlor epoxide	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
Endosulfan I	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
Dieldrin	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
4,4'-DDE	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
Endrin	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
Endosulfan II	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
4,4'-DDD	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
Endosulfan sulfate	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
4,4'-DDT	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
Methoxychlor	0.50	0.10	0.50	UJ	0.50	UJ	0.50	UJ	0.50	UJ	0.50	UJ
Endrin ketone	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
Endrin aldehyde	0.10	0.02	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UL
alpha-Chlordane	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
gamma-Chlordane	0.050	0.010	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UL
Toxaphene	5.0	1.7	5.0	U	5.0	U	5.0	U	5.0	U	5.0	UL
Aroclor-1016	1.0	0.33	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UL
Aroclor-1221	2.0	0.67	2.0	U	2.0	U	2.0	U	2.0	U	2.0	UL
Aroclor-1232	1.0	0.33	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UL
Aroclor-1242	1.0	0.33	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UL
Aroclor-1248	1.0	0.33	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UL
Aroclor-1254	1.0	0.33	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UL
Aroclor-1260	1.0	0.33	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UL
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

TCL AQUEOUS PCB's (ug/L)

CLIENT ID:			W-MW-EI		W-MW-GD		W-MW-GI		W-MW-OI		W-MW-PD	
LABORATORY ID:			940074-16		940074-07		940074-08		940074-21		940074-22	
ANALYTE	CRQL	MDL										
alpha-BHC	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
beta-BHC	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
delta-BHC	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
gamma-BHC (Lindane)	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
Heptachlor	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
Aldrin	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
Heptachlor epoxide	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
Endosulfan I	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
Dieldrin	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
4,4'-DDE	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
Endrin	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
Endosulfan II	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
4,4'-DDD	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
Endosulfan sulfate	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
4,4'-DDT	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
Methoxychlor	0.50	0.10	0.50	UJ	0.50	UJ	0.50	UJ	0.50	UJ	0.50	UJ
Endrin ketone	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
Endrin aldehyde	0.10	0.02	0.10	UL	0.10	U	0.10	UL	0.10	UL	0.10	UL
alpha-Chlordane	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
gamma-Chlordane	0.050	0.010	0.050	UL	0.050	U	0.050	UL	0.050	UL	0.050	UL
Toxaphene	5.0	1.7	5.0	UL	5.0	U	5.0	UL	5.0	UL	5.0	UL
Aroclor-1016	1.0	0.33	1.0	UL	1.0	U	1.0	UL	1.0	UL	1.0	UL
Aroclor-1221	2.0	0.67	2.0	UL	2.0	U	2.0	UL	2.0	UL	2.0	UL
Aroclor-1232	1.0	0.33	1.0	UL	1.0	U	1.0	UL	1.0	UL	1.0	UL
Aroclor-1242	1.0	0.33	1.0	UL	1.0	U	1.0	UL	1.0	UL	1.0	UL
Aroclor-1248	1.0	0.33	1.0	UL	1.0	U	1.0	UL	1.0	UL	1.0	UL
Aroclor-1254	1.0	0.33	1.0	UL	1.0	U	1.0	UL	1.0	UL	1.0	UL
Aroclor-1260	1.0	0.33	1.0	UL	1.0	U	1.0	UL	1.0	UL	1.0	UL
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL AQUEOUS PCB's (ug/L)

CLIENT ID:			RB-3		W-MW-II	
LABORATORY ID:			940059-25		940059-21	
ANALYTE	CRQL	MDL				
alpha-BHC	0.050	0.010	0.050	U	0.050	UL
beta-BHC	0.050	0.010	0.050	U	0.050	UL
delta-BHC	0.050	0.010	0.050	U	0.050	UL
gamma-BHC (Lindane)	0.050	0.010	0.050	U	0.050	UL
Heptachlor	0.050	0.010	0.050	U	0.050	UL
Aldrin	0.050	0.010	0.050	U	0.050	UL
Heptachlor epoxide	0.050	0.010	0.050	U	0.050	UL
Endosulfan I	0.050	0.010	0.050	U	0.050	UL
Dieldrin	0.10	0.02	0.10	U	0.10	UL
4,4'-DDE	0.10	0.02	0.10	U	0.10	UL
Endrin	0.10	0.02	0.10	U	0.10	UL
Endosulfan II	0.10	0.02	0.10	U	0.34	L
4,4'-DDD	0.10	0.02	0.10	U	0.10	UL
Endosulfan sulfate	0.10	0.02	0.10	U	0.10	UL
4,4'-DDT	0.10	0.02	0.10	U	0.10	UL
Methoxychlor	0.50	0.10	0.50	U	0.50	UL
Endrin ketone	0.10	0.02	0.10	U	0.10	UL
Endrin aldehyde	0.10	0.02	0.10	U	0.10	UL
alpha-Chlordane	0.050	0.010	0.050	U	0.050	UL
gamma-Chlordane	0.050	0.010	0.050	U	0.050	UL
Toxaphene	5.0	1.7	5.0	U	5.0	UL
Aroclor-1016	1.0	0.33	1.0	U	1.0	UL
Aroclor-1221	2.0	0.67	2.0	U	2.0	UL
Aroclor-1232	1.0	0.33	1.0	U	1.0	UL
Aroclor-1242	1.0	0.33	1.0	U	1.0	UL
Aroclor-1248	1.0	0.33	1.0	U	1.0	UL
Aroclor-1254	1.0	0.33	1.0	U	1.0	UL
Aroclor-1260	1.0	0.33	1.0	U	1.0	UL
DILUTION FACTOR:			1.0		1.0	

Inorganics

CT0 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TOTAL TAL AQUEOUS METALS (ug/L)

CLIENT ID.			FB-1		RB-1		W-MW-AD		W-MW-AI		W-MW-BI	
LABORATORY ID			940059-14		940059-01		940059-03		940059-04		940059-06	
ANALYTE	CRDL	IDL										
ALUMINUM	200	13.0	20.3	B	26.0	B	13100		285		50.2	B
ANTIMONY	60.0	27.0	36.6	B	38.8	B	30.0	B	27.0	U	27.0	U
ARSENIC	10.0	3.0	3.0	U	3.0	U	8.3		3.0	U	3.0	U
BARIUM	200	3.0	127		3.8	B	628		163		136	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	2.0		1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	30400		82.9	B	44000		23900		28600	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
COPPER	25.0	6.0	129		6.0	U	6.0	U	8.8		6.0	U
IRON	100	5.0	69.0	B	20.9	B	5740		749		81.5	B
LEAD	3.0	1.0	1.0	U	1.0	U	19.3		9.8		1.0	U
MAGNESIUM	5000	23.0	11700		23.6		11800		9600		6660	
MANGANESE	15.0	2.0	20.5		2.0	U	387		258		234	
MERCURY	0.20	0.10	0.12	U	0.13	U	0.22		0.13	U	0.14	U
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	854		81.0	U	2540		885		656	
SELENIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
SILVER	10.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
SODIUM	5000	9.0	7980		160	B	18900		7990		27200	
THALLIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.4		4.0	U	4.0	U
ZINC	20.0	7.0	28.3		7.0	U	33.6		26.2		18.1	

CEIMIC CORPORATION

TAL AQUEOUS DISSOLVED METALS (ug/L)

CLIENT ID:			DFB-1		DRB-1		DW-MW-AD		DW-MW-AI		DW-MW-BI	
LABORATORY ID:			941059-14		941059-01		941059-03		941059-04		941059-06	
ANALYTE	CRDL	IDL										
ALUMINUM	200	13.0	117	B	24.2		16.5	B	29.2	B	13.0	U
ANTIMONY	60.0	27.0	31.8	B	27.0	U	39.0	B	41.0	B	27.0	U
ARSENIC	10.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
BARIUM	200	3.0	126		3.0	U	222		141		291	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	31800		182	B	23100		22700		58700	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
COPPER	25.0	6.0	117		6.5		6.2	B	6.7	B	6.0	U
IRON	100	5.0	136		17.2	B	25.2	B	30.8	B	14.6	B
LEAD	3.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
MAGNESIUM	5000	23.0	12100		29.6		6120		9110		13200	
MANGANESE	15.0	2.0	4.3		2.0	U	100		221		517	
MERCURY	0.20	0.10	0.13	U	0.14	U	0.14	U	0.14	U	0.14	U
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	935		81.0	U	1060		817		1170	
SELENIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
SILVER	10.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
SODIUM	5000	9.0	8300		402	B	13200		7690		37900	
THALLIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
ZINC	20.0	7.0	23.0		7.0	U	7.0	U	12.2		20.6	

CEIMIC CORPORATION

Total TAL AQUEOUS ~~DISSOLVED~~ METALS (ug/L)

CLIENT ID:			FB-2		FB-3		RB-5		W-MW-BD		W-MW-CD	
LABORATORY ID:			940074-01		942074-23		940074-13		940074-04		940074-05	
ANALYTE	CRDL	IDL										
ALUMINUM	200	13.0	13.0	U	13.0	U	13.0	U	294		5080	
ANTIMONY	60.0	27.0	27.0	UL	27.0	UL	27.0	UL	27.0	UL	27.0	UJ
ARSENIC	10.0	3.0	3.0	U	10.5		3.0	U	3.0	U	3.0	UJ
BARIUM	200	3.0	3.0	U	133		3.0	U	108		485	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	155	B	18900		143		31800		51000	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	UL
COPPER	25.0	6.0	6.0	UL	31.3	L	6.0	UL	6.0	UL	6.0	UJ
IRON	100	5.0	62.6	B	2190		20.3	B	605		1650	
LEAD	3.0	1.0	2.1	B	9.6	B	1.8	B	7.3	B	7.7	B
MAGNESIUM	5000	23.0	25.9	B	9410		30.0	B	11700		12500	
MANGANESE	15.0	2.0	2.0	U	63.1		2.0	U	97.4		277	
MERCURY	0.20	0.10	0.13	UL	0.13	UL	0.13	UL	0.15	UL	0.13	UL
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	81.0	U	862		81.0	U	711	B	1110	J
SELENIUM	5.0	4.0	4.0	UL	4.0	UL	4.0	UL	4.0	UL	4.0	UJ
SILVER	10.0	1.0	4.4	B	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ
SODIUM	5000	9.0	249	B	15700	J	712	B	13800	J	18800	J
THALLIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	UJ
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
ZINC	20.0	7.0	7.0	U	295		7.0	U	59.2		12.1	L

CEIMIC CORPORATION

TAL AQUEOUS DISSOLVED METALS (ug/L)

CLIENT ID:			DFB-2		DFB-3		DRB-5		DW-MW-BD		DW-MW-CD	
LABORATORY ID:			941074-01		943074-23		941074-13		941074-04		941074-05	
ANALYTE	CRDL	IDL										
ALUMINUM	200	13.0	13.0	U	13.0	U	13.0	U	13.0	U	13.0	U
ANTIMONY	60.0	27.0	41.9	L	27.0	UL	27.0	UL	27.0	UL	27.0	UL
ARSENIC	10.0	3.0	3.0	U	9.2		3.0	U	3.0	U	3.0	U
BARIUM	200	3.0	3.0	U	133		3.0	U	96.2		330	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	184	B	22200		200	B	29000		44600	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
COPPER	25.0	6.0	6.0	UL	6.0	UL	6.0	UL	8.9	L	6.0	UL
IRON	100	5.0	22.3	B	49.9	B	23.3	B	43.3	B	22.7	B
LEAD	3.0	1.0	1.7	B	1.0	U	1.6	B	4.5	B	1.0	U
MAGNESIUM	5000	23.0	41.5	B	11100		41.5	B	10500		10300	
MANGANESE	15.0	2.0	3.5	B	16.6	B	4.3	B	84.8	B	172	B
MERCURY	0.20	0.10	0.13	UL	0.13	UL	0.13	UL	0.17	L	0.13	UL
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	81.0	U	1080		81.0	U	1140		1340	
SELENIUM	5.0	4.0	4.0	UL	4.0	UL	4.0	UL	4.0	UL	4.0	UL
SILVER	10.0	1.0	1.0	UJ	1.0	UJ	6.5	B	3.3	B	1.0	UJ
SODIUM	5000	9.0	865	B	17700	J	1460	B	14100	J	18300	J
THALLIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
ZINC	20.0	7.0	7.0	U	71.6		7.0	U	44.4		7.0	U

CEIMIC CORPORATION

Total TAL AQUEOUS ~~DISSOLVED~~ METALS (ug/L)

CLIENT ID:			W-MW-CI		W-MW-ED		W-MW-EI		W-MW-ES		W-MW-GD	
LABORATORY ID:			940074-06		940074-15		940074-16		940074-17		940074-07	
ANALYTE	CRDL	IDL										
ALUMINUM	200	13.0	278		3430		4120		61.3		43.5	
ANTIMONY	60.0	27.0	27.0	UJ	27.0	UL	27.0	UL	27.0	UL	27.0	UL
ARSENIC	10.0	3.0	3.0	UJ	3.0	U	3.0	U	3.0	U	3.0	U
BARIUM	200	3.0	403		263		470		178		58.3	
BERYLLIUM	5.0	1.0	1.0	U	1.3		1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	52100		18000		30200		22400		15200	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	UL	3.0	U	3.0	U	3.0	U	3.0	U
COPPER	25.0	6.0	6.0	UJ	6.0	UL	6.0	UL	6.0	UL	6.0	UL
IRON	100	5.0	215	B	1620		2160		352		395	
LEAD	3.0	1.0	1.5	B	17.8		12.0		2.3	B	1.5	B
MAGNESIUM	5000	23.0	13600		5860		8830		11000		5740	
MANGANESE	15.0	2.0	560		39.0		204		16.4	B	10.6	B
MERCURY	0.20	0.10	0.57	L	0.13	UL	0.13	UL	0.12	UL	0.13	UL
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	711	B	1170		748	B	434	B	1100	
SELENIUM	5.0	4.0	4.0	UJ	4.0	UL	4.0	UL	4.0	UL	4.0	UL
SILVER	10.0	1.0	1.0	UJ	1.0	UJ	1.0	UJ	1.8	B	4.5	B
SODIUM	5000	9.0	24700	J	66900	J	13200	J	9610	J	18000	J
THALLIUM	10.0	4.0	4.0	UJ	4.0	U	4.0		4.0	U	4.0	U
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
ZINC	20.0	7.0	17.3	B	45.7		19.0		17.4		7.0	U

CEIMIC CORPORATION

TAL AQUEOUS DISSOLVED METALS (ug/L)

CLIENT ID:			DW-MW-CI		DW-MW-ED		DW-MW-EI		DW-MW-ES		DW-MW-GD	
LABORATORY ID:			941074-06		941074-15		941074-16		941074-17		941074-07	
ANALYTE	CRDL	IDL										
ALUMINUM	200	13.0	13.0	U	13.0	U	13.0	U	13.0	U	13.0	U
ANTIMONY	60.0	27.0	27.0	UJ	27.0	UL	27.0	UL	41.6	L	27.0	UL
ARSENIC	10.0	3.0	3.0	UJ	3.0	U	3.0	U	3.0	U	3.0	U
BARIUM	200	3.0	401		105		196		145		59.8	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	50200		10500		27800		21100		14800	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
COPPER	25.0	6.0	11.8	L	8.9	L	6.0	L	14.1	L	6.0	UL
IRON	100	5.0	46.6	B	24.5	B	45.4	B	19.4	B	49.2	B
LEAD	3.0	1.0	2.9	B	2.7	B	1.0	U	1.2	B	1.2	B
MAGNESIUM	5000	23.0	12900		3120		7770		10100		5560	
MANGANESE	15.0	2.0	513		9.3	B	140		6.1	B	7.9	B
MERCURY	0.20	0.10	0.13	UL	0.14	UL	0.14	UL	0.14	UL	0.13	UL
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	1300	J	1540		857		905		1290	
SELENIUM	5.0	4.0	4.0	UJ	4.0	UL	4.0	UL	4.0	UL	4.0	UL
SILVER	10.0	1.0	2.1	B	9.1	B	10.3	B	6.8	B	1.6	B
SODIUM	5000	9.0	25400	J	67000	J	13600	J	10000	J	18600	J
THALLIUM	10.0	4.0	4.0	UJ	4.0	U	4.0	U	4.0	U	4.0	U
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
ZINC	20.0	7.0	11.0	L	7.0	U	7.0	U	7.0	U	14.1	

CTO 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TOTAL TAL AQUEOUS METALS (ug/L)

CLIENT ID:			RB-3		W-MW-GS		W-MW-II		W-MW-IS	
LABORATORY ID:			942059-25		942059-32		942059-21		942059-22	
ANALYTE	CRDL	IDL								
ALUMINUM	200	13.0	110	B	2340		3520		37.2	
ANTIMONY	60.0	27.0	27.0	U	27.0	U	27.0	U	27.0	U
ARSENIC	10.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U
BARIUM	200	3.0	3.0	U	83.7		162		125	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	74.9	B	17200		36400		18800	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U
COPPER	25.0	6.0	6.0	U	6.0	U	8.3		7.3	
IRON	100	5.0	124		2890		2400		54.4	
LEAD	3.0	1.0	1.2		1.0	U	4.9	B	1.0	U
MAGNESIUM	5000	23.0	23.0	U	7380		15800		8860	
MANGANESE	15.0	2.0	2.0	U	55.6		200		15.1	
MERCURY	0.20	0.10	0.13	U	0.21		0.12	U	0.13	U
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	81.0	U	1420		1470		954	
SELENIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U
SILVER	10.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U
SODIUM	5000	9.0	139	B	17000		25300		14400	
THALLIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U
VANADIUM	50.0	4.0	4.0	U	5.7		4.0	U	4.0	U
ZINC	20.0	7.0	7.0	U	8.7		19.9		22.9	

CEIMIC CORPORATION

TAL AQUEOUS DISSOLVED METALS (ug/L)

CLIENT ID:			DRB-3		DW-MW-GS		DW-MW-II		DW-MW-IS	
LABORATORY ID:			943059-25		943059-32		943059-21		943059-22	
ANALYTE	CRDL	IDL								
ALUMINUM	200	13.0	14.0		37.8	B	20.6	B	13.0	U
ANTIMONY	60.0	27.0	76.3	B	30.7	B	42.1	B	36.4	B
ARSENIC	10.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U
BARIUM	200	3.0	3.0	U	61.1		92.6		120	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	164	B	18300		37200		19500	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U
COPPER	25.0	6.0	6.0	U	6.0	U	6.0	U	6.0	U
IRON	100	5.0	16.9	B	20.6	B	22.0	B	15.2	B
LEAD	3.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U
MAGNESIUM	5000	23.0	25.8		7520		15500		9020	
MANGANESE	15.0	2.0	2.0	U	5.7		163		15.7	
MERCURY	0.20	0.10	0.14	U	0.13	U	0.13	U	0.13	U
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	81.0	U	1410		1240		904	
SELENIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U
SILVER	10.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U
SODIUM	5000	9.0	427	B	17800		26400		14800	
THALLIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U
ZINC	20.0	7.0	7.0	U	11.5		7.0	U	27.8	

CT0 0134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TOTAL TAL AQUEOUS METALS (ug/L)

CLIENT ID:			W-MW-ID	
LABORATORY ID.			940059-20	
ANALYTE	CRDL	IDL		
ALUMINUM	200	13.0	123	B
ANTIMONY	60.0	27.0	27.0	U
ARSENIC	10.0	3.0	3.0	U
BARIUM	200	3.0	245	
BERYLLIUM	5.0	1.0	1.0	U
CADMIUM	5.0	4.0	4.0	U
CALCIUM	5000	33.0	45800	
CHROMIUM	10.0	8.0	8.0	U
COBALT	50.0	3.0	3.0	U
COPPER	25.0	6.0	6.0	U
IRON	100	5.0	84.8	B
LEAD	3.0	1.0	1.0	U
MAGNESIUM	5000	23.0	11900	
MANGANESE	15.0	2.0	561	
MERCURY	0.20	0.10	0.11	U
NICKEL	40.0	17.0	17.0	U
POTASSIUM	5000	81.0	1480	
SELENIUM	5.0	4.0	4.0	U
SILVER	10.0	1.0	1.0	U
SODIUM	5000	9.0	23000	
THALLIUM	10.0	4.0	4.0	U
VANADIUM	50.0	4.0	4.0	U
ZINC	20.0	7.0	12.1	

CEIMIC CORPORATION

TAL AQUEOUS DISSOLVED METALS (ug/L)

CLIENT ID:			DW-MW-ID	
LABORATORY ID:			941059-20	
ANALYTE	CRDL	IDL		
ALUMINUM	200	13.0	13.0	U
ANTIMONY	60.0	27.0	41.6	B
ARSENIC	10.0	3.0	3.0	U
BARIUM	200	3.0	206	
BERYLLIUM	5.0	1.0	1.0	U
CADMIUM	5.0	4.0	4.0	U
CALCIUM	5000	33.0	41100	
CHROMIUM	10.0	8.0	8.0	U
COBALT	50.0	3.0	3.0	U
COPPER	25.0	6.0	6.0	U
IRON	100	5.0	12.6	B
LEAD	3.0	1.0	1.0	U
MAGNESIUM	5000	23.0	10300	
MANGANESE	15.0	2.0	482	
MERCURY	0.20	0.10	0.14	U
NICKEL	40.0	17.0	17.0	U
POTASSIUM	5000	81.0	1310	
SELENIUM	5.0	4.0	4.0	U
SILVER	10.0	1.0	1.0	U
SODIUM	5000	9.0	30000	
THALLIUM	10.0	4.0	4.0	U
VANADIUM	50.0	4.0	4.0	U
ZINC	20.0	7.0	7.0	U

CEIMIC CORPORATION

Total / TAL AQUEOUS ~~DISSOLVED~~ METALS (ug/L)

CLIENT ID:			W-MW-GI		W-MW-JD		W-MW-JI		W-MW-JS		W-MW-MI	
LABORATORY ID:			940074-08		940074-18		940074-19		940074-20		940074-09	
ANALYTE	CRDL	IDL										
ALUMINUM	200	13.0	150		87.3		146		20.0		187	
ANTIMONY	60.0	27.0	27.0	UL	27.0	UL	27.0	UL	27.0	UL	27.0	UJ
ARSENIC	10.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	UJ
BARIUM	200	3.0	103		276		156		224		408	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	30700		32600		27200		44500		54000	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
COPPER	25.0	6.0	6.0	UL	6.0	UL	6.0	UL	6.0	UL	6.0	UL
IRON	100	5.0	184	B	119	B	227	B	126	B	204	B
LEAD	3.0	1.0	4.3	B	1.5	B	4.1	B	3.2	B	2.4	B
MAGNESIUM	5000	23.0	15700		8030		8100		14600		14000	
MANGANESE	15.0	2.0	32.8		68.2		25.1		7.0		582	
MERCURY	0.20	0.10	0.14	UL	0.13	UL	0.13	UL	0.13	UL	0.13	UL
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	48.5		17.0	U
POTASSIUM	5000	81.0	637	B	2440		867		932		748	B
SELENIUM	5.0	4.0	4.0	UL	4.0	UL	4.0	UL	4.0	UL	4.0	UL
SILVER	10.0	1.0	1.0	UJ	1.0	UJ	3.0	B	1.0	UJ	11.9	J
SODIUM	5000	9.0	17000	J	27300	J	23300	J	29700	J	25200	J
THALLIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.5	K	4.7	K
ZINC	20.0	7.0	27.3		8.5		45.6		27.7		25.5	L

CEIMIC CORPORATION

TAL AQUEOUS DISSOLVED METALS (ug/L)

CLIENT ID:			DW-MW-GI		DW-MW-JD		DW-MW-JI		DW-MW-JS		DW-MW-MI	
LABORATORY ID:			941074-08		941074-18		941074-19		941074-20		941074-09	
ANALYTE	CRDL	IDL										
ALUMINUM	200	13.0	13.0	U	13.0	U	13.0	U	13.0	U	13.0	U
ANTIMONY	60.0	27.0	27.0	UL	27.0	UL	27.0	UL	27.0	UL	27.0	UJ
ARSENIC	10.0	3.0	3.0	U	3.0	U	3.0	U	3.0	UJ	3.0	UJ
BARIUM	200	3.0	88.2		250		135		218		372	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	33.0	27100		33700		27700		48000		51300	
CHROMIUM	10.0	8.0	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
COBALT	50.0	3.0	3.0	U	3.0	U	3.0	U	3.0	UL	3.0	UL
COPPER	25.0	6.0	9.2	L	6.0	L	13.0	L	6.0	UL	6.0	UJ
IRON	100	5.0	21.4	B	45.2	B	26.1	B	29.6	B	22.7	B
LEAD	3.0	1.0	1.2	B	3.3	B	1.0	U	1.5	B	2.0	B
MAGNESIUM	5000	23.0	13400		8130		7950		15400		13000	
MANGANESE	15.0	2.0	14.3	B	67.7		22.5		6.4	B	513	B
MERCURY	0.20	0.10	0.13	UL	0.13	UL	0.13	UL	0.14	UL	0.13	UL
NICKEL	40.0	17.0	17.0	U	17.0	U	17.0	U	17.0	U	17.0	U
POTASSIUM	5000	81.0	876		2740		1340		1440		964	J
SELENIUM	5.0	4.0	4.0	UL	4.0	UL	4.0	UL	4.0	UL	4.0	UJ
SILVER	10.0	1.0	6.2	B	10.1	B	8.1	B	6.4	B	3.0	B
SODIUM	5000	9.0	16500	J	27200	J	22000	J	30100	J	24600	J
THALLIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	UJ
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
ZINC	20.0	7.0	10.9		7.5		32.4		16.6		8.7	L

CTO 159, NAWC WARMINSTER, WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

CLIENT ID:			RB-0818		W-MW-HN40D		W-MW-HN40I		W-MW-HN40S		W-MW-HN41D	
LABORATORY ID:			940739-01		940739-03		940739-04		940739-05		940739-06	
TAL METAL WATERS (UG/L)												
ANALYTE	CRDL	IDL										
ALUMINUM	200	16.0	17.2	B	413		398		5590		293	
ANTIMONY	60.0	37.0	37.0	U	37.0	U	37.0	U	37.0	U	37.0	U
ARSENIC	10.0	2.0	2.0	U	2.0	U	3.8		5.6		2.3	
BARIUM	200	3.0	4.8	B	172		220		445		435	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.1		1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	6.0	116	B	39800		40000		45400		58600	
CHROMIUM	10.0	7.0	7.0	U	7.0	U	8.8	B	7.1	B	12.3	B
COBALT	50.0	5.0	5.0	U	5.0	U	5.0	U	5.5		5.0	UL
COPPER	25.0	5.0	6.2	B	9.2	B	5.0	U	19.0	B	11.1	B
IRON	100	3.0	33.0	B	659		389		7210		492	
LEAD	3.0	1.0	1.0	UL	2.7	L	1.1	L	8.5		4.6	L
MAGNESIUM	5000	22.0	22.0	U	13700		14600		18400		19000	
MANGANESE	15.0	1.0	1.7	B	134		131		897		359	
MERCURY	0.20	0.13	0.14	U	0.13	U	0.13	U	0.13	U	0.13	U
NICKEL	40.0	12.0	12.0	U	12.0	U	12.0	U	12.0	U	12.0	U
POTASSIUM	5000	161	161	U	1150		1090		2380		2330	
SELENIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
SILVER	10.0	4.0	4.0	UL	4.0	UL	4.0	UL	4.0	UL	4.0	UL
SODIUM	5000	28.0	340	B	14200		11500		10900		17200	
THALLIUM	10.0	2.0	2.0	U	2.0	U	2.0	U	2.0	U	2.0	UL
VANADIUM	50.0	3.0	3.0	U	3.0	U	3.0	U	9.7	B	3.0	U
ZINC	20.0	4.0	4.2	K	48.8		5.9	B	29.9	K	83.2	
MOLYBDENUM	80.0	57.0	57.0	U	57.0	U	57.0	U	57.0	U	57.0	U

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CLIENT ID:			RB-0818D		W-MWHN40DD		W-MWHN40ID		W-MWHN40SD		W-MWHN41DD	
LABORATORY ID:			941739-01		941739-03		941739-04		941739-05		941739-06	

DISSOLVED TAL METAL WATERS (UG/L)

ANALYTE	CRDL	IDL										
ALUMINUM	200	16.0	16.0	U	17.2	B	19.7	B	108	B	16.0	U
ANTIMONY	60.0	37.0	37.0	U	37.0	U	37.0	U	37.0	U	37.0	U
ARSENIC	10.0	2.0	2.0	U	2.0	U	4.0		4.3		3.4	
BARIUM	200	3.0	3.0	U	121		99.3		174		344	
BERYLLIUM	5.0	1.0	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
CADMIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
CALCIUM	5000	6.0	137	B	39700		40300		39900		50600	
CHROMIUM	10.0	7.0	7.0	U	7.0	U	7.0	U	7.0	U	7.0	U
COBALT	50.0	5.0	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
COPPER	25.0	5.0	5.0	U	6.0	B	5.0	U	13.0	B	6.2	B
IRON	100	3.0	35.0	B	34.6	B	33.1	B	155	B	36.9	B
LEAD	3.0	1.0	1.0	UL	1.0	UL	1.0	UL	1.0	UL	1.0	UL
MAGNESIUM	5000	22.0	24.9	B	13600		14500		15300		16400	
MANGANESE	15.0	1.0	3.4	B	113		119		157		227	
MERCURY	0.20	0.13	0.13	U	0.13	U	0.13	U	0.14	U	0.13	U
NICKEL	40.0	12.0	12.0	U	12.0	U	12.0	U	12.0	U	12.0	U
POTASSIUM	5000	161	161	U	1170		1180		1200		1870	
SELENIUM	5.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
SILVER	10.0	4.0	4.0	UL	4.0	UL	4.0	UL	4.0	UL	4.0	UL
SODIUM	5000	28.0	283	B	14500		11700		10200		14900	
THALLIUM	10.0	2.0	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
VANADIUM	50.0	3.0	3.0	U	3.0	U	3.0	U	3.2	B	3.0	U
ZINC	20.0	4.0	4.0	U	25.1	K	4.0	U	12.3	K	11.7	K
MOLYBDENUM	80.0	57.0	57.0	U	57.0	U	57.0	U	57.0	U	57.0	U

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CEIMIC CORPORATION

CLIENT ID:			W-MW-HN10S		W-MW-HN41S		W-MW-HN49D		W-MW-HN49I		W-MW-HN49S	
LABORATORY ID:			941092-03		941092-08		941092-16		941092-17		941092-18	
TAL METAL WATERS (UG/L)												
ANALYTE	CRDL	IDL										
ALUMINUM	200	14	66.7	B	6250		13400		3650		25500	
ANTIMONY	60	32	32.0	U	32.0	U	32.0	U	32.0	U	32.0	U
ARSENIC	10	2	2.0	U	2.6		4.2		2.0	U	9.8	
BARIUM	200	1	135		137		300		445		991	
BERYLLIUM	5	1	1.0	U	1.0	U	1.4		1.0	U	5.0	
CADMIUM	5	3	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
CALCIUM	5000	4	37300		37500		23000		37800		50500	
CHROMIUM	10	5	6.0	B	12.0	B	5.0	U	5.0	U	41.3	
COBALT	50	3	3.0	U	3.0	U	3.0	U	3.0	U	17.4	
COPPER	25	2	6.9	B	6.8	B	9.7	B	7.0	B	41.1	
IRON	100	7	125	B	7460		4980		2240		42300	
LEAD	3	1	1.0	U	3.4	B	10.1	B	2.7	B	14.6	
MAGNESIUM	5000	22	11700		18400		9040		24900		35600	
MANGANESE	15	1	4.4	B	259		176		275		1200	
MERCURY	0.2	0.1	0.12	U	0.13	U	0.13	U	0.13	U	0.14	
NICKEL	40	7	7.0	U	7.0	U	7.0	U	7.0	U	45.2	
POTASSIUM	5000	69	1140		1700		2360		1550		9310	
SELENIUM	5	2	2.0	U	2.0	U	2.2	B	2.0	U	2.0	U
SILVER	10	4	4.0	UL	4.0	UL	4.0	UL	4.0	UL	4.0	UL
SODIUM	5000	18	14300		11600		70600		20700		18400	
THALLIUM	10	3	5.2	B	3.0	U	3.5	B	6.4	B	4.4	B
VANADIUM	50	1	1.0	U	6.5		1.0	U	2.2		33.6	
ZINC	20	3	30.5		16.4	B	90.0		29.5		99.4	

CTO 134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION

CLIENT ID:		W-MW-BD		W-MW-ND	
LABORATORY ID:		940074-04		940074-10	
MISCELLANEOUS (MG/L)	RDL				
TOTAL ORGANIC CARBON	1.0	4.0		2.5	
ALKALINITY (AS CACO3)	2.0	119		118	
BIOCHEMICAL OXYGEN DEMAND (BOD)	2.0	2.0	U	2.0	U
CHEMICAL OXYGEN DEMAND (COD)	5.0	8.1		5.0	U
HARDNESS (AS CACO3)	2.0	128		123	
pH	NA	6.25		6.27	
TOTAL DISSOLVED SOLIDS (TDS)	5.0	191		200	
TOTAL SUSPENDED SOLIDS (TSS)	5.0	20.0		22.0	

SOILS

Volatile Organics

CTO 134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL SOIL VOLATILE ORGANICS (ug/kg)

CLIENT ID:			W-SB-A		W-SB-B		W-SB-C		W-SB-D		W-SB-E		W-SB-F	
LABORATORY ID:			930957-02		930957-12		930957-13		930957-06		930957-14		930957-07	
ANALYTE	CRQL	MDL												
Chloromethane	10	2	12	U	3	J	12	U	12	U	12	U	3	J
Bromomethane	10	2	12	U	4	B	12	U	12	U	12	U	4	B
Vinyl Chloride	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Chloroethane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Methylene Chloride	10	2	3	B	3	B	3	B	12	U	12	U	3	B
Acetone	10	2	12	U	11	U	12	U	12	J	9	J	12	U
Carbon Disulfide	10	2	12	U	11	U	12	U	12	U	12	U	12	U
1,1-Dichloroethene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
1,1-Dichloroethane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
1,2-Dichloroethene (total)	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Chloroform	10	2	12	U	11	U	12	U	12	U	12	U	12	U
1,2-Dichloroethane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
2-Butanone	10	2	12	U	11	U	12	U	12	U	12	U	12	U
1,1,1-Trichloroethane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Carbon Tetrachloride	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Bromodichloromethane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
1,2-Dichloropropane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
cis-1,3-Dichloropropene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Trichloroethene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Dibromochloromethane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
1,1,2-Trichloroethane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Benzene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
trans-1,3-Dichloropropene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Bromoform	10	2	12	U	11	U	12	U	12	U	12	U	12	U
4-Methyl-2-Pentanone	10	2	12	U	11	U	12	U	12	U	12	U	12	U
2-Hexanone	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Tetrachloroethene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
1,1,2,2-Tetrachloroethane	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Toluene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Chlorobenzene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Ethylbenzene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Styrene	10	2	12	U	11	U	12	U	12	U	12	U	12	U
Xylene (total)	10	2	12	U	11	U	12	U	12	U	12	U	12	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0		1.0	
% SOLIDS:			81.0		87.0		85.0		84.0		85.0		86.0	

CTO 134 NAWC WARMINSTER, PENNSYLVANIA
CEIMIC CORPORATION
TCL SOIL VOLATILE ORGANICS (ug/kg)

CLIENT ID:			W-SB-G		W-SB-H		W-SB-I		W-SB-J		W-SB-K	
LABORATORY ID:			930957-06		930957-17		930957-09		930957-18		930957-03	
ANALYTE	CRQL	MDL										
Chloromethane	10	2	3	J	11	U	11	U	11	U	12	U
Bromomethane	10	2	17	U	11	U	3	B	11	U	7	B
Vinyl Chloride	10	2	17	U	11	U	11	U	11	U	12	U
Chloroethane	10	2	17	U	11	U	11	U	11	U	12	U
Methylene Chloride	10	2	5	B	11	U	11	U	11	U	3	B
Acetone	10	2	17	U	11	U	8	J	11	U	10	J
Carbon Disulfide	10	2	17	U	11	U	11	U	11	U	12	U
1,1-Dichloroethene	10	2	17	U	11	U	11	U	11	U	12	U
1,1-Dichloroethane	10	2	17	U	11	U	11	U	11	U	12	U
1,2-Dichloroethene (total)	10	2	17	U	11	U	11	U	11	U	12	U
Chloroform	10	2	17	U	11	U	11	U	11	U	12	U
1,2-Dichloroethane	10	2	17	U	11	U	11	U	11	U	12	U
2-Butanone	10	2	17	U	11	U	11	U	11	U	12	U
1,1,1-Trichloroethane	10	2	17	U	11	U	11	U	11	U	12	U
Carbon Tetrachloride	10	2	17	U	11	U	11	U	11	U	12	U
Bromodichloromethane	10	2	17	U	11	U	11	U	11	U	12	U
1,2-Dichloropropane	10	2	17	U	11	U	11	U	11	U	12	U
cis-1,3-Dichloropropene	10	2	17	U	11	U	11	U	11	U	12	U
Trichloroethene	10	2	17	U	11	U	11	U	11	U	12	U
Dibromochloromethane	10	2	17	U	11	U	11	U	11	U	12	U
1,1,2-Trichloroethane	10	2	17	U	11	U	11	U	11	U	12	U
Benzene	10	2	17	U	11	U	11	U	11	U	12	U
trans-1,3-Dichloropropene	10	2	17	U	11	U	11	U	11	U	12	U
Bromoform	10	2	17	U	11	U	11	U	11	U	12	U
4-Methyl-2-Pentanone	10	2	17	U	11	U	11	U	11	U	12	U
2-Hexanone	10	2	17	U	11	U	11	U	11	U	12	U
Tetrachloroethene	10	2	17	U	11	U	11	U	11	U	12	U
1,1,2,2-Tetrachloroethane	10	2	17	U	11	U	11	U	11	U	12	U
Toluene	10	2	17	U	11	U	11	U	11	U	12	U
Chlorobenzene	10	2	17	U	11	U	11	U	11	U	12	U
Ethylbenzene	10	2	17	U	11	U	11	U	11	U	12	U
Styrene	10	2	17	U	11	U	11	U	11	U	12	U
Xylene (total)	10	2	17	U	11	U	11	U	11	U	12	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		1.0	
% SOLIDS:			58.0		87.0		92.0		91.0		82.0	

Inorganics

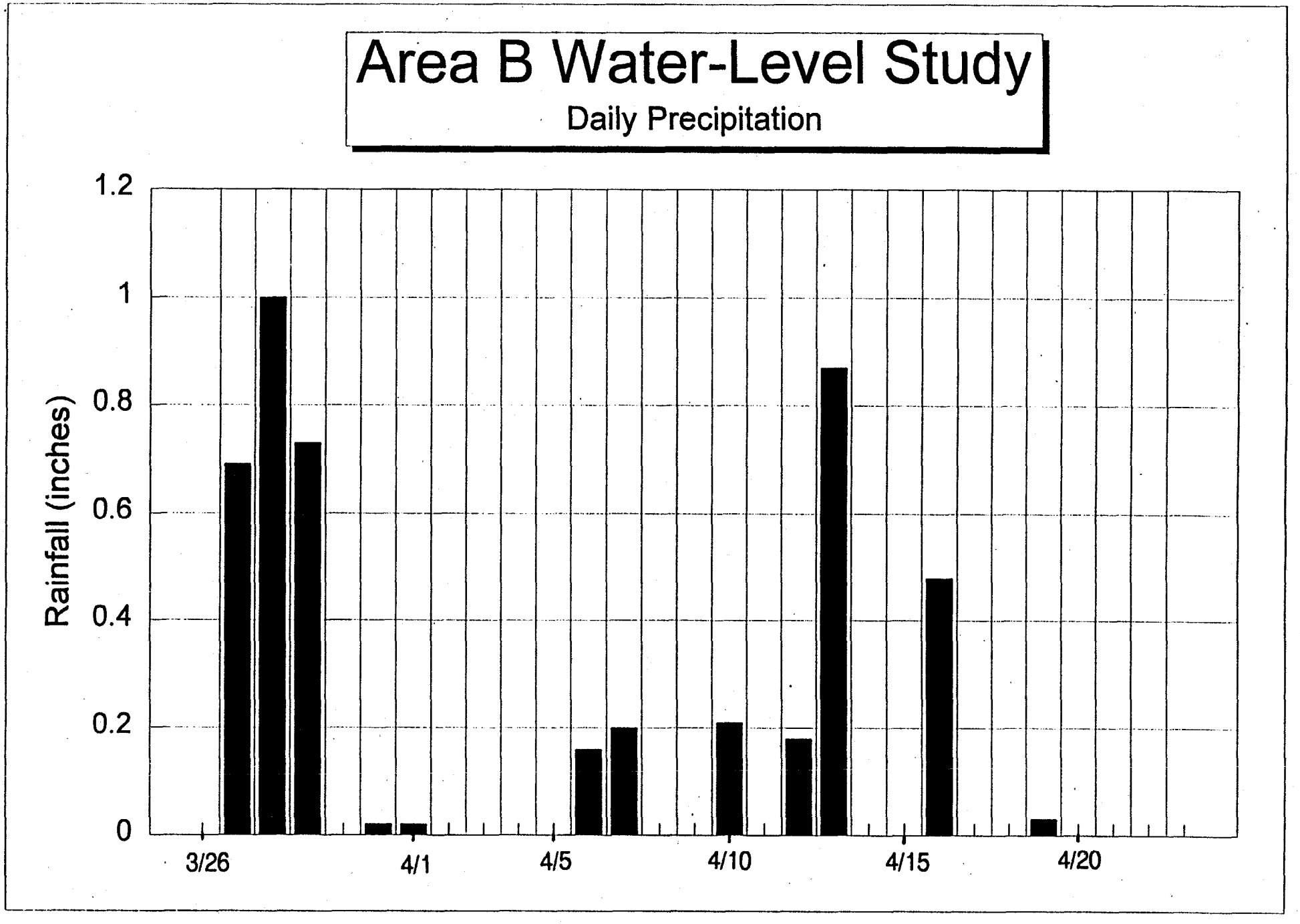
CEIMIC CORPORATION
TOTAL
TAL SOIL METALS (mg/kg)

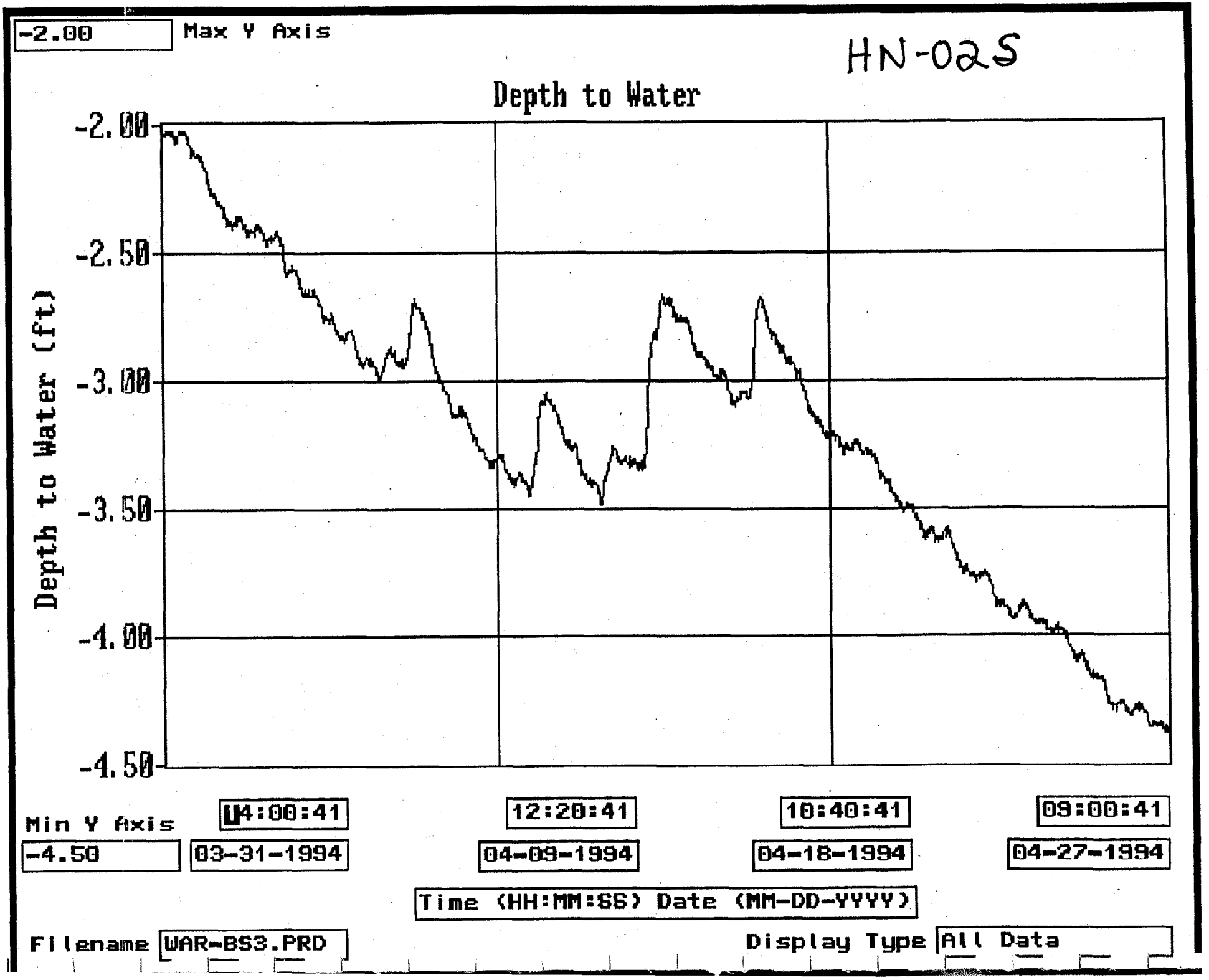
CLIENT ID:			W-SB-A		W-SB-B		W-SB-C		W-SB-D		W-SB-E		W-SB-F	
LABORATORY ID:			930957-02		930957-12		930957-13		930957-06		930957-14		930957-07	
ANALYTE	CRDL	IDL												
ALUMINUM	40.0		16400		11900		11000		13200		9310		4780	
ANTIMONY	12.0		6.1	UL	6.4	UL	6.2	UL	5.7	UL	5.2	UL	4.7	UL
ARSENIC	2.0		1.6		4.0		3.0		0.23	U	2.4		0.2	U
BARIUM	40.0		58.2		45.6	K	36.0		61.1	K	64.8		7.8	B
BERYLLIUM	1.0		1.8		0.72	K	0.71		0.98	K	0.56		0.31	
CADMIUM	1.0		0.91	UJ	0.94	UJ	0.92	UJ	0.85	UJ	0.77	UJ	0.70	UJ
CALCIUM	1000		481		827		768		1910		681		414	
CHROMIUM	2.0		20.3	J	21.7	J	18.0	J	18.5	J	15.2	J	13.1	J
COBALT	10.0		20.2		18.8		13.2		14.5		8.3		1.6	
COPPER	5.0		16.3		14.5	K	5.3		3.6	K	13.8		4.6	
IRON	20.0		23400		24400		17500		28900		16000		6980	
LEAD	0.60		4.6	J	12.2	J	8.2	J	23.5	J	5.7	J	1.6	J
MAGNESIUM	1000		1640		2510		1270		4960		1300		518	
MANGANESE	3.0		486		757	K	657		470	K	700		30.9	
MERCURY	0.1		0.37		0.080	B	0.050	U	0.12	B	0.050	U	0.050	B
NICKEL	6.0		16.5	J	10.0	J	6.6	J	17.1	J	9.1	J	3.0	UJ
POTASSIUM	1000		332		732		280		3060		357		89.1	
SELENIUM	1.0		0.54	B	0.17	U	0.30	B	0.23	U	0.18	U	0.20	U
SILVER	2.0		1.9	B	0.16	UJ	0.54	B	0.24	UJ	1.1	B	0.19	UJ
SODIUM	1000		70.3		132	L	59.6		115	B	86.7		84.7	B
THALLIUM	2.0		0.42	U	0.34	U	0.38	U	0.46	U	0.37	U	0.40	U
VANADIUM	10.0		29.3		41.2	K	27.9		19.4	K	23.9		15.7	
ZINC	4.0		28.8		29.2		15.6		48.6		18.0		3.1	B
% SOLIDS:			83.1		82.2		82.0		82.3		84.2		86.7	

CEIMIC CORPORATION
TOTAL
TAL SOIL METALS (mg/kg)

CLIENT ID:			W-SB-G		W-SB-H		W-SB-I		W-SB-J		W-SB-K	
LABORATORY ID:			930957-08		930957-17		930957-09		930957-18		930957-03	
ANALYTE	CRDL	IDL										
ALUMINUM	40.0		12700		11700		5260		5860		17500	
ANTIMONY	12.0		6.0	UL	5.5	UL	5.7	UL	4.7	UL	4.9	UL
ARSENIC	2.0		1.3		0.28		0.35		0.83		2.1	
BARIUM	40.0		44.1		225		15.0	B	35.6		59.6	K
BERYLLIUM	1.0		0.69		0.48		0.42		0.57		1.7	K
CADMIUM	1.0		0.89	UJ	0.82	UJ	0.85	UJ	0.69	UJ	0.73	UJ
CALCIUM	1000		408		292		544		443		498	
CHROMIUM	2.0		20.3	J	12.4	J	13.3	J	7.9	J	20.3	J
COBALT	10.0		7.7		14.0		5.9		5.9		22.1	
COPPER	5.0		21.6		15.4		30.6		4.6		15.1	K
IRON	20.0		19200		9290		9990		10500		24900	
LEAD	0.60		3.9	J	1.6	J	1.7	J	3.3	J	4.1	J
MAGNESIUM	1000		1660		583		644		660		1750	
MANGANESE	3.0		344		2010		151		636		477	K
MERCURY	0.1		0.050	U	0.19	B	0.050	U	0.050	U	0.13	B
NICKEL	8.0		11.5	J	8.0	J	3.6	UJ	4.1	J	21.7	J
POTASSIUM	1000		516		90.5		200		142		314	
SELENIUM	1.0		0.18	U	0.22	B	0.17	U	0.18	U	0.21	U
SILVER	2.0		0.23	B	0.32	B	0.19	UJ	0.22	UJ	1.1	B
SODIUM	1000		65.6	B	74.1		78.9	B	55.2		74.1	L
THALLIUM	2.0		0.36	U	0.44	U	0.35	U	0.36	U	0.42	
VANADIUM	10.0		30.5		15.4		18.7		15.8		31.3	K
ZINC	4.0		15.8		10.5		8.0	B	9.0		30.8	
% SOLIDS:			84.2		86.4		86.5		89.7		83.3	

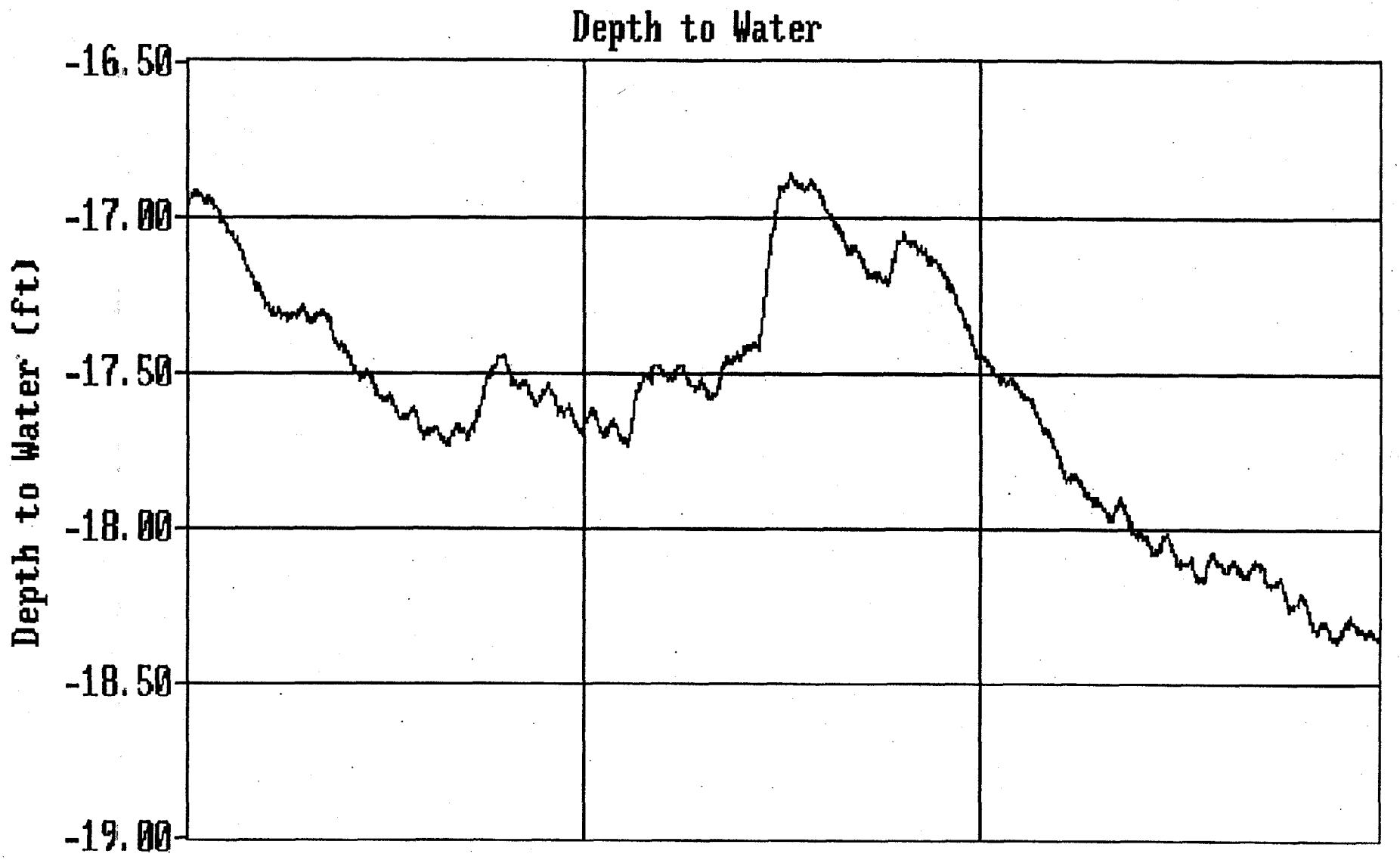
APPENDIX D
LONG TERM WATER LEVEL STUDY RESULTS


Area B Water-Level Study
Daily Precipitation
Rainfall (inches)
1.2
1
0.8
0.6
0.4
0.2
0
3/26
4/1
4/5
4/10
4/15
4/20


-2.00
Max Y Axis
HN-02S
Depth to Water
-2.00
-2.50
-3.00
-3.50
-4.00
-4.50
Depth to Water (ft)
Min Y Axis
-4.50
14:00:41
03-31-1994
12:20:41
04-09-1994
10:40:41
04-18-1994
09:00:41
04-27-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-BS3.PRD
Display Type
All Data

-16.50 Max Y Axis

HN-02 I



Min Y Axis -19.00

14:00:50 03-31-1994

12:20:50 04-09-1994

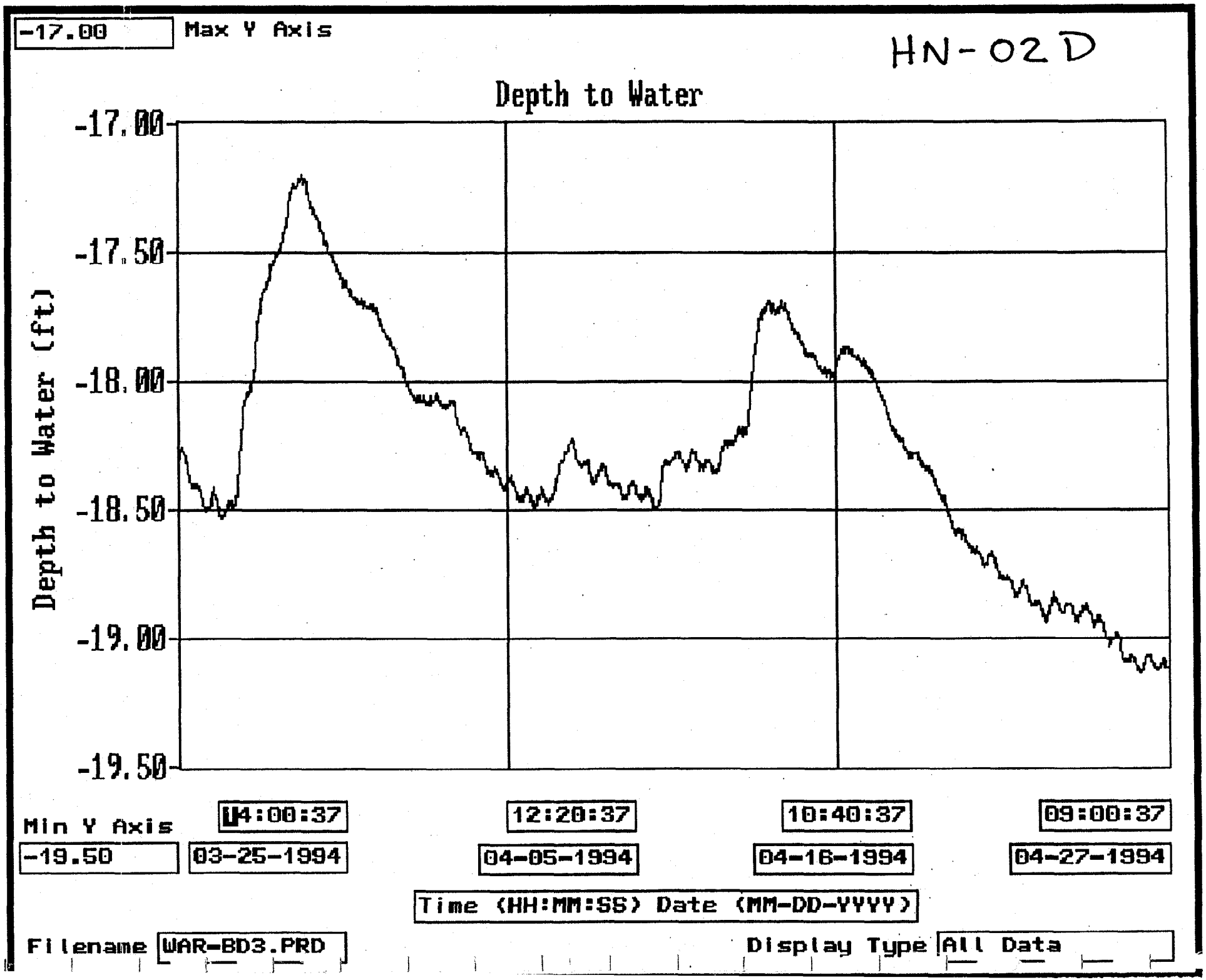
10:40:50 04-18-1994

09:00:50 04-27-1994

Time (HH:MM:SS) Date (MM-DD-YYYY)

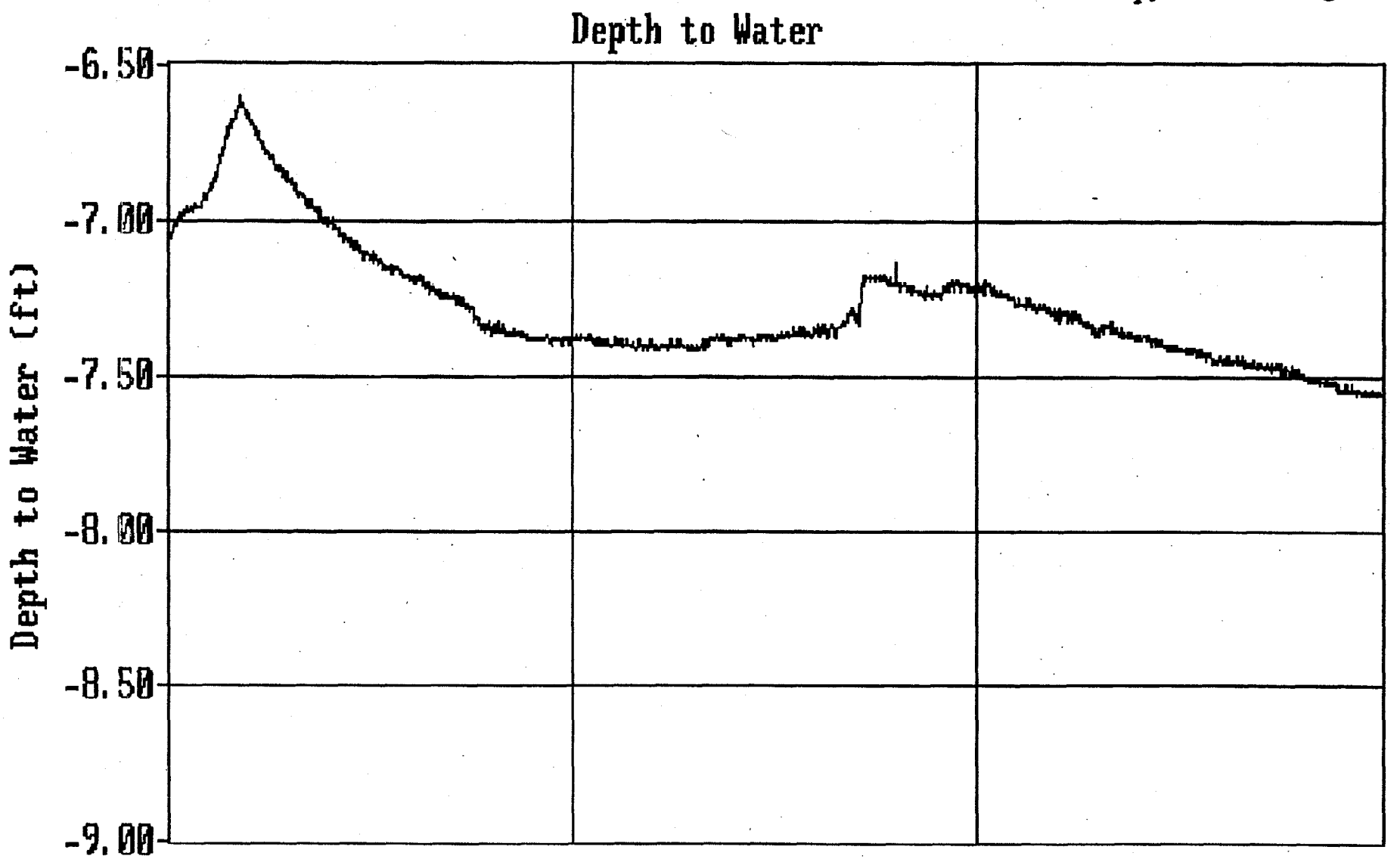
Filename WAR-BI3.PRD

Display Type All Data


-17.00
Max Y Axis
HN-02D
Depth to Water
-17.00
-17.50
-18.00
-18.50
-19.00
-19.50
Depth to Water (ft)
Min Y Axis
-19.50
14:00:37
03-25-1994
12:20:37
04-05-1994
10:40:37
04-16-1994
09:00:37
04-27-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-BD3.PRD
Display Type
All Data

-6.50 Max Y Axis

HN-05 S



Min Y Axis -9.00

03:00:00 03-28-1994

11:10:14 04-07-1994

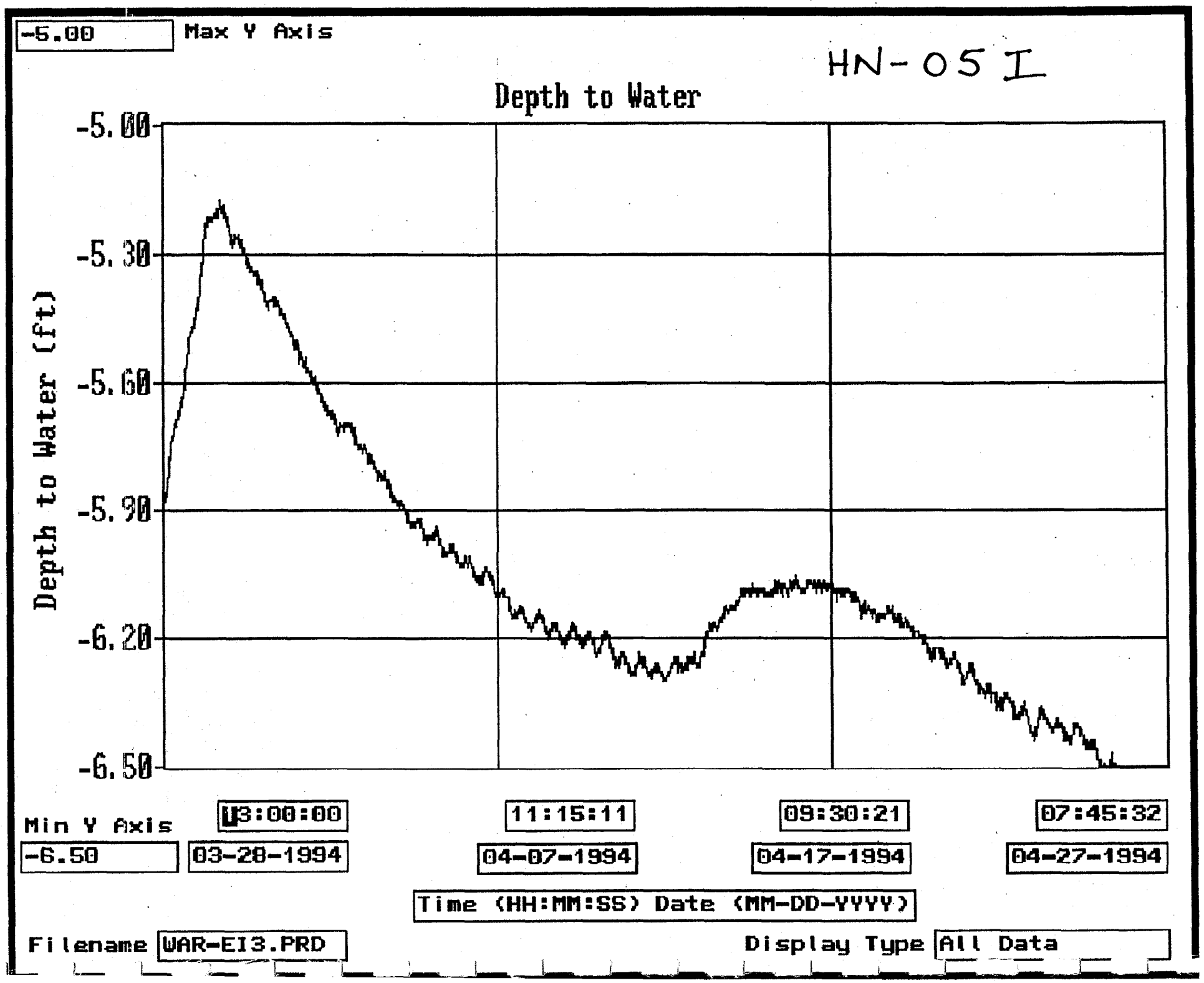
09:20:29 04-17-1994

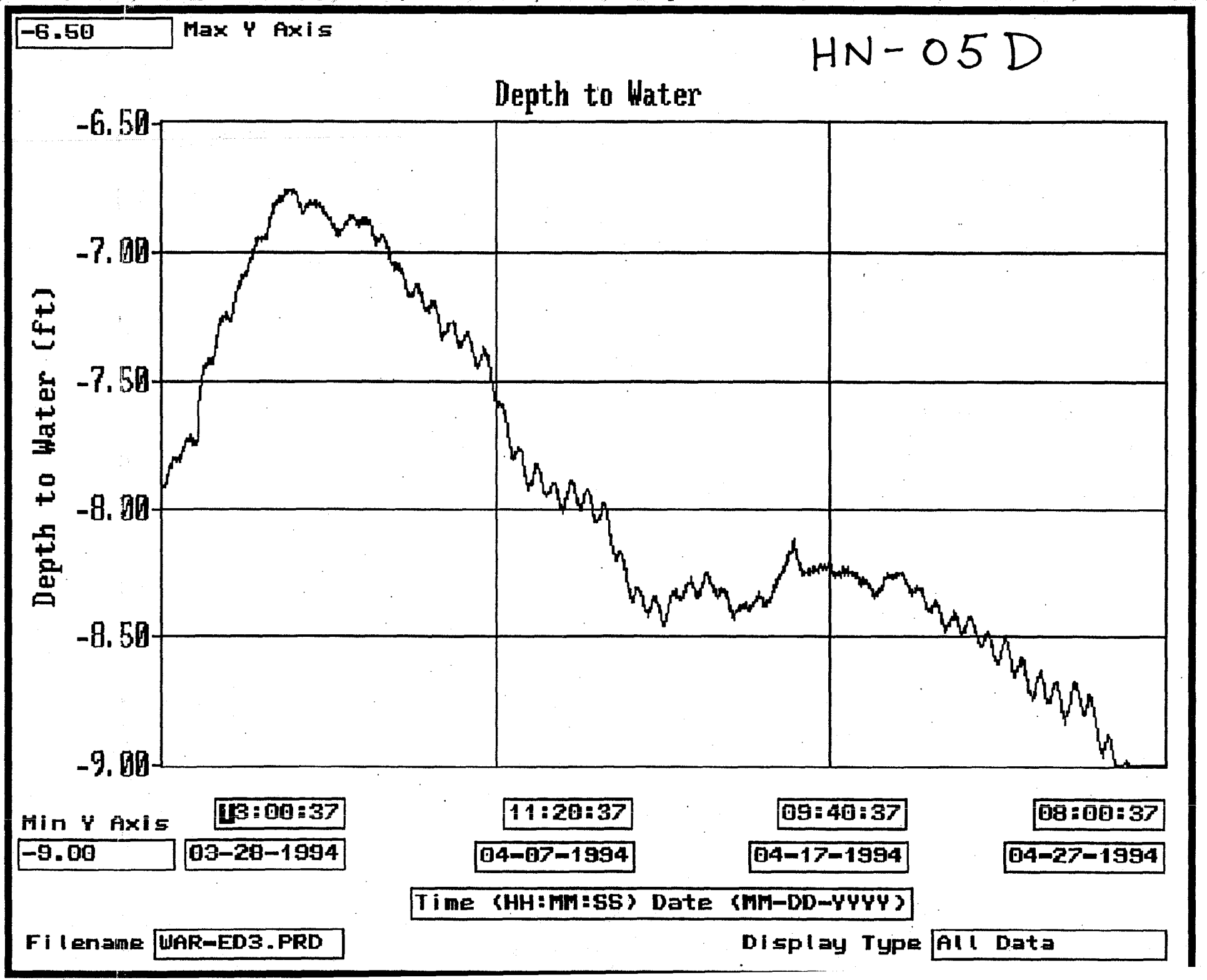
07:30:43 04-27-1994

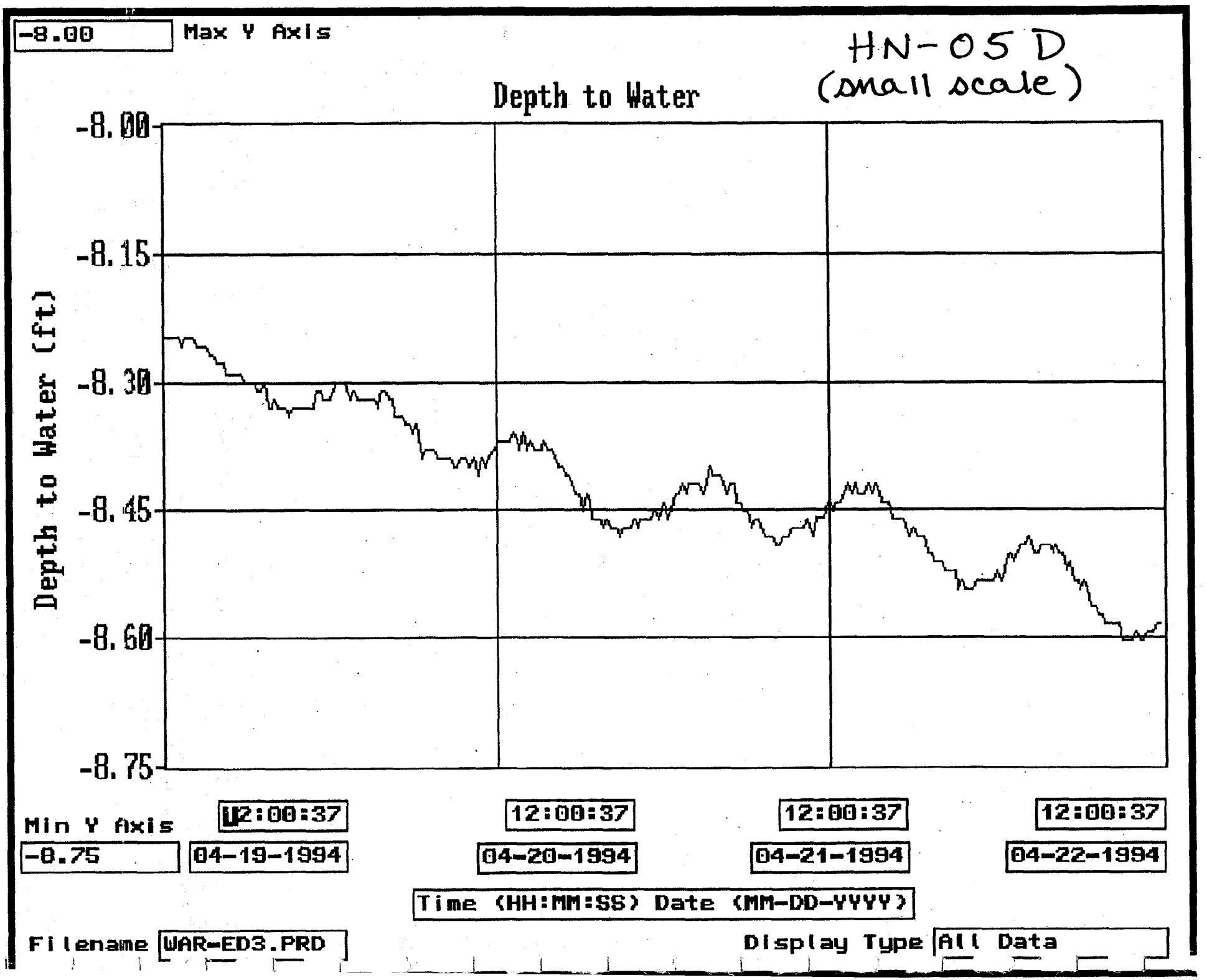
Time (HH:MM:SS) Date (MM-DD-YYYY)

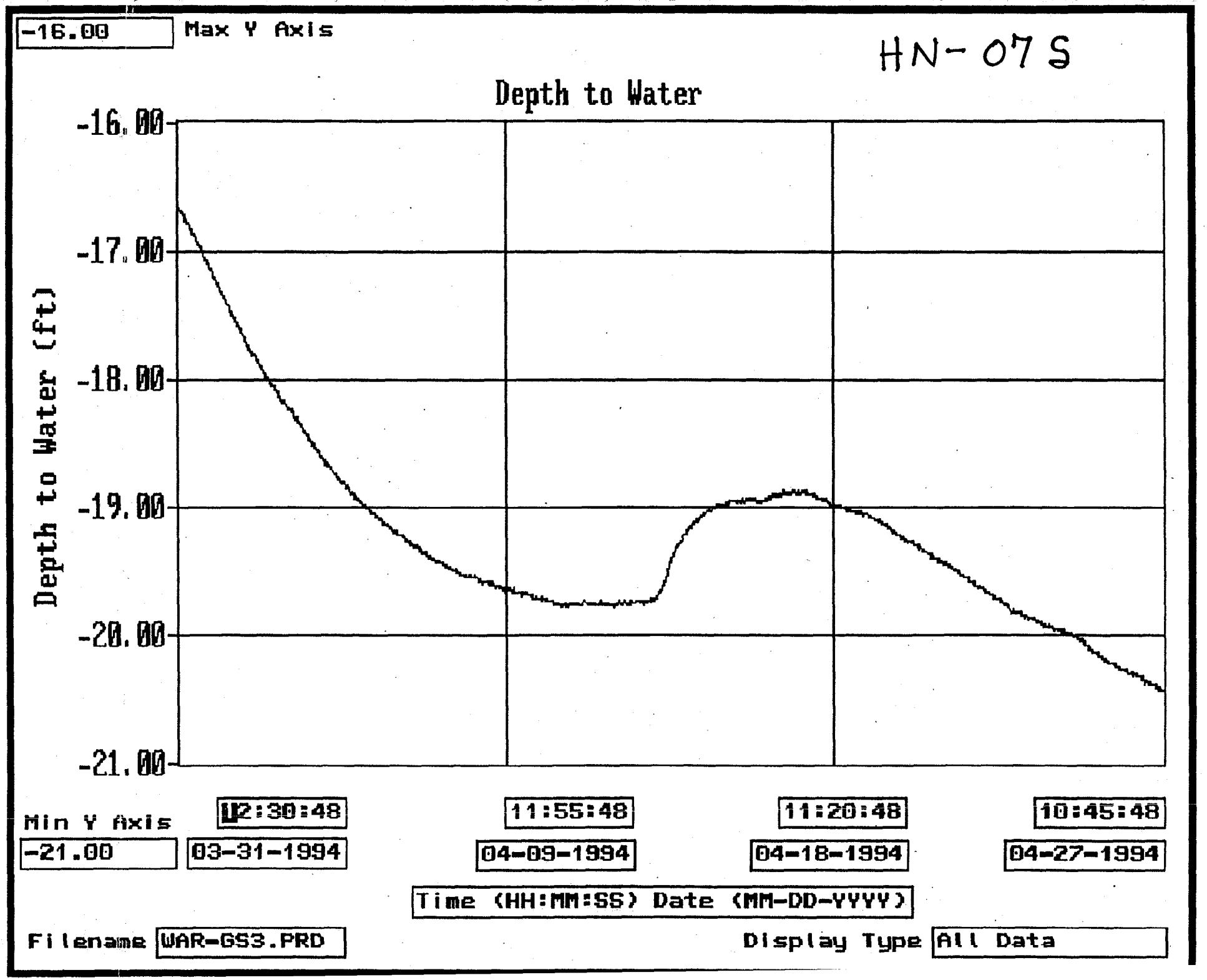
Filename WAR-ES3.PRD

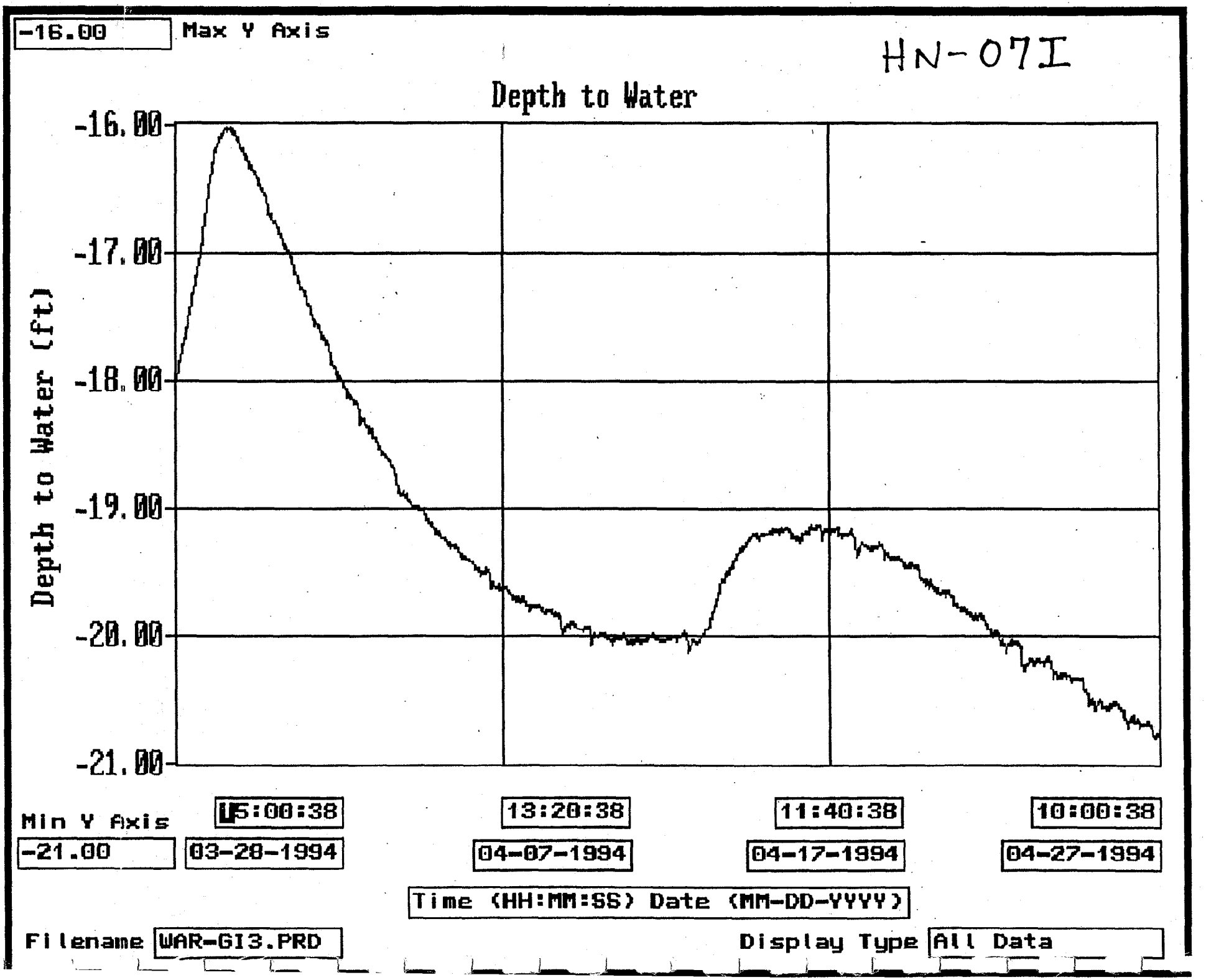
Display Type All Data

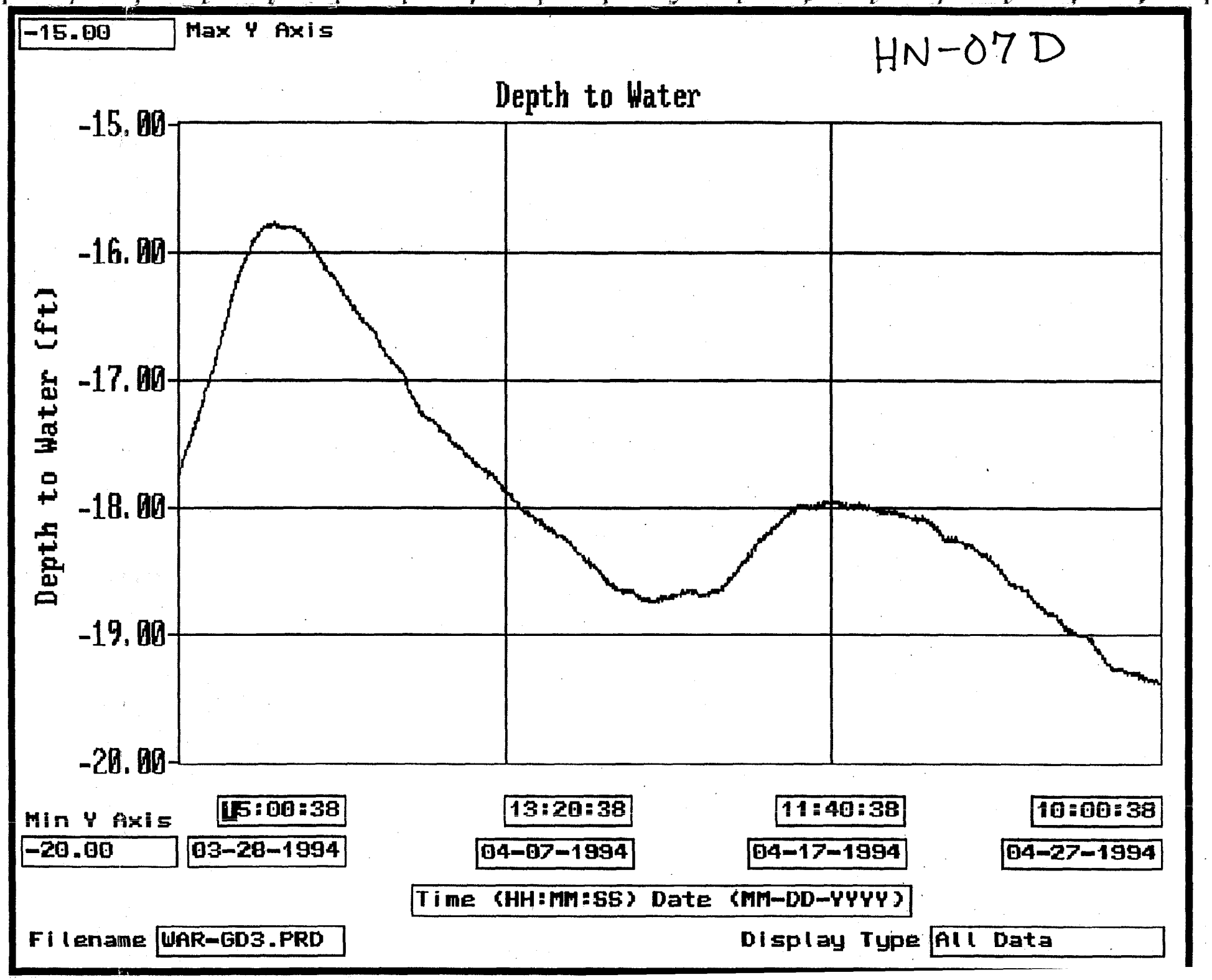

-5.00
Max Y Axis
HN-05 I
Depth to Water
-5.00
-5.30
-5.60
-5.90
-6.20
-6.50
Depth to Water (ft)
Min Y Axis
-6.50
03:00:00
03-28-1994
11:15:11
04-07-1994
09:30:21
04-17-1994
07:45:32
04-27-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-EI3.PRD
Display Type
All Data

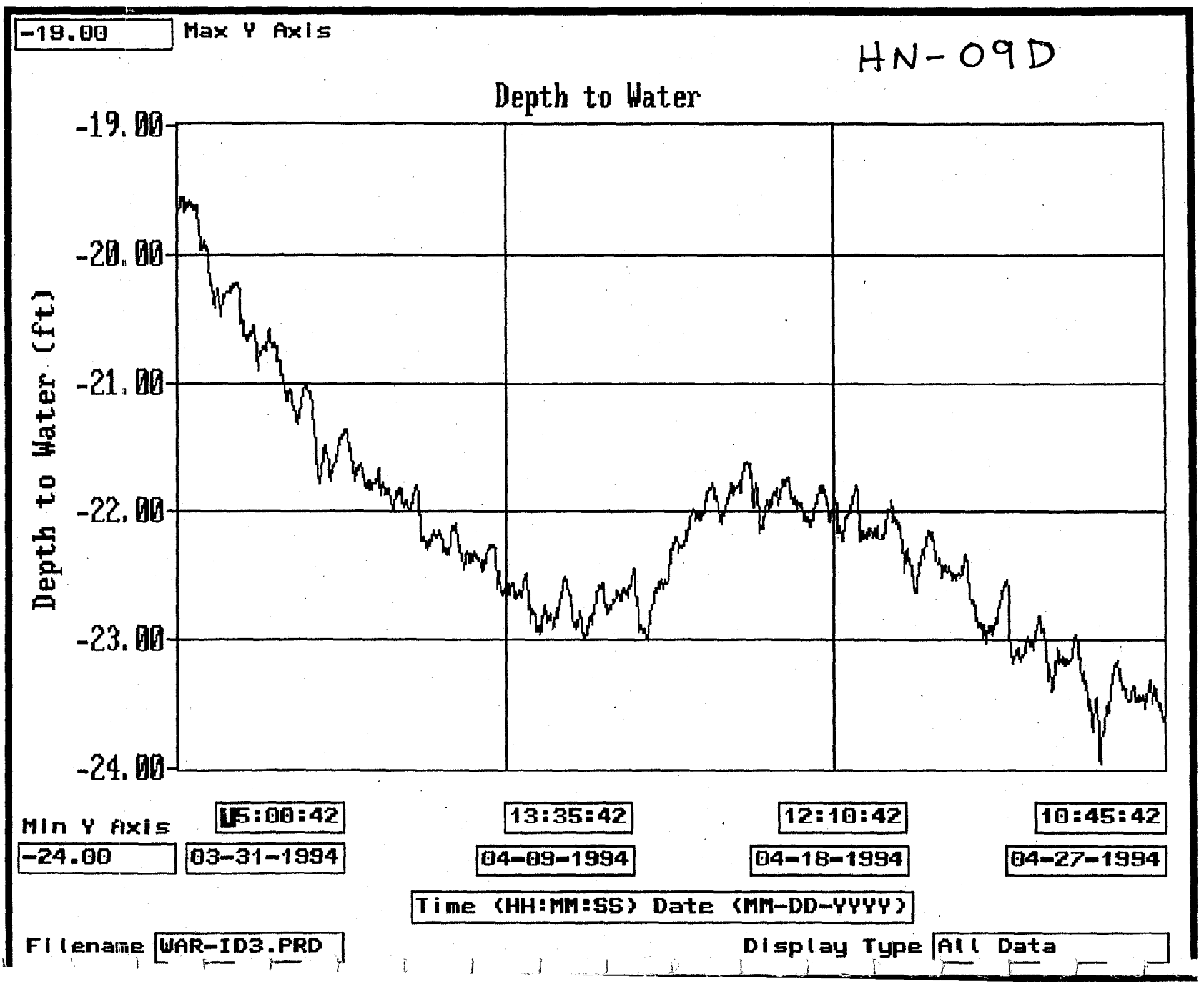

-6.50
Max Y Axis
HN-05D
Depth to Water
-6.50
-7.00
-7.50
-8.00
-8.50
-9.00
Depth to Water (ft)
Min Y Axis
-9.00
03:00:37
03-28-1994
11:20:37
04-07-1994
09:40:37
04-17-1994
08:00:37
04-27-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-ED3.PRD
Display Type
All Data

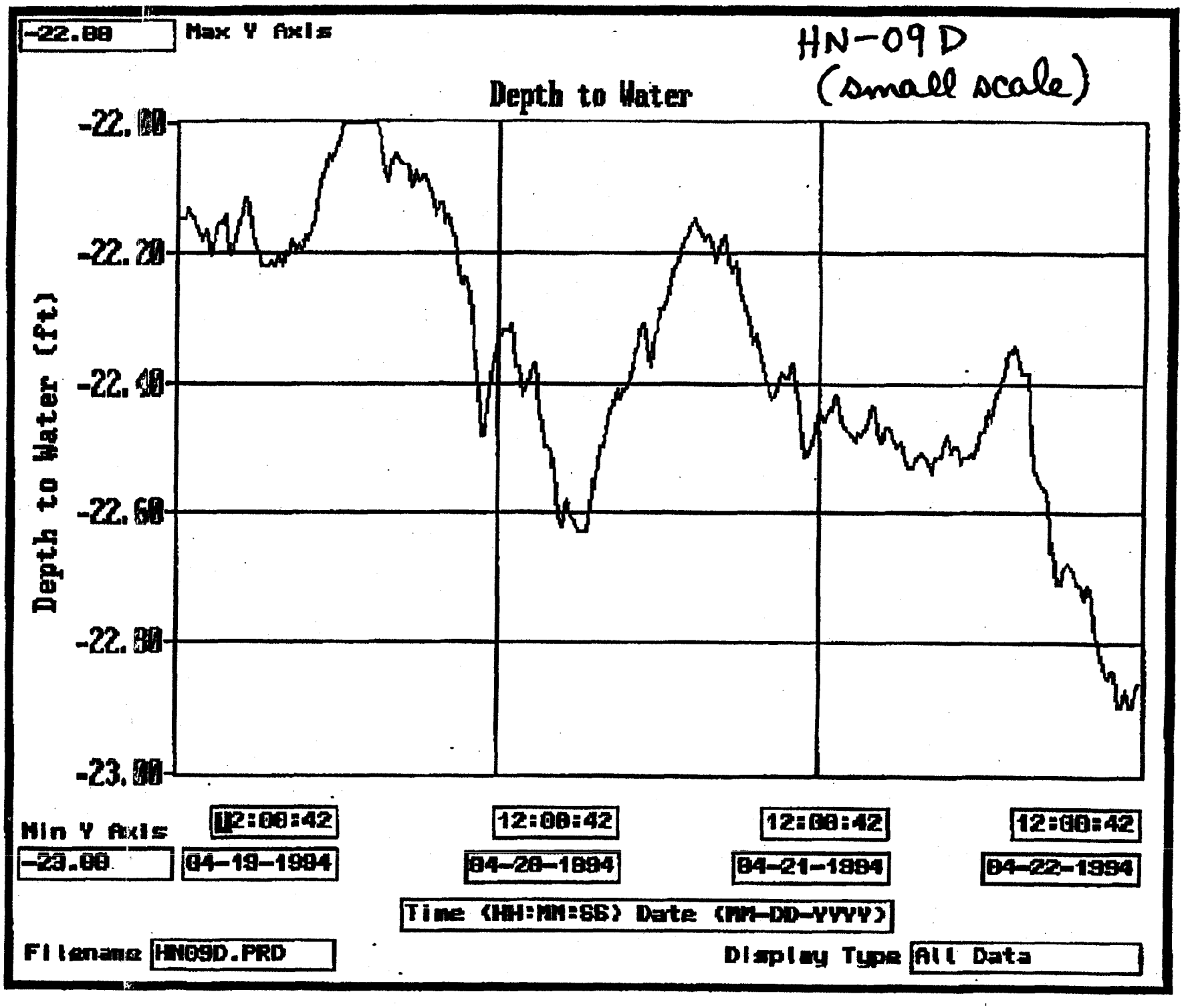

-8.00
Max Y Axis
HN-05 D
(small scale)
Depth to Water
-8.00
-8.15
-8.30
-8.45
-8.60
-8.75
Depth to Water (ft)
Min Y Axis
-8.75
12:00:37
04-19-1994
12:00:37
04-20-1994
12:00:37
04-21-1994
12:00:37
04-22-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-ED3.PRD
Display Type
All Data


-16.00
Max Y Axis
HN-07S
Depth to Water
-16.00
-17.00
-18.00
-19.00
-20.00
-21.00
Depth to Water (ft)
Min Y Axis
-21.00
12:30:48
03-31-1994
11:55:48
04-09-1994
11:20:48
04-18-1994
10:45:48
04-27-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-GS3.PRD
Display Type
All Data


-16.00
Max Y Axis
HN-07I
Depth to Water
-16.00
-17.00
-18.00
-19.00
-20.00
-21.00
Depth to Water (ft)
Min Y Axis
-21.00
15:00:38
03-28-1994
13:20:38
04-07-1994
11:40:38
04-17-1994
10:00:38
04-27-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-GI3.PRD
Display Type
All Data

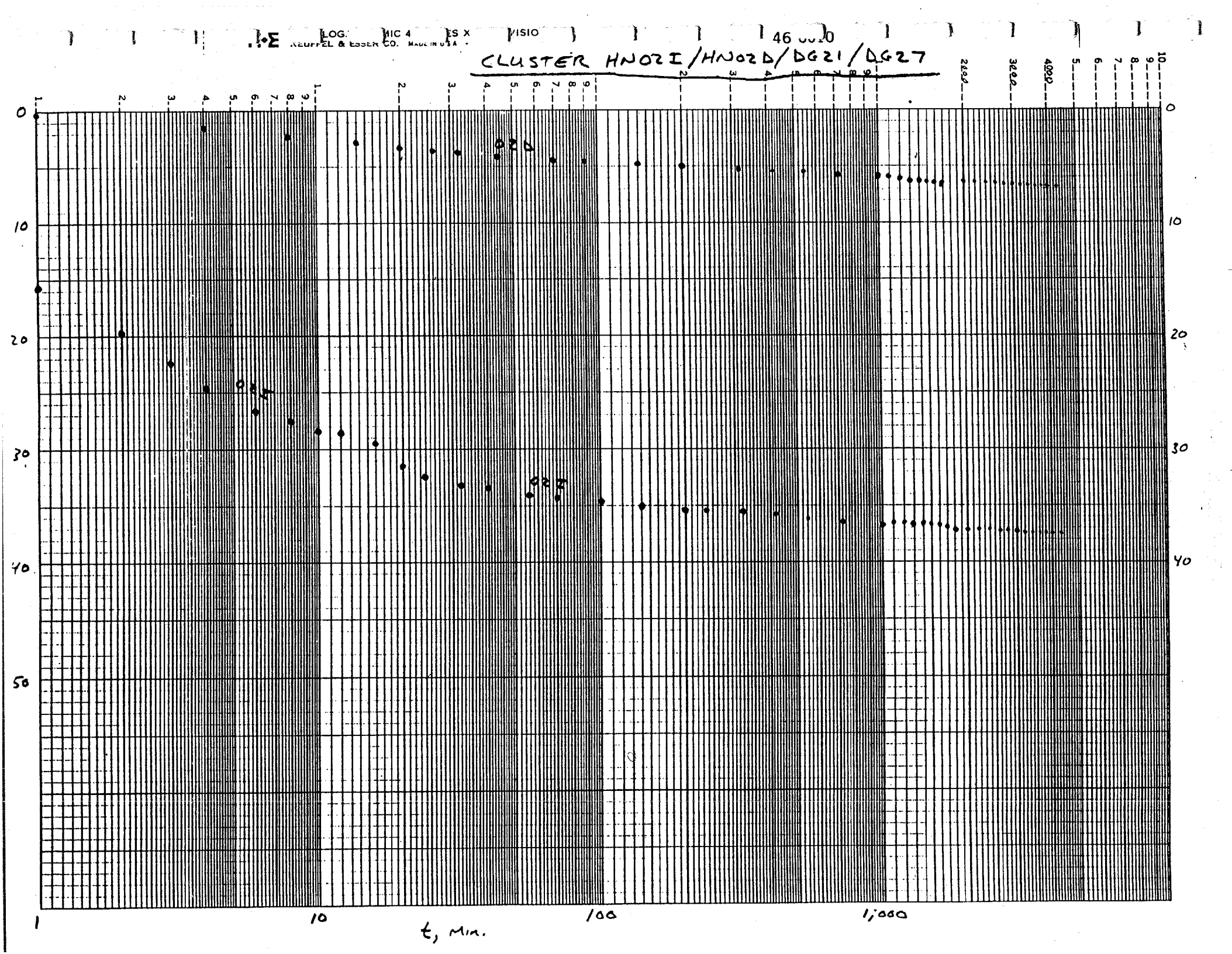

-15.00
Max Y Axis
HN-07D
Depth to Water
-15.00
-16.00
-17.00
-18.00
-19.00
-20.00
Depth to Water (ft)
Min Y Axis
-20.00
15:00:38
03-28-1994
13:20:38
04-07-1994
11:40:38
04-17-1994
10:00:38
04-27-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-GD3.PRD
Display Type
All Data


-19.00
Max Y Axis
HN-09D
Depth to Water
-19.00
-20.00
-21.00
-22.00
-23.00
-24.00
Depth to Water (ft)
Min Y Axis
-24.00
15:00:42
03-31-1994
13:35:42
04-09-1994
12:10:42
04-18-1994
10:45:42
04-27-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
WAR-ID3.PRD
Display Type
All Data


-22.00
Max Y Axis
HN-09D
(small scale)
Depth to Water
-22.00
-22.20
-22.40
-22.60
-22.80
-23.00
Depth to Water (ft)
Min Y Axis
-23.00
12:00:42
04-19-1994
12:00:42
04-20-1994
12:00:42
04-21-1994
12:00:42
04-22-1994
Time (HH:MM:SS) Date (MM-DD-YYYY)
Filename
HN09D.PRD
Display Type
All Data

APPENDIX E
PUMPING TEST RESULTS

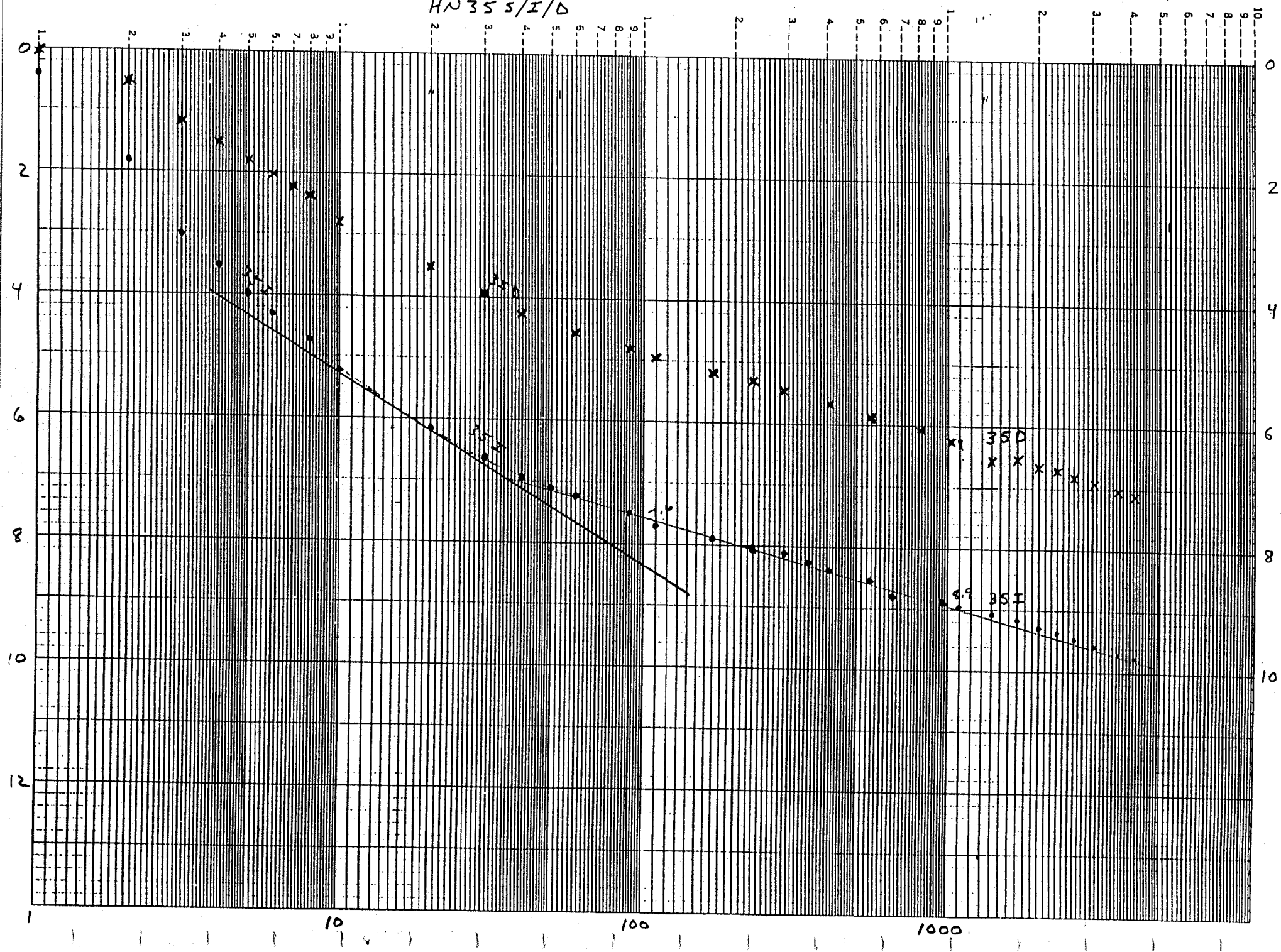
DRAWDOWN GRAPHS


CLUSTER HN02I/HN02D/DG21/DG27
0
10
20
30
40
50
1
10
100
1,000
t, Min.

K·E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

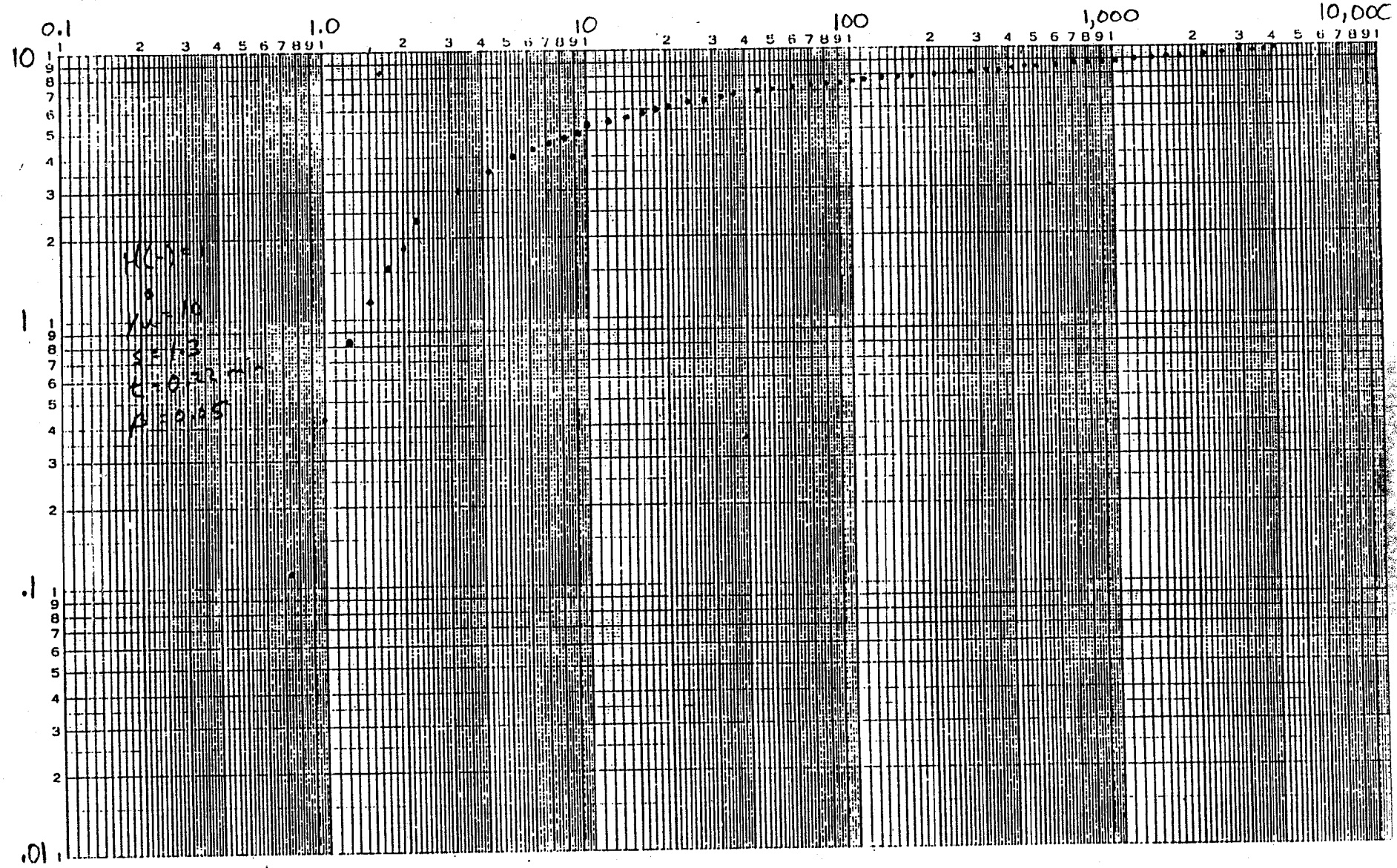
46 6010

HN35 S/I/D



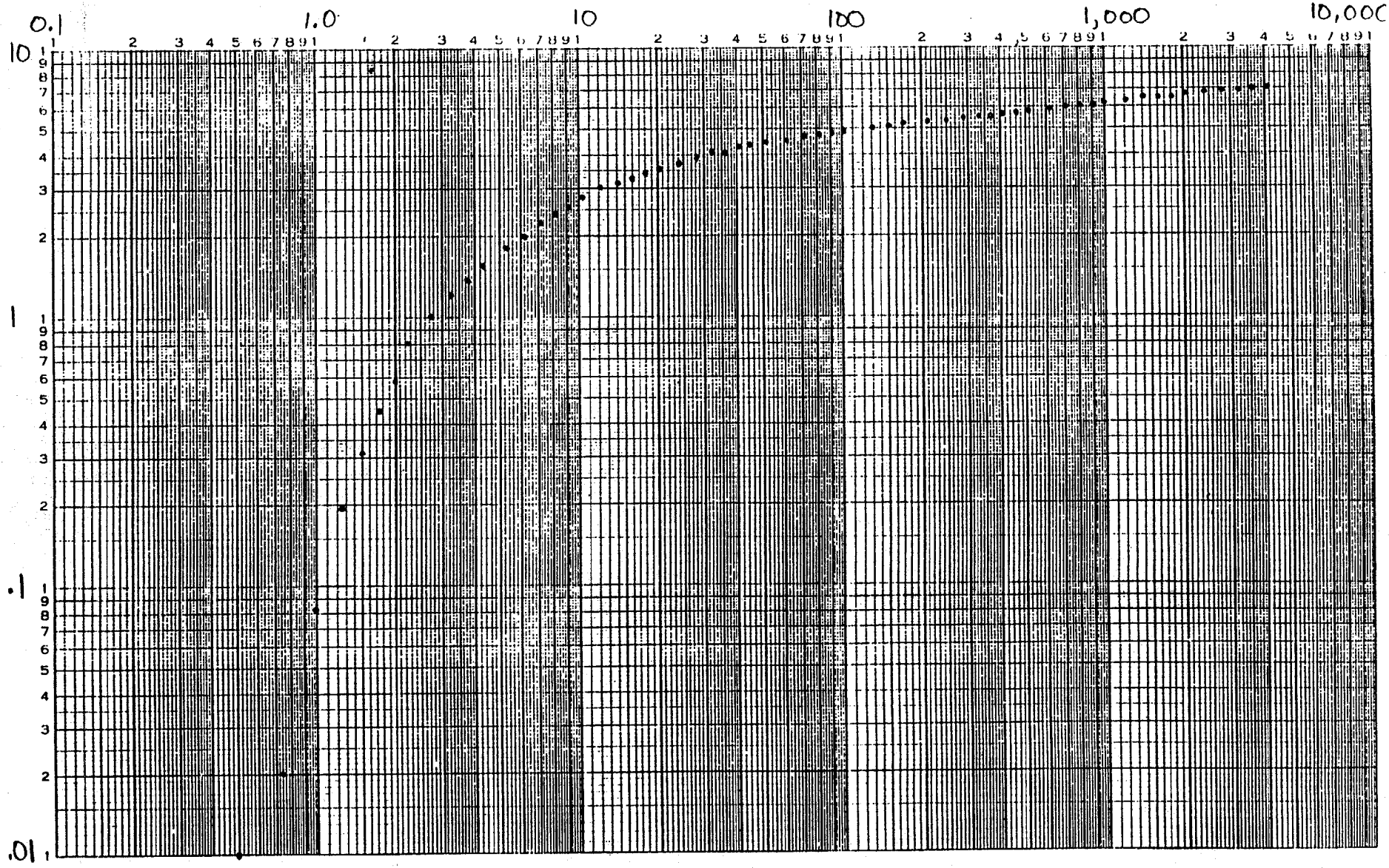
Hu,p
β=.05
10 m

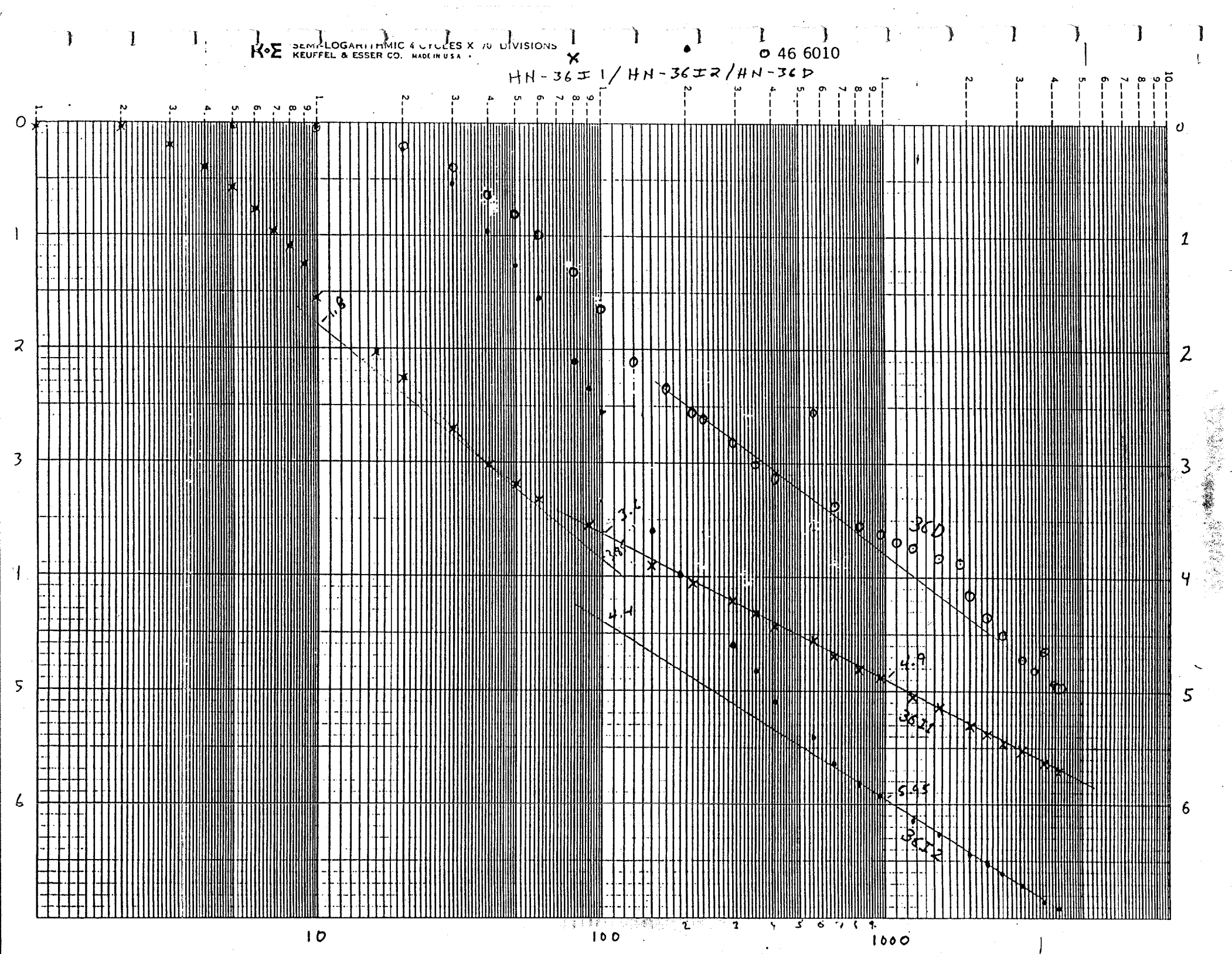
AREA B PUMPING TEST
HN-35 I



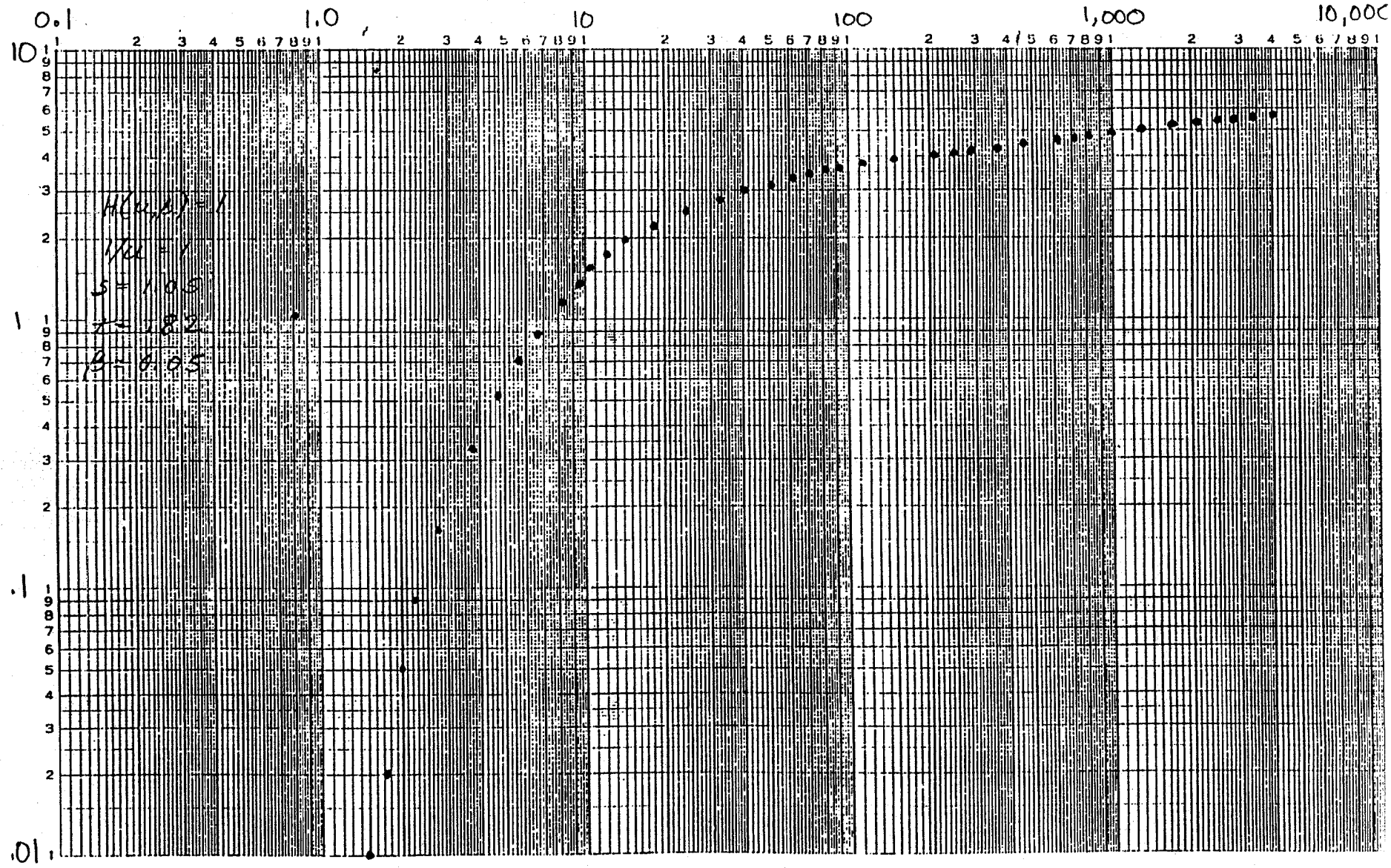
AREA B PUMPING TEST

HN-35D




K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6010
HN-36I1/HN-36I2/HN-36D
36D
36I1
36I2
10
100
1000

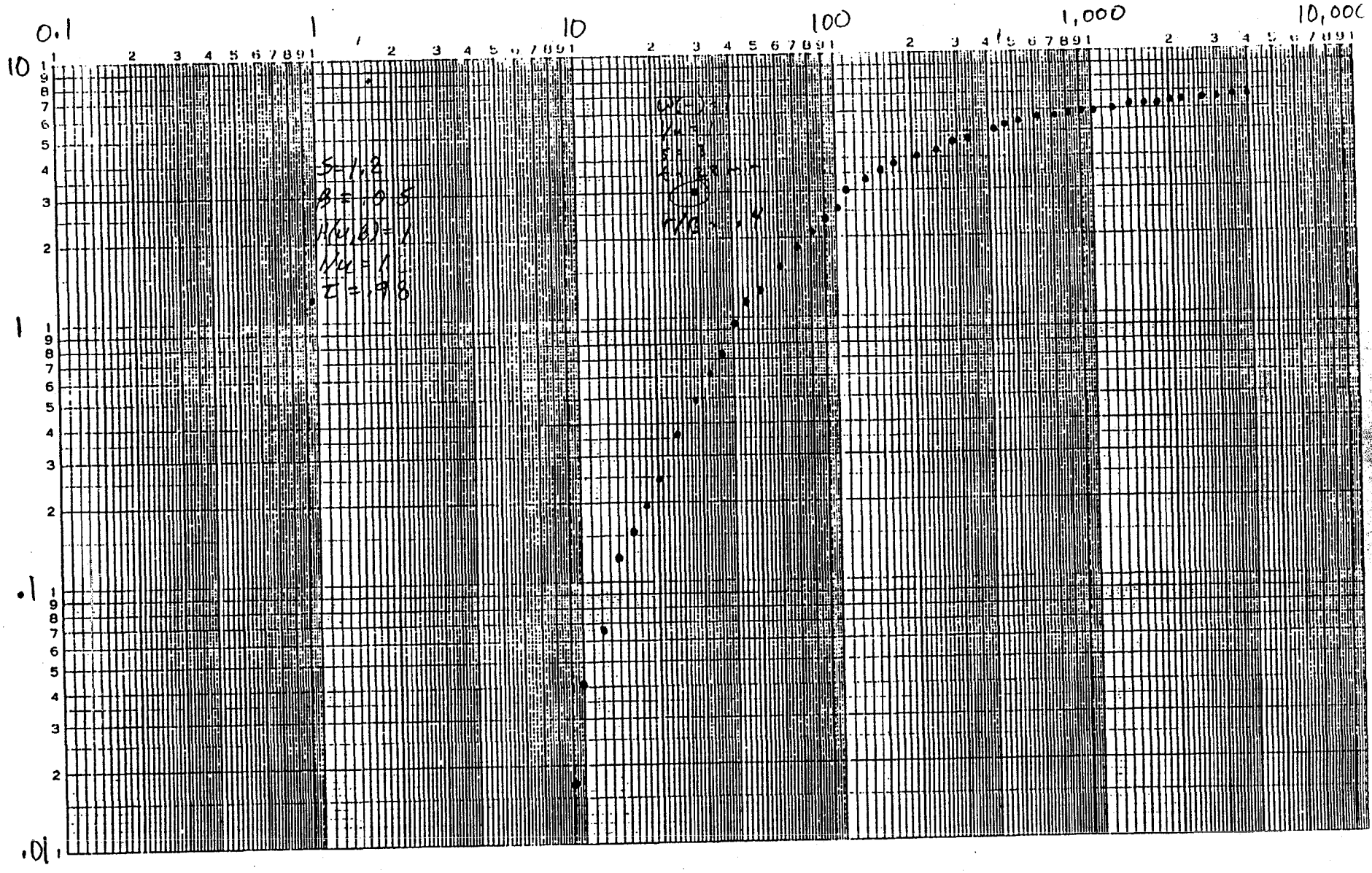
AREA B PUMPING TEST
HN-36 I 1



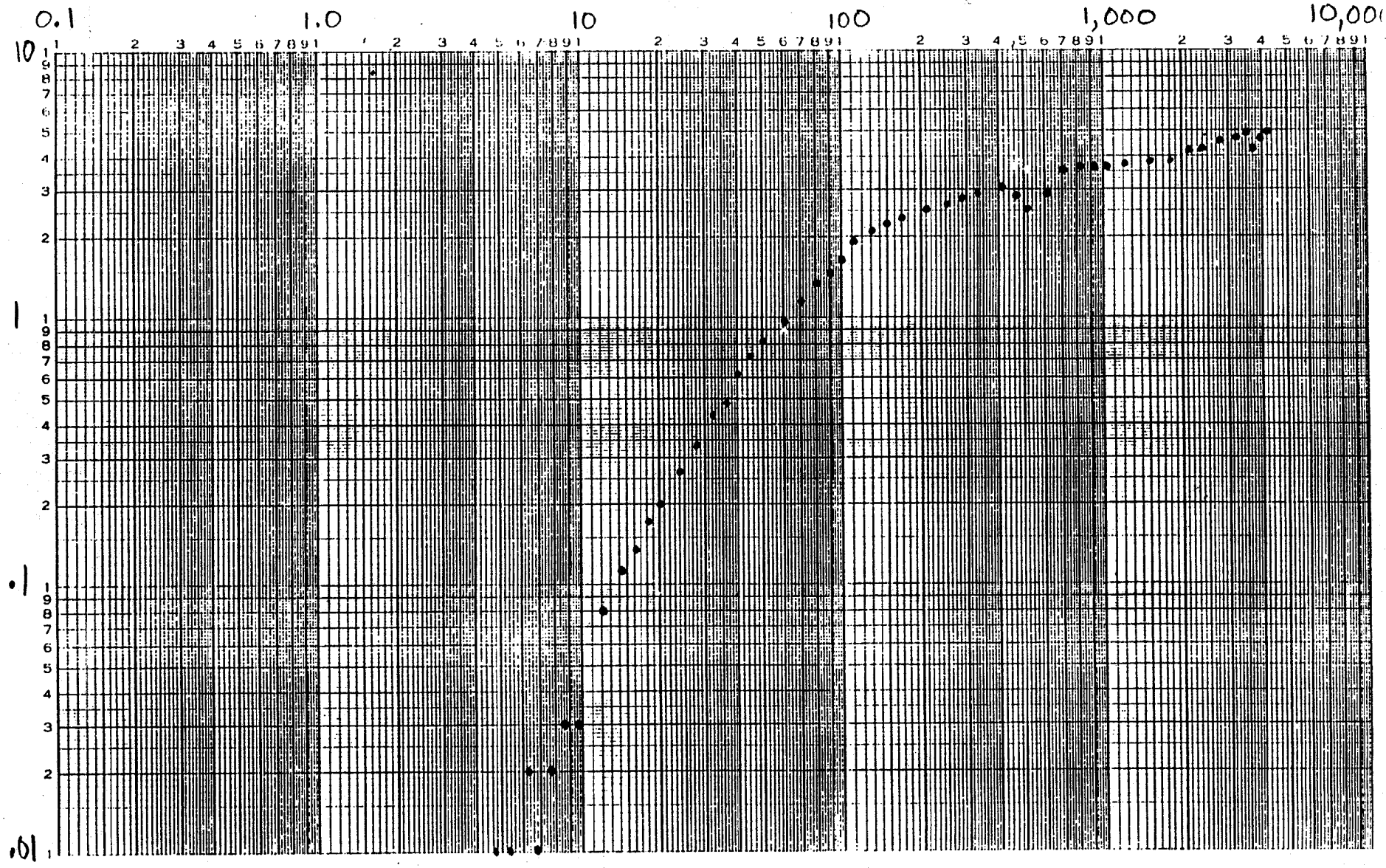
r/B ..4

AREA B PUMPING TEST

HN-36I2



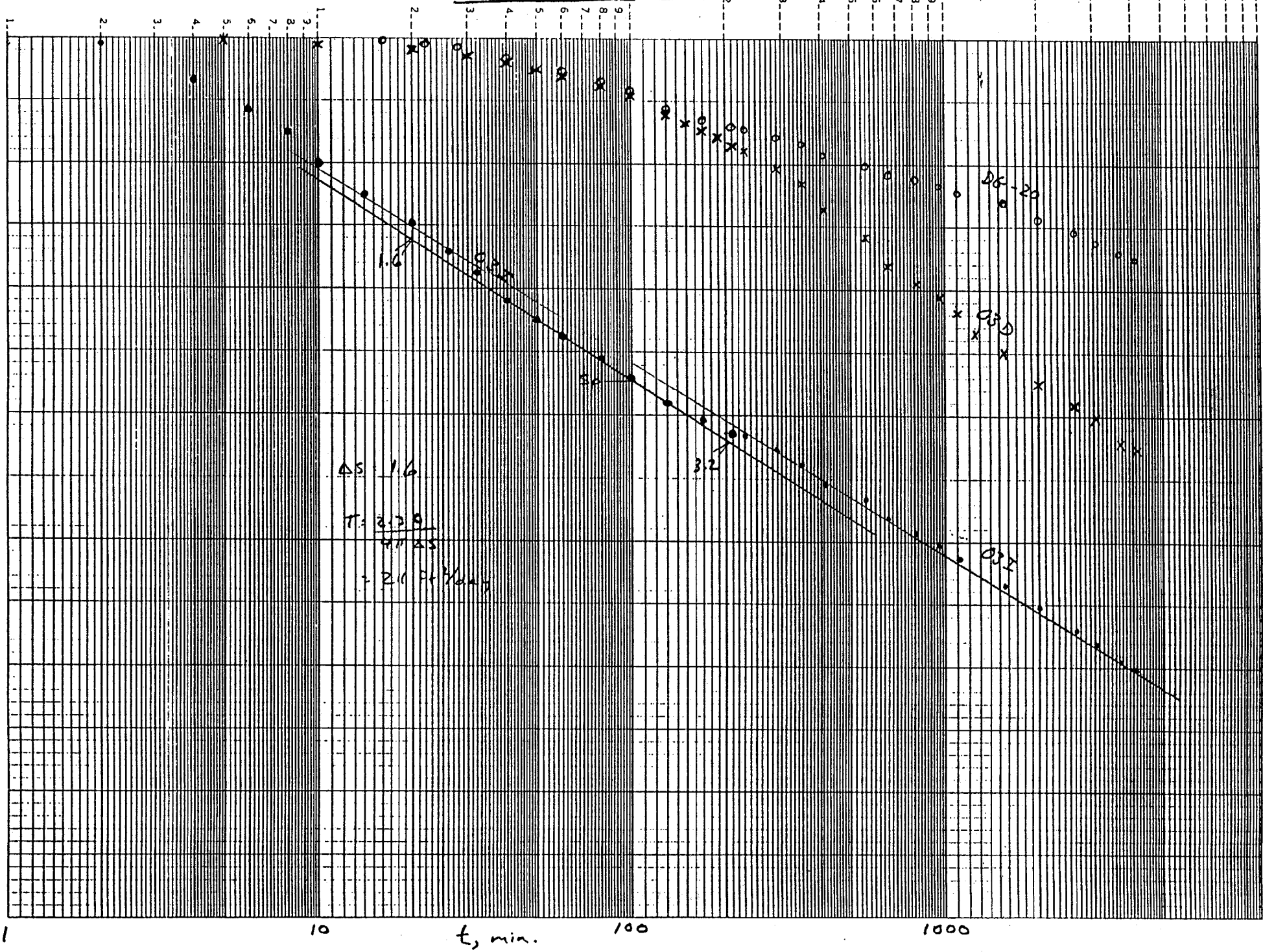
AREA B PUMPING TEST
HN-36 D



K·E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

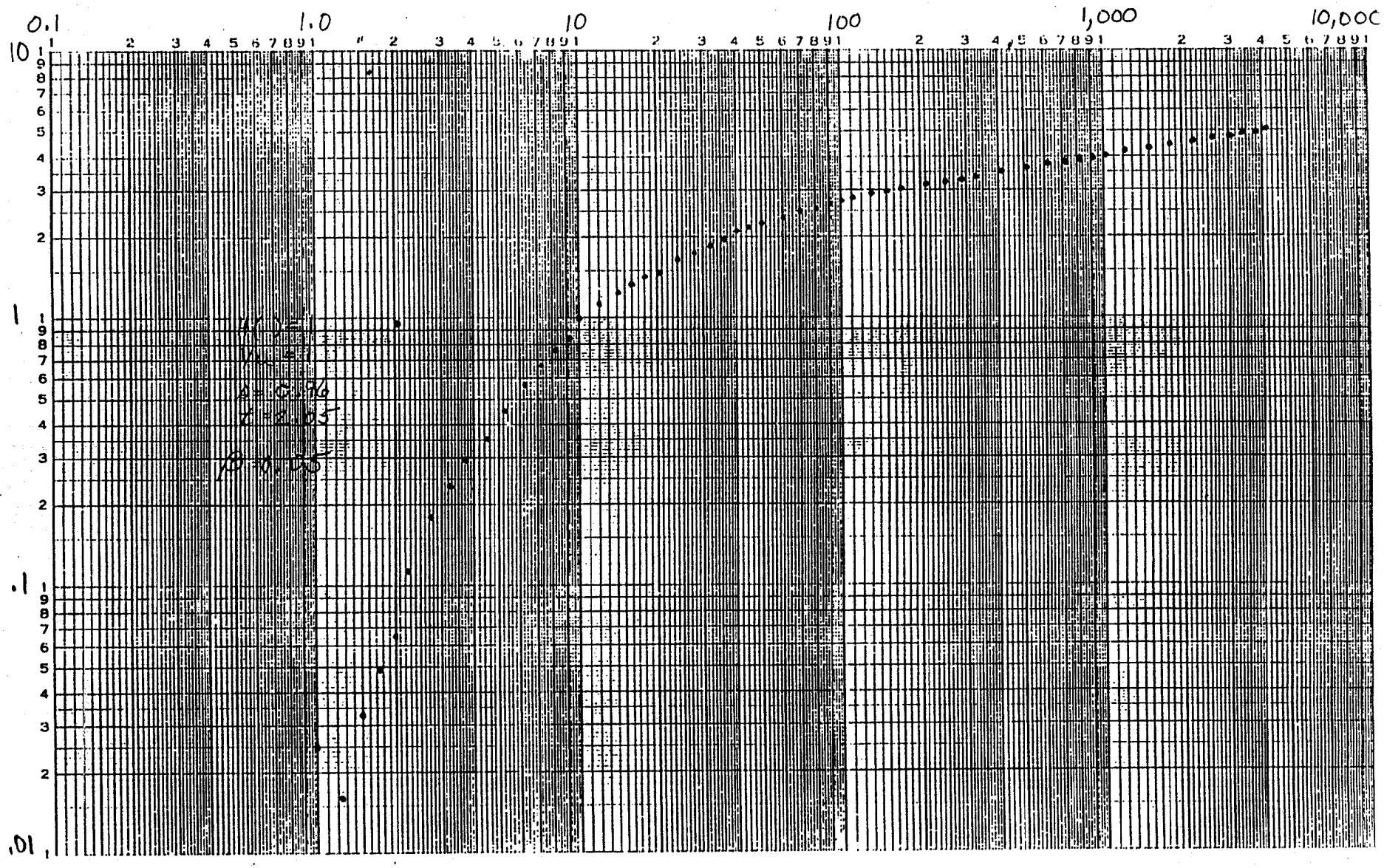
46 6010

HN 03I/03D/DG20

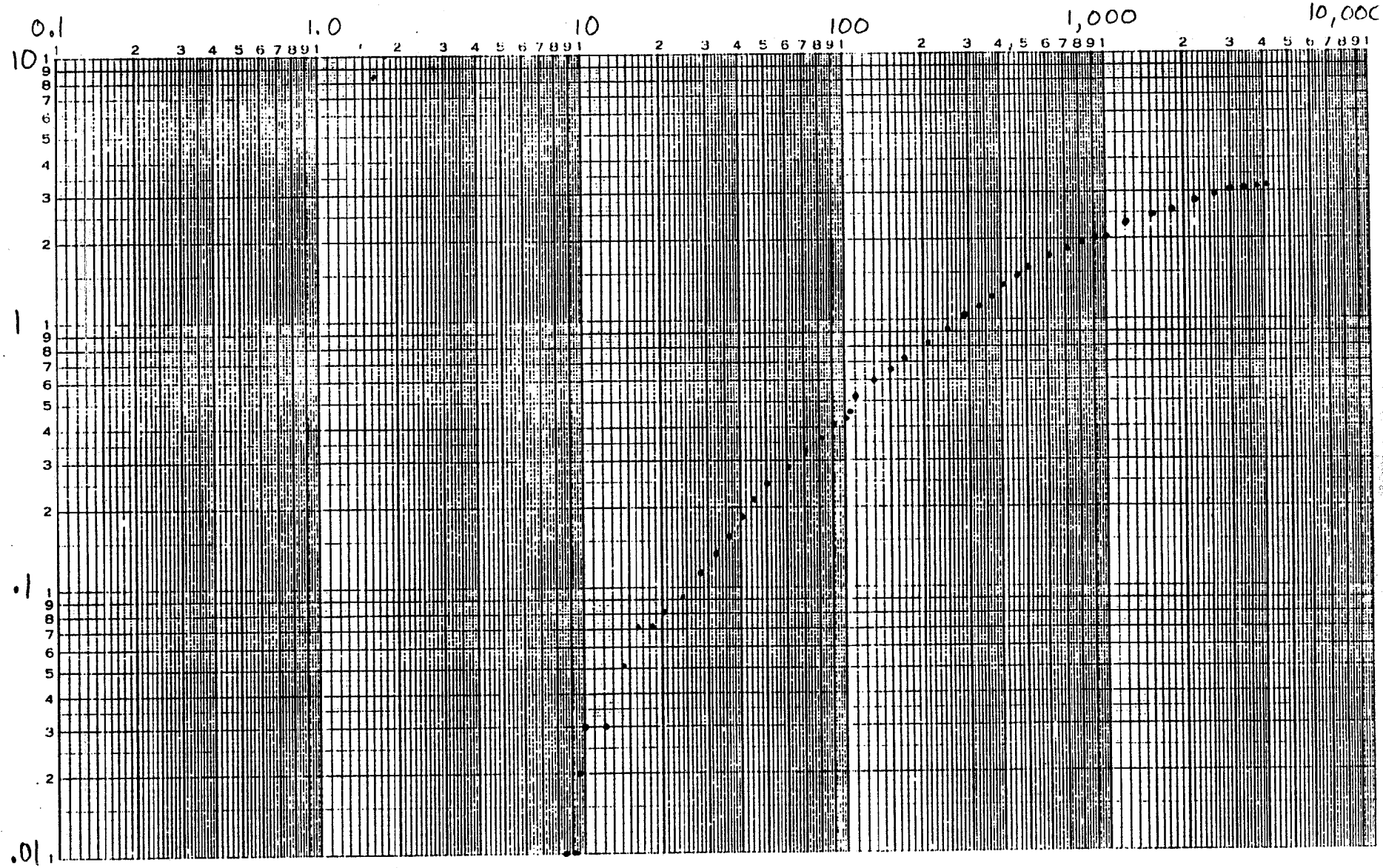


Hu, β
β = .05
10 min →

AREA B PUMPING TEST
HN-03 I

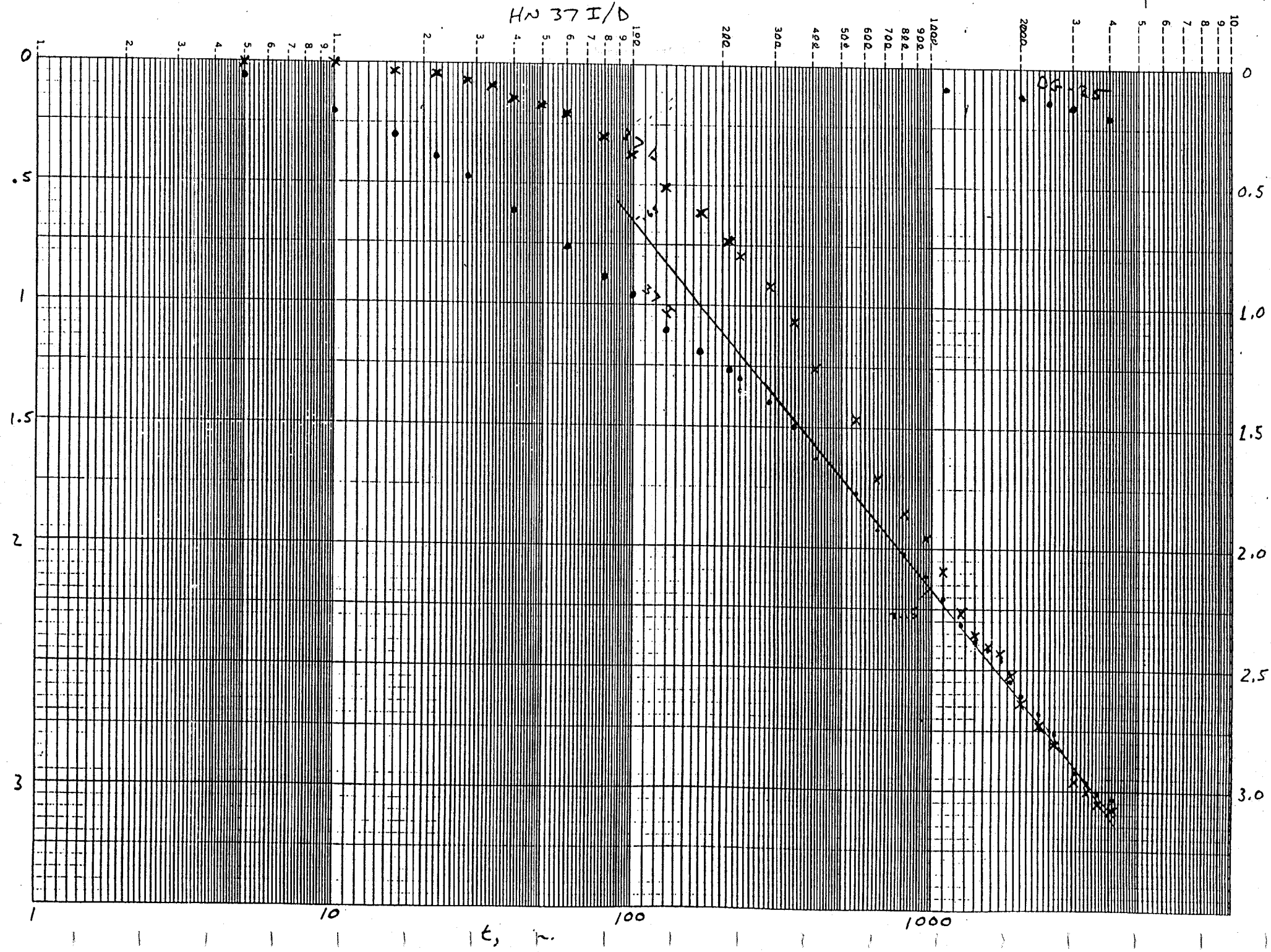


AREA B PUMPING TEST
HN-03D



K·E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

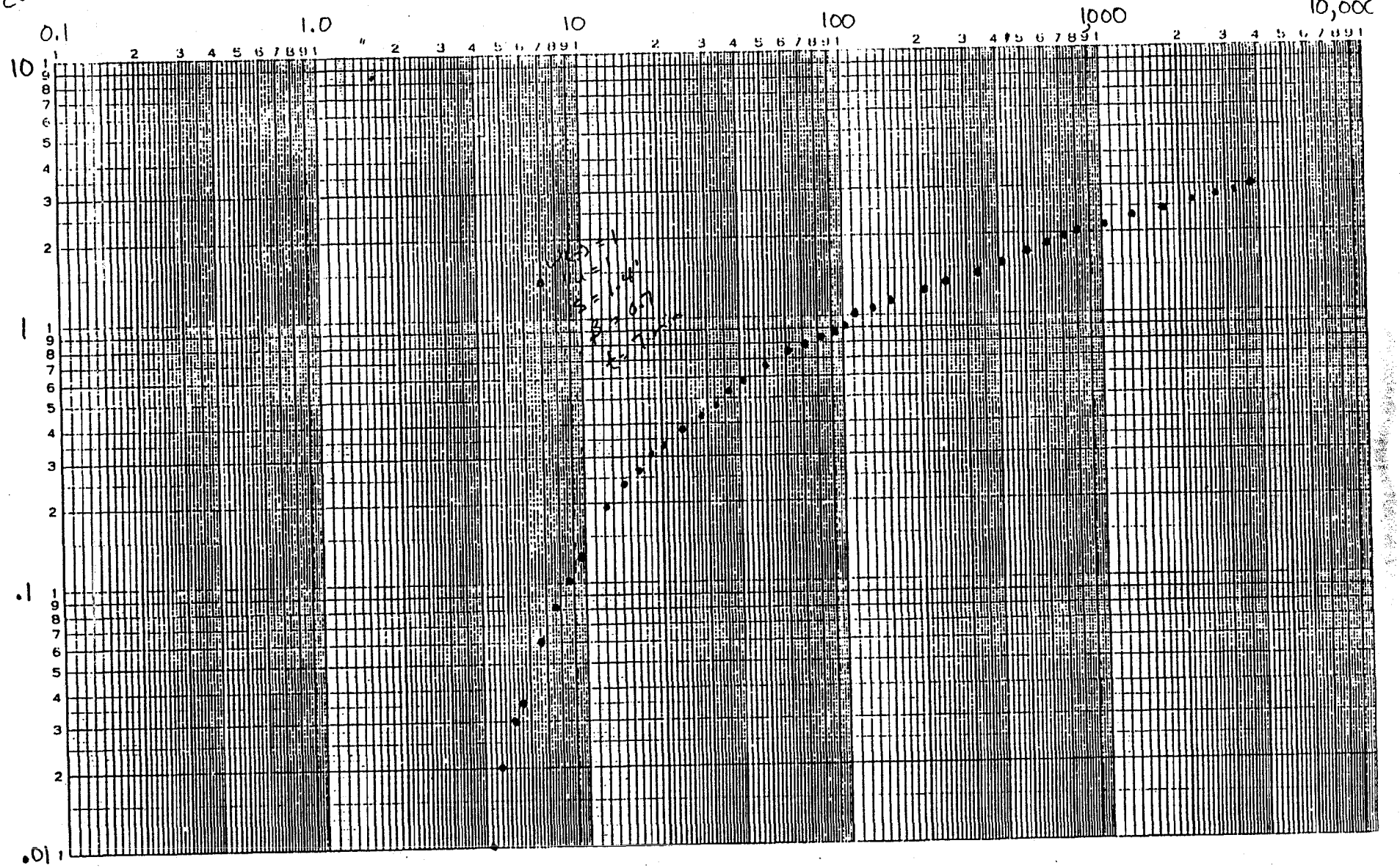
46 6010



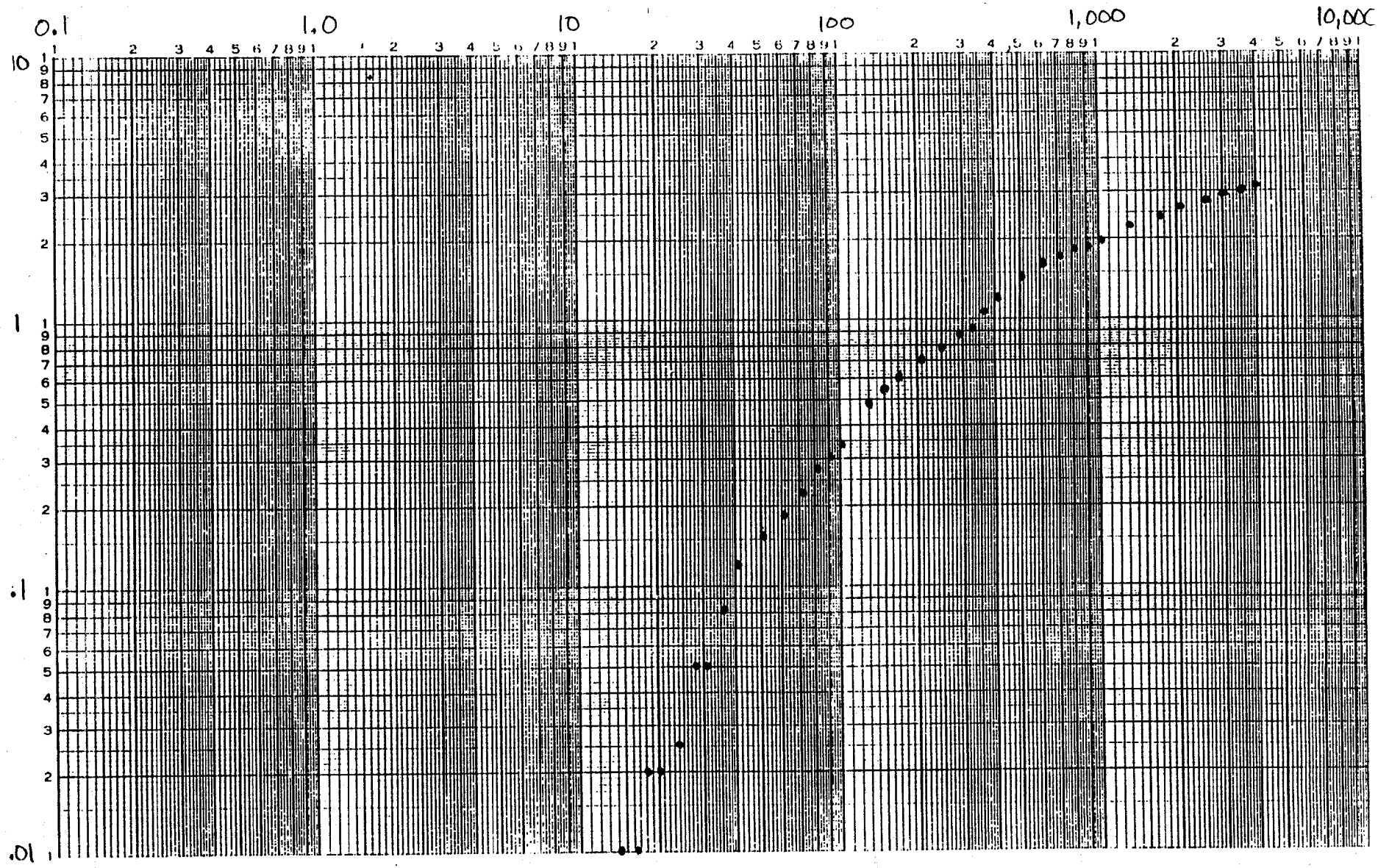
AREA B PUMPING TEST

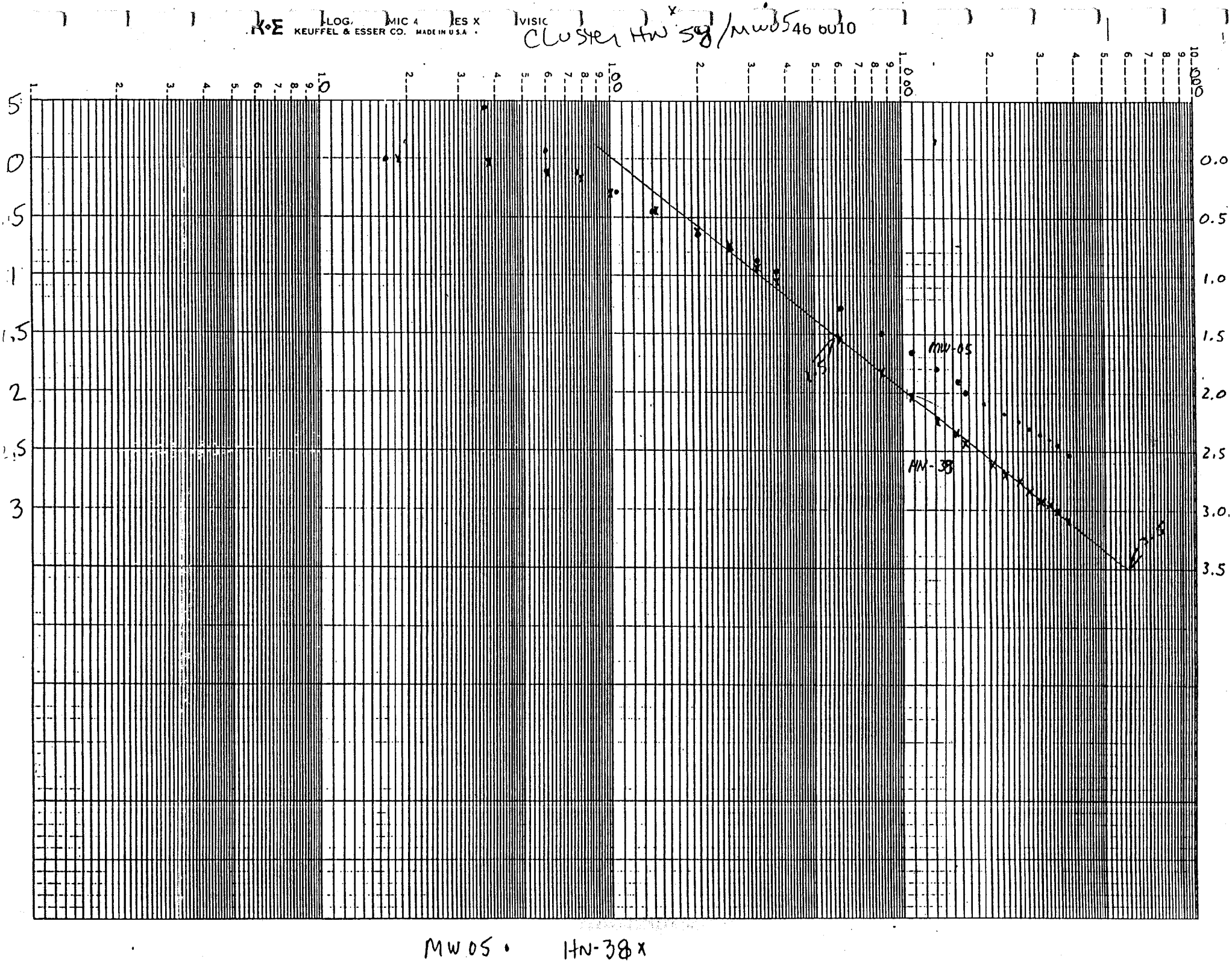
HN-37I

This Curve

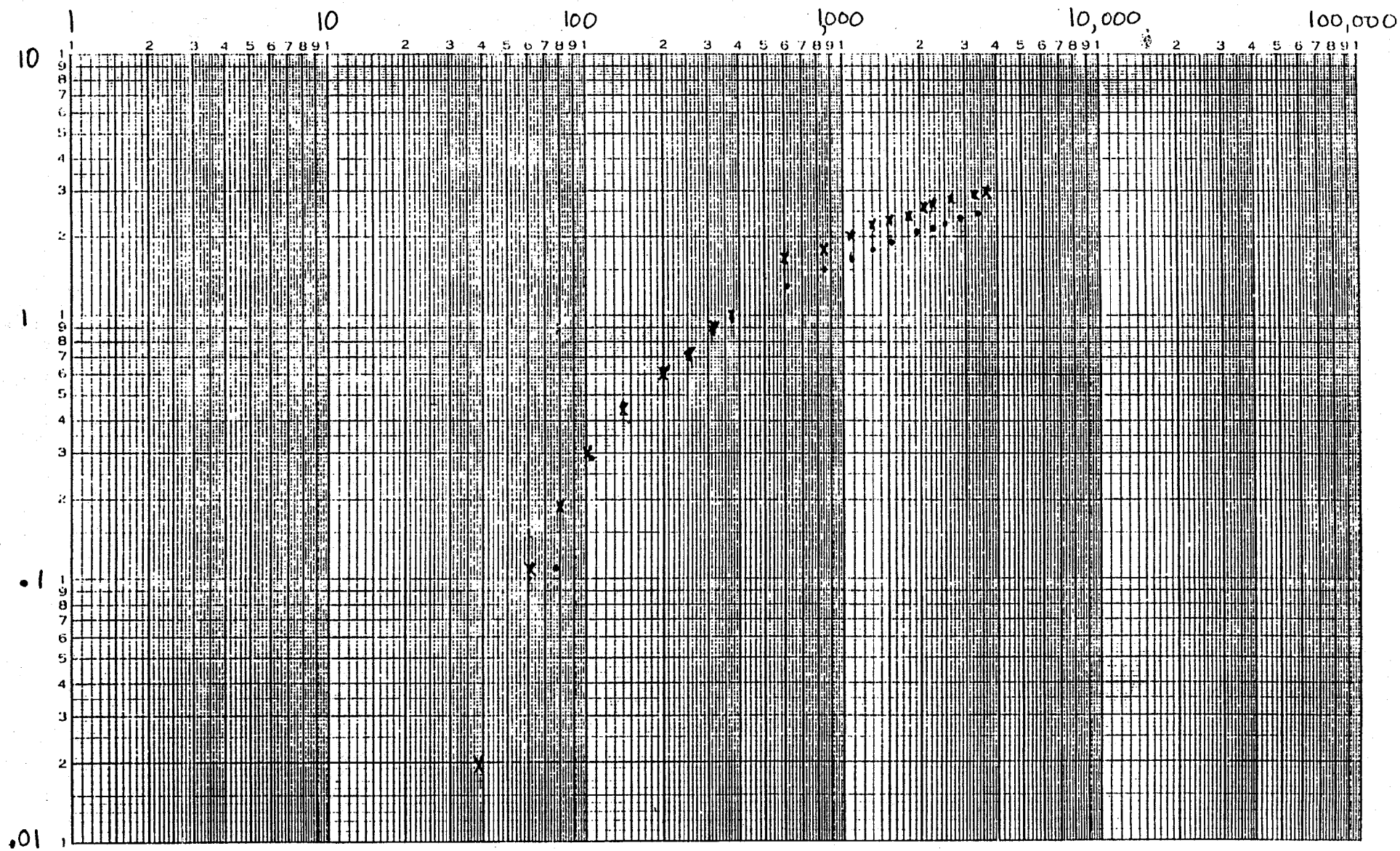


AREA B PUMPING TEST
HN-37D




K+E LOG MIC 4 ES X VISIC
KEUFFEL & ESSER CO. MADE IN U.S.A.
Cluster HN 59/MW05 46 6010
MW-05
HN-38
MW05 • HN-38 x

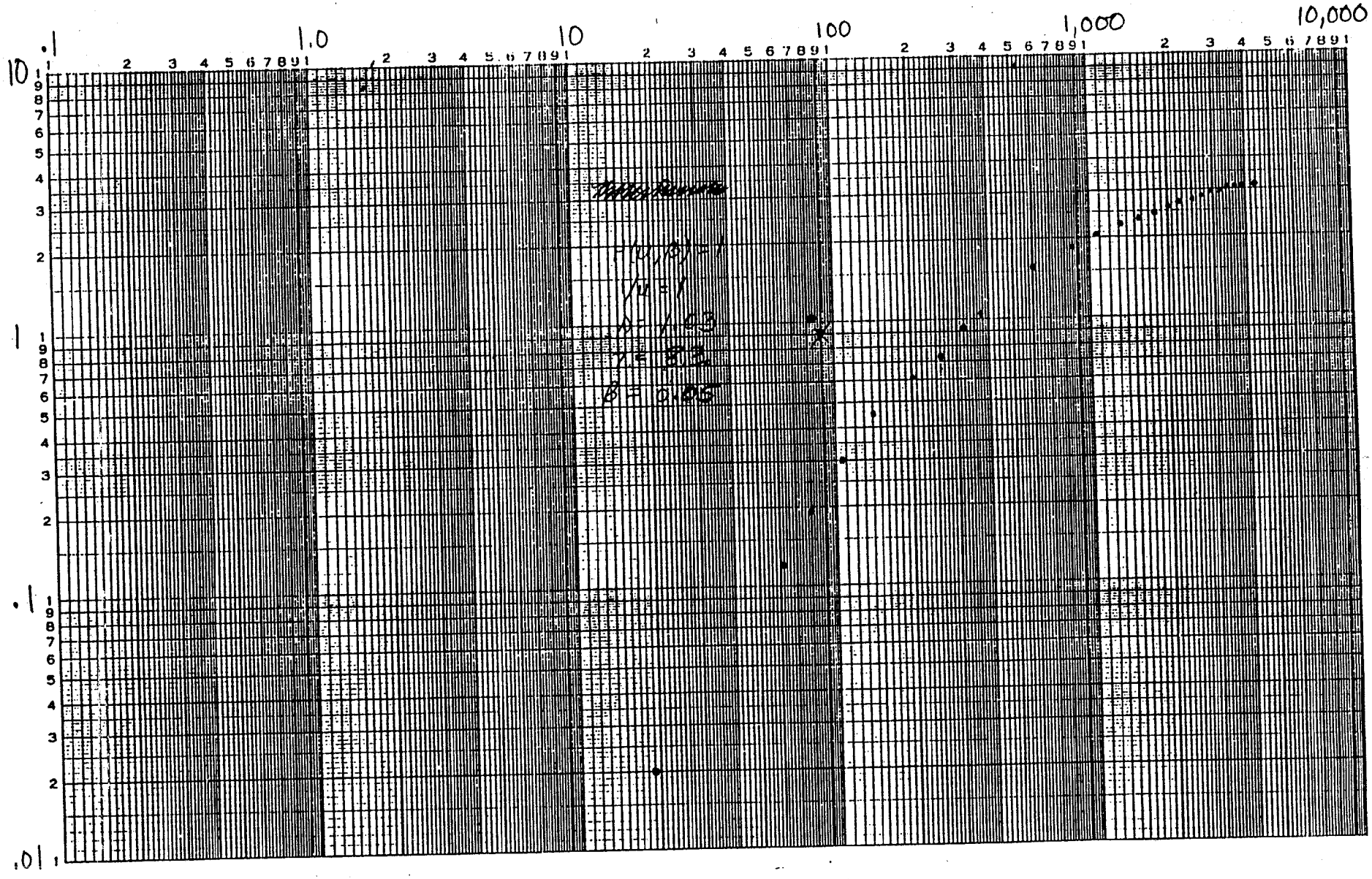
(•) MW-05 (x) 11N 38



Full Logarithmic, 3 x 5

AREA B PUMPING TEST

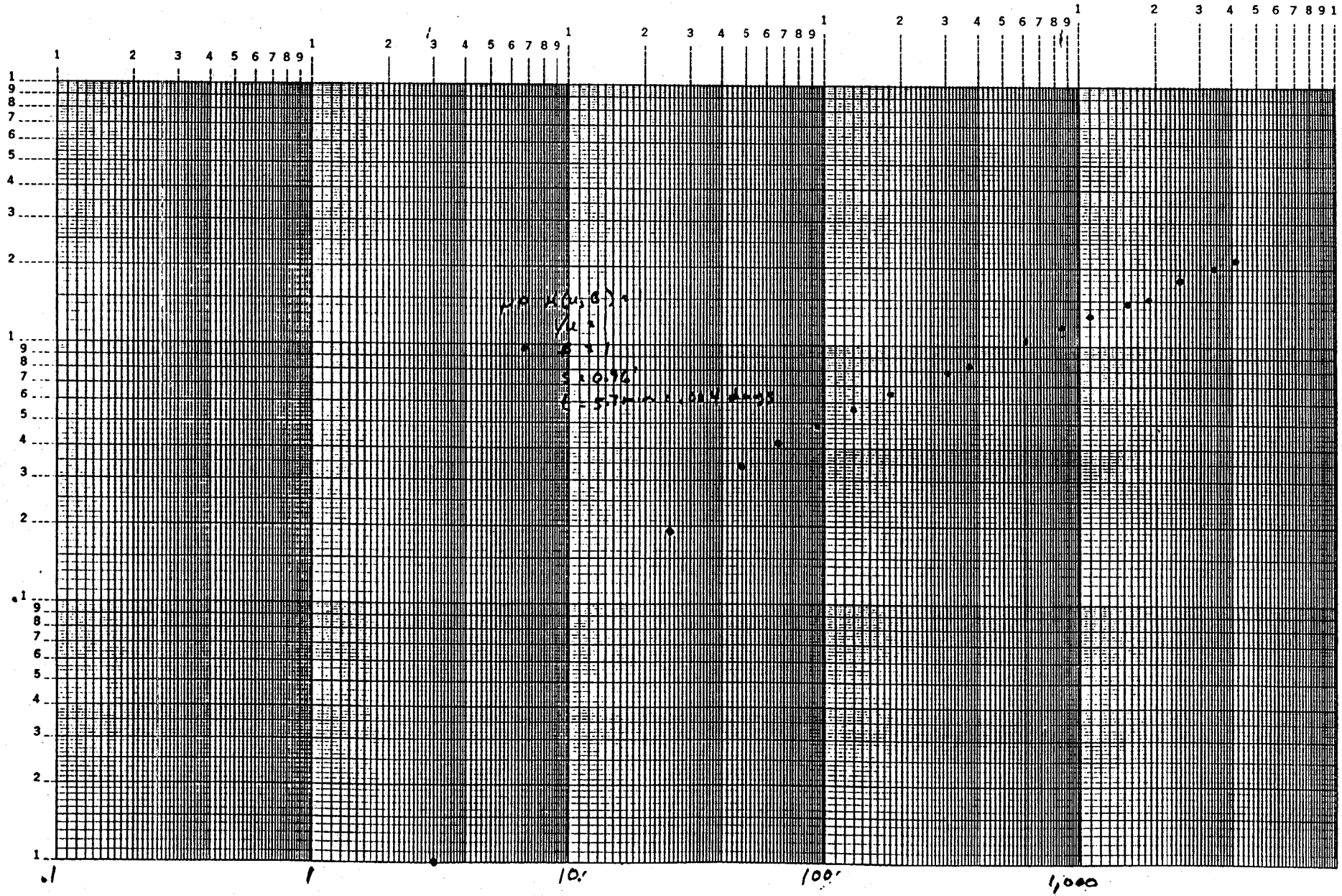
HN-38

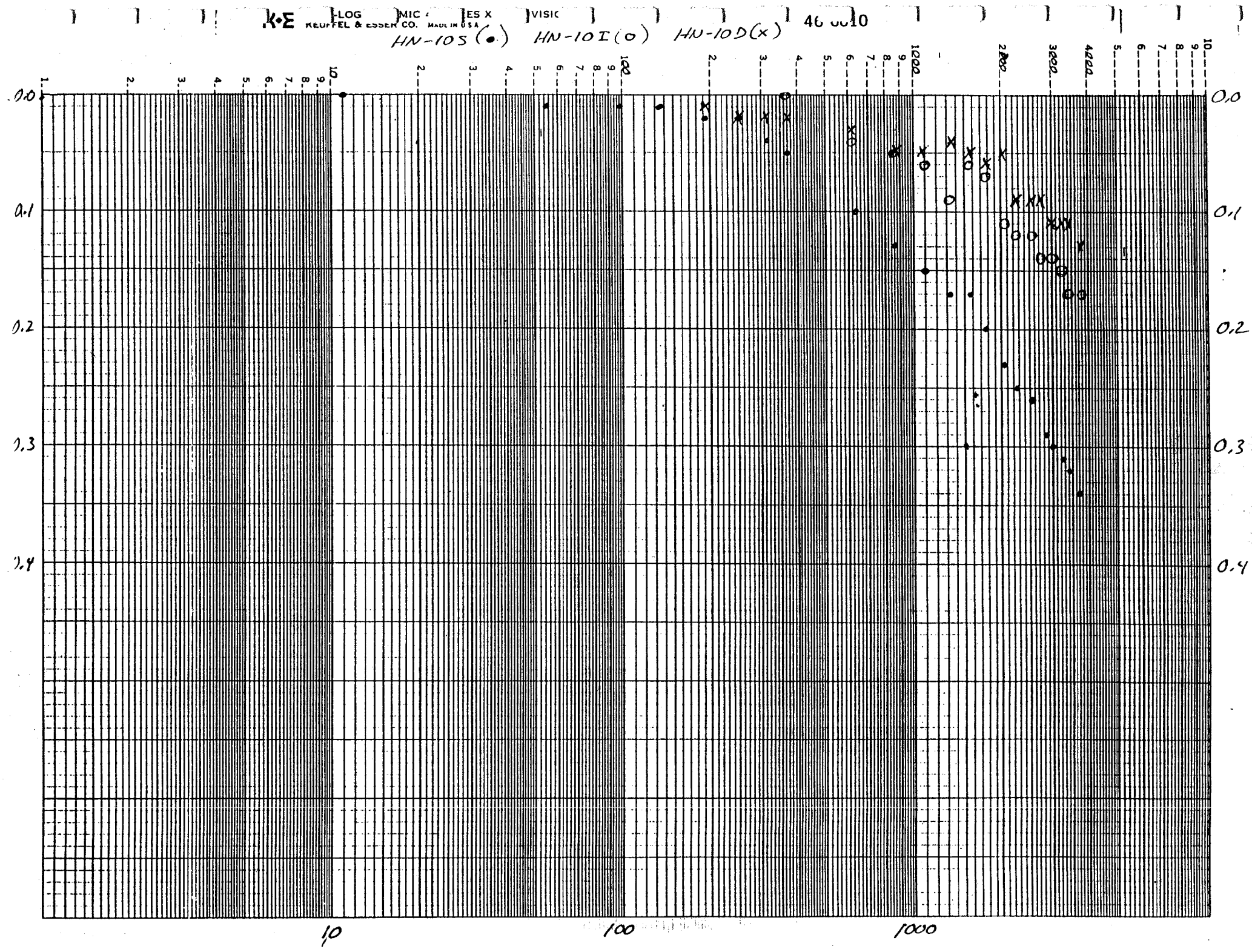


K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

MW-06

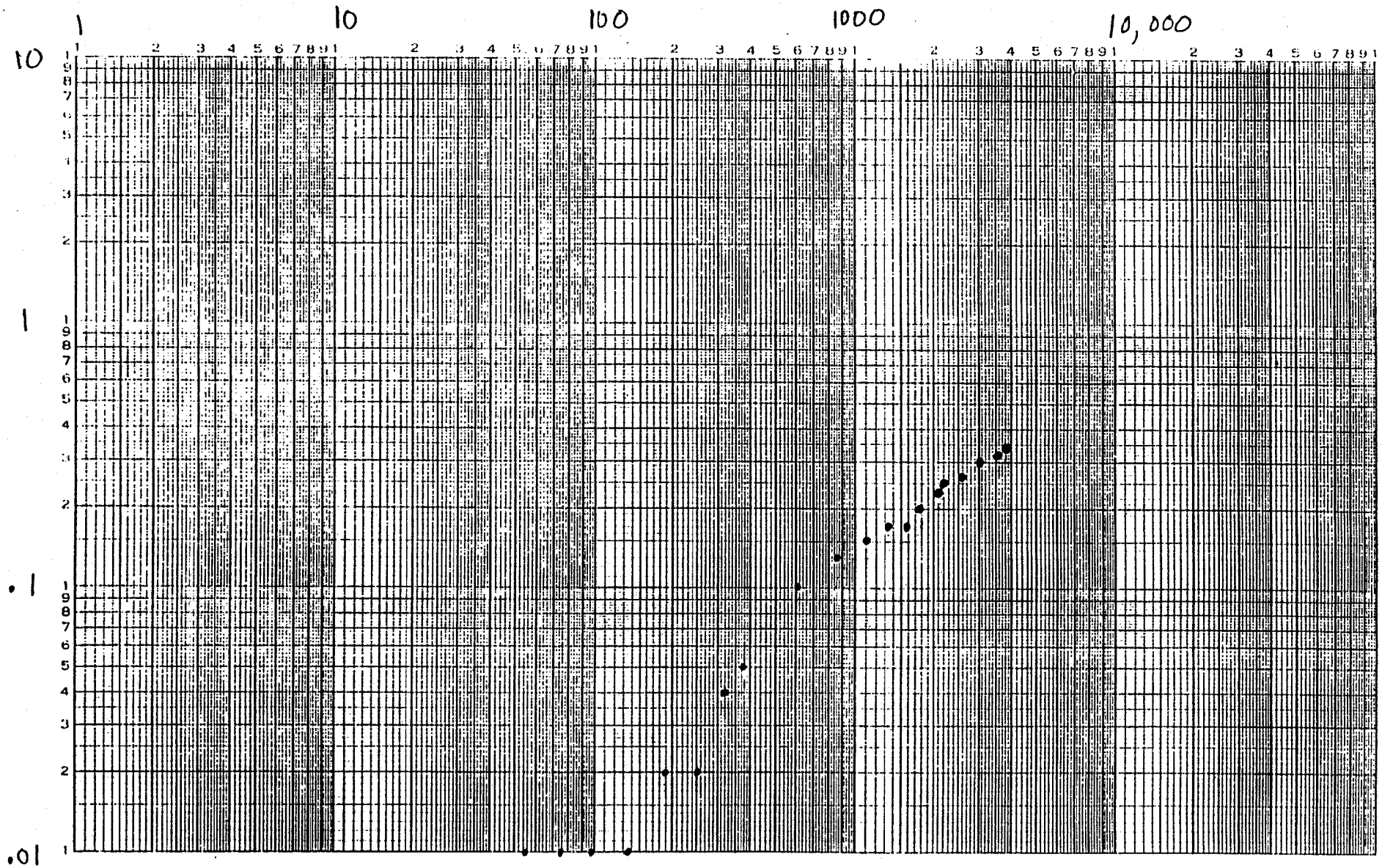



K+E LOGARITHMIC CYCLES X VISIC
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 0010
HN-10S (•) HN-10I (o) HN-10D (x)
0.0
0.1
0.2
0.3
0.4
10
100
1000

Full Logarithmic, 3 x 5

NATIONAL 12-191

HN 105 (•)



CALCULATIONS

CALCULATION WORKSHEET Order No. 19116 (01-91)

PAGE OF

CLIENT	JOB NUMBER
Navy	1412
SUBJECT: Area B Pumping Test	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
JPO	JJD		9/16/94

Observation Well 35 I

- Semilog time/dd analysis using Hantush (1956) method

$$T = \frac{2.3Q}{4\pi \Delta s_p} e^{-r/L} \qquad Q = 1733 \text{ ft}^3/\text{day}$$

$$S = \frac{r^4 T t_p}{2 L r^2}$$

$s_p = 1/2\ s_m$ (max. projected dd) - Since s_m projected $\approx 12'$,

$s_p = 6'$

$\approx s_p = 6'$, $t_p = 17$ min $= .0118$ days, $\Delta s_p = 3'$

$$2.3 \frac{s_p}{\Delta s_p} = 2.3\left(\frac{6}{3}\right) = 4.6 = e^{r/L} K_0(r/L)$$

From Table, $r/L = .012$, $e^{-r/L} = 0.988$

- Since $r/L = .012$ & $r = 32.5'$, $L = 2708$ ft

$$T = \frac{2.3(1733)}{4\pi(3)}(.988)$$

$= 104 \text{ ft}^2/\text{day}$

$$S = \frac{(32.5)(4)(104)(.0118)}{2(2708)(32.5)^2}$$

$= 2.8 \times 10^{-5}$

$c = L^2/T$

$= 70{,}512$ d

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CLIENT		JOB NUMBER	
SUBJECT AREA B PUMPING TEST			
BASED ON		DRAWING NUMBER	
BY KCK	CHECKED BY	APPROVED BY	DATE 9/8/94

OBSERVATION WELL HN-35I

- Log-log time/drawdown data matched against Hantush (1960) type curves for a leaky confined aquifer with storage in the confining layers

- Match Point
  $H(u,\beta) = 1$
  $1/u = 10$
  $s = 1.3'$
  $t = 0.22$ min $= .00015$ days
  $\beta = 0.05$

$$T = \frac{Q}{4\pi s} H(u,\beta), \qquad Q = 9 \text{ gpm} = 1733 \text{ ft}^3/\text{day}$$

$$= 106 \text{ ft}^2/\text{day}$$

$$S = \frac{4Ttu}{r^2}, \qquad r = 32.5 \text{ ft}$$

$$= 6.0 \times 10^{-6}$$

$$\frac{K'S'}{D'} = \beta^2 (4/r)^2 (T)(S)$$

$$= (.0025)(.01515)(106)(.000006)$$

$$= 2.4 \times 10^{-8} \text{ days}^{-1}$$

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CLIENT	JOB NUMBER		
Navy	1412		
SUBJECT: Area B Pumping Test			
BASED ON	DRAWING NUMBER		
BY: JPO	CHECKED BY:	APPROVED BY	DATE: 9/8/94

Observation Well 36 I.1

- Log-Log time/drawdown data matched against Hantush (1960) Type Curves for Leaky Confined Aquifers w/ Storage in the Confining Layer(s)

@ Match Point:

$H(u,\beta) = 1$

$1/u = 1$

$s = 1.05'$

$t = 0.82 \text{ min} = .00057 \text{ days}$

$\beta = 0.05$

$T = \frac{Q}{4\pi s} H(u,\beta)$, $Q = 1733 \text{ ft}^3/\text{day}$

$= 131 \text{ ft}^2/\text{day}$

$S = \frac{4Ttu}{r^2}$, $r = 122'$

$= 2.0 \times 10^{-5}$

$\frac{K'S'}{D'} = \beta^2 (4/r)^2 T S$

$= (.0025)(.0011)(131)(.00002)$

$= 7.2 \times 10^{-9} \text{ days}^{-1}$

CLIENT	JOB NUMBER
Navy	1412
SUBJECT: Area B Pumping Test	
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BY	CHECKED BY	APPROVED BY	DATE
JPO	[illegible]		9/8/94

Observation Well 36 I 1

- Semilog time/drawdown data evaluated using Hantush Inflection Point Method (1956).

$$T = \frac{2.3\,Q}{4\pi\,\Delta S_p} e^{-r/L}$$

$$S = \frac{r\,4\,T\,t_p}{2\,L\,r^2}$$

S_p (dd @ inflection pt) = ½ S_m (max. projected dd)

S_m projected to be ~ 6'

S_p = ½ (6)

= 3'

@ S_p = 3', t_p = 38 min = .0264 days

$2.3 \frac{S_p}{\Delta S_p} = e^{r/L} K_0(r/L)$ – Slope of tangent line down @ S_p = 3' = ΔS_p = 2.05'

2.3 (3/2.05) = 3.366

From annex 4.1 Table, @ $e^{r/L} K_0(r/L) = 3.36$,

$r/L = 0.045$, $e^{-r/L} = 0.956$

$$T = \frac{2.3\,(1733\ ft^3/day)}{4\pi\,(2.05')}(.956)$$

$= 148\ ft^2/day$

Since $r/L \sim .045$ and $r = 122'$, $L = 2711'$

$$S = \frac{(122)(4)(148)(.0264)}{2(2711)(122)^2}$$

$= 2.4 \times 10^{-5}$

CLIENT Navy	JOB NUMBER 1412
SUBJECT Area B Pumping Test	
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BY JPO / CHECKED BY fgb	APPROVED BY / DATE 9/8/94

Observation Well 36 I1 - Hantush Inflection Point Method Analysis (continued)

$c = L^2/T$

$= (2711')^2/148\ ft^2/day$

$= 49,659$ days

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE ____ OF ____

CLIENT		JOB NUMBER	
SUBJECT AREA B PUMPING TEST			
BASED ON		DRAWING NUMBER	
BY KCK	CHECKED BY	APPROVED BY	DATE 9/8/94

OBSERVATION WELL 36 I2

- Log-log time/drawdown data matched against Hantush (1960) type curves for a leaky confined aquifer with storage in the confining layers

- MATCH POINT
  $H(u, \beta) = 1$
  $1/u = 1$
  $S = 1.2$
  $t = .98$ min $= .00068$ days
  $\beta = 0.05$

$T = \frac{Q}{4\pi S} H(u, \beta)$, $Q = 9$ gpm $= 1733$ ft^3/day

$= 115$ ft^2/day

$S = \frac{4Tt u}{r^2}$, $r = 122.5$ ft

$= 2.1 \times 10^{-5}$

$\frac{K'S'}{D'} = \beta^2 (4/r)^2 (T)(S)$

$= (.0025)(.00107)(115)(.000021)$

$= 6.4 \times 10^{-9}$ days^{-1}

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CLIENT	JOB NUMBER
Navy	1412
SUBJECT: Area B Pumping Test	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
JPO	[illegible]		9/8/94

Observation Well HN 03I

- Log-Log time/drawdown data matched against Hantush (1960) Type Curves for a Leaky Confined Aquifer w/ Storage in the Confining Layer(s)

- Match Point:

$H(u,\beta) = 1$

$1/u = 1$

$s = 0.96$

$t = 2.05$ min $= .0014$ days

$\beta = 0.05$

$T = \frac{Q}{4\pi s} H(u,\beta)$, $Q = 9$ gpm $= 1733$ ft^3/day

$= 144$ ft^2/day

$S = \frac{4Ttu}{r^2}$, $r = 250'$

$= 1.3 \times 10^{-5}$

$\frac{K'S'}{D'} = \beta^2 (4/r)^2 (T)(S)$

$= (.0025)(.000256)(144)(.000013)$

$= 1.2 \times 10^{-9}$ days^{-1}

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CLIENT	JOB NUMBER
NAVY	1412

SUBJECT: AREA B Pumping Test

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BY	CHECKED BY	APPROVED BY	DATE
JPO	JJD		9/14/94

Observation Well HN 03I -

- Semilog time/dd data analysis w/ Hantush Method (1956)

$$T = \frac{2.3\,Q}{4\pi\,\Delta s_p}\,e^{-r/L}$$

$$S = \frac{r\,4\,T\,t_p}{2\,L\,r^2}$$

$s_p = 1/2\ s_m$ (max projected dd)

s_m est. to be ~ 5.5', ∴ s_p = 2.75', t_p = 100 min = 0.069 days

Δs_p = 1.6'

$$2.3\,\frac{s_p}{\Delta s_p} = e^{r/L}\,K_0(r/L) = 3.95$$

From Table, r/L = 0.024

- since r = 250', L = 10,417 ft

From Table, $e^{-r/L}$ = .976

$$T = \frac{2.3\,Q}{4\pi\,\Delta s_p}(.976)$$

= 193 ft³/day

$$S = \frac{(250)(4)(193)(.069)}{2(10{,}417)(250)^2}$$

$= 1.02 \times 10^{-5}$

$c = L^2/T = 562{,}248$ d

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CLIENT	JOB NUMBER
Navy	1412

SUBJECT: Area B Pumping Test

BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
JPO			

Observation Well 37 I

- Semilog time/dd analysis using Hantush (1956) Method

$$T = \frac{2.3Q}{4\pi \Delta s_p} e^{-r/L}$$

$$S = \frac{r\,4\,T t_p}{2 L r^2}$$

s_p (dd @ inflection pt) = ½ s_m (projected max dd)

s_m projected @ ~4'

s_p = ½(4) = 2'

@ s_p = 2', t_p = 770 min = 0.53 days, Δs_p = 1.5'

$2.3\, s_p/\Delta s_p$ = 2.3(2/1.5) = 3.07 = $e^{r/L} K_0(r/L)$

From Table, r/L = 0.063, e^{-x} = 0.939

$$T = \frac{2.3(1733)}{4\pi(1.5)}(.939)$$

= 198 ft²/day

Since r/L = 0.063 and r = 317', L = 5031'

$$S = \frac{(317)(4)(198)(.53)}{2(5031)(317)^2}$$

= .000132

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CLIENT		JOB NUMBER	
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BY KCK	CHECKED BY	APPROVED BY	DATE 9/8/94

OBSERVATION WELL HN-37I

- LOG-LOG time/drawdown data matched against HANTUSH (1960) TYPE curves for a LEAKY confined aquifer with STORAGE in The confining layers

- MATCH POINT

$H(u,\beta) = 1$

$1/u = 1$

$s = 1.45'$

$t = 7 \text{ min} = .0049 \text{ day}$

$\beta = 0.7$

$T = \frac{Q}{4\pi s} H(u,\beta)$, $Q = 9 \text{ gpm} = 1733 \text{ ft}^3/\text{day}$

$= 98.5 \text{ ft}^2/\text{day}$

$S = \frac{4Tt u}{r^2}$, $r = 317' \text{ ft}$

$= 11.9 \times 10^{-5}$

$\frac{K'S'}{D'} = \beta^2 (4/r)^2 (T)(S)$

$= 1 \times 10^{-7} \text{ days}^{-1}$

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CLIENT	JOB NUMBER
Navy	1412

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BY	CHECKED BY	APPROVED BY	DATE
JPO	[illegible]		

Observation Well HA-38

- Semi-log time/dd analysis using Hantush (1956) Method

$$T = \frac{2.3Q}{4\pi \Delta s_p} e^{-r/L}$$

$$S = \frac{r\,4\,T t_p}{2 L r^2}$$

s_p (dd @ inflection pt) = ½ s_m (projected max. dd)

s_m projected @ ~4'

$s_p = 2'$, @ $s_p = 2'$, $t_p = 1000$ min = 0.69 days, $\Delta s_p = 2.0$

$2.3\ s_p/\Delta s_p = 2.3 = e^{-r/L} K_0(r/L)$

From Table, $r/L = 0.16$, $e^{-r/L} = 0.852$

$$T = \frac{2.3(1733)(.852)}{4(\pi)(2)}$$

$= 135\ ft^2/day$

Since $r/L = .16$ and $r = 520'$, $L = 3250'$

$$S = \frac{(520)(4)(135)(.69)}{2(3250)(520)^2}$$

$= .000110$

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Observation well HN-38

- Log-Log time/drawdown data matched against Hantush (1960) type curves for a leaky confined aquifer with storage in the confining layer(s).

- Match point:

$H(u, \beta) = 1$

$1/u = 1$

$s = 1.03'$

$t = 833$ min $= 0.058$ days

$\beta = 0.05$

$T = \frac{Q}{4\pi s} H(u, \beta)$, $Q = 9$ gpm $= 1733$ ft^3/day

$= 134$ ft^2/day

$S = \frac{4 T t u}{r^2}$, $r = 520$ ft

$= 1.1 \times 10^{-4}$

$\frac{K'S'}{D'} = \beta^2 (4/r)^2 (T)(S)$

$= (.05)^2 (.000059)(134)(.00011)$

$= 5.5 \times 10^{-10}$ days^{-1}

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CLIENT	JOB NUMBER
NAVY CTO 159	1412

SUBJECT: Area B Pumping Test

BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
JPO	[illegible]		9/8/94

Observation Well MW 06

- Log-log time drawdown analysis using Hantush (1960) type curves for Leaky Confined Aquifers w/ Storage in the Confining Layer(s)

* Match Point:

$H(u,\beta) = 1$

$1/u = 1$

$\beta = 1$

$s = 0.96'$

$t = 0.004$ days

$T = \frac{Q}{4\pi s} H(u,\beta)$, $Q = 1733\ ft^3/day$

$= 144\ ft^2/day$

$S = \frac{4Ttu}{r^2}$, $r = 480'$

$= .0000100$

$\frac{K'S'}{D'} = \beta^2 (4/r)^2 (T)(S)$

$= (1)(.00007)(144)(.00001)$

$= 1 \times 10^{-7}\ days^{-1}$

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE OF

CLIENT	JOB NUMBER
Navy	1412

SUBJECT: Area B Pumping Test

BASED ON	DRAWING NUMBER

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JPO			9/19/94

Well Cluster 35S/35I/35D

- Vertical K analysis of aquitards – Neuman – Witherspoon Ratio Method (1972).

- From semilog time/DD graph, aquifer dd @ t=100 min (.069 days) = 7.6' (35I); dd in underlying ftn = 4.9' (35D), No dd in shallow well.

- Distance from aquifer bottom to WBZ in 35D ≈ 7 ft

Therefore:

$s = 7.6'$ $r = 32.5'$

$s_c = 4.9'$ $T = 105\ ft^2/day$ (avg)

$z = 7'$ $S = 2 \times 10^{-5}$ (avg)

$t = .069$ days

$s_c/s = 0.64 = W(u, u_c)/W(u)$

$$u = \frac{r^2 S}{4Tt} = \frac{(32.5)^2(.00002)}{4(105)(.069)} = 7 \times 10^{-4}$$

From Table, $1/u_c = 12$

$$\frac{K'D'}{s'} = 1/u_c \times \frac{z^2}{4t} = 2130\ ft^2/day$$

From Hantush (1960) Curve Matching Analysis,

$$\frac{K's'}{D'} = 2.4 \times 10^{-8}\ days^{-1}$$

$$\frac{K'D'}{s'} \times \frac{K's'}{D'} = (2130)(2.4 \times 10^{-8}) = 5.1 \times 10^{-5}\ ft^2/day^2$$

$K' = 7.2 \times 10^{-3}\ ft^2/day$ $(1 \times 10^{-5}\ cm/sec)$

Since $K'D'/s' = 2130$ & $D = z = 7'$,

$s' = .000024$

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CLIENT	JOB NUMBER
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BY	CHECKED BY	APPROVED BY	DATE
JPO	LDU		9/19/94

Well Cluster DG18/36I1/36I2/36D

- Vertical K analysis of aquitards - Neuman-Witherspoon Ratio Method (1972)

- From semilog time/dd graph, aquifer dd @ t = 1000 min (.69 days) = 5.95' (36I2), in overlying aquitard 4.9' (36I1), in underlying aquitard ~ 3.8' (36D). Avg dd in aquitard = (4.9' + 3.8')/2 = 4.35'

- Distance from aquifer top to WBZ in 36I1 ≈ 5', distance from aq. bottom to WBZ in 36D ≈ 15'; Avg. distance = $\frac{5+15}{2}$ = 10 ft = Z

Therefore,

$s = 5.95'$ $\quad r = 122$ ft

$s_c = 4.35'$ $\quad T = 140$ ft²/day (avg)

$Z = 10'$ $\quad S = 2.2 \times 10^{-5}$ (avg)

$t = .69$ days $\quad u = \frac{r^2 S}{4Tt} = 8.5 \times 10^{-4}$

$s_c/s = .73 = W(u, u_c)/W(u)$

From Table, $1/u_c \simeq 21$

$$\frac{K'D'}{s'} = \left(\frac{1}{u_c}\right)\left(\frac{Z^2}{4t}\right) = 761 \text{ ft}^2/\text{day}$$

From Hantush (1960) Curve Matching Analysis:

$$\frac{K's'}{D'} = 7.2 \times 10^{-9} \text{ days}^{-1}$$

$$\frac{K'D'}{s'} \times \frac{K's'}{D'} = (761)(7.2 \times 10^{-9}) = 5.5 \times 10^{-6} \text{ ft}^2/\text{day}^2$$

$K' = 2.3 \times 10^{-7}$ ft/day, Since $K'D'/s' = 761$ ft²/day and $D = Z = 10'$,

$s' = .00003$ ft

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CLIENT: Navy	JOB NUMBER: 1412
SUBJECT: Area B Pumping Test	
BASED ON	DRAWING NUMBER
BY: JPO / CHECKED BY: LJO	APPROVED BY / DATE: 9/19/94

Well Cluster DG20/HN03I/HN03D

- Analysis of vertical K of overlying/underlying aquitards using a modification of the Neuman-Witherspoon Ratio method (1972).

- From semilog time/dd graph, dd @ t = 4000 min (2.8 days) in aquifer observation well HN03I = 5.0 ft, DD in shallow well DG20 = 1.75', & dd in deep well HN03D = 3.3' - Average drawdown in aquitards =

$(1.75' + 3.3')/2 = \sim 2.5'$

- Distance from aquifer top to water bearing zone in DG-20 ≈ 49'
- Distance from aquifer bottom to WBZ in HN03D ≈ 29'
- Avg distance from aquifer boundary to aquitard piezometer ≈

$\frac{49' + 29'}{2} = 39'$

therefore,

$s = 5'$ $\quad r = 250'$

$s_c = 2.5'$ $\quad T_{avg} = (144 + 193)/2 \approx 168\ ft^2/day$

$z = 39'$ $\quad S_{avg} = \sim 1.2 \times 10^{-5}$

$t = 0.28$ days

$s_c/s = 2.5/5 = 0.5 = W(u, u_c)/W(u)$

$u = \frac{r^2 S}{4Tt} = \frac{(250)^2(.000012)}{4(168)(.28)} = .0004$

From Table,

$1/u_c = 6$

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SUBJECT: Area B Pumping Test

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JPO	[illegible]		9/19/94

Cluster DG20/HN03I/HN03D Neuman-Witherspoon analysis (Cont.)

$$\frac{K'D'}{S'} = \frac{1}{u_c} \times \frac{Z^2}{4t}$$

$$= 6\left(39^2/4(2.8)\right)$$

$$= 136 \text{ ft}^2/\text{day}$$

From Hantush (1960) Curve Matching Analysis,

$$\frac{K'S'}{D'} = 1.2 \times 10^{-9} \text{ days}^{-1}$$

$$\frac{K'\cancel{D'}}{\cancel{S'}} \times \frac{K'\cancel{S'}}{\cancel{D'}} = 136\,(1.2 \times 10^{-9})$$

$$K'^2 = 1.6 \times 10^{-7} \text{ ft}^2/\text{day}^2$$

$$K' = 4.0 \times 10^{-4} \text{ ft/day} \quad (1 \times 10^{-6} \text{ cm/sec})$$

Since $\frac{K'D'}{S'} = 136 \text{ ft}^2/\text{day}$, & $D' = Z = 39'$, $K' = .0004$ ft/day,

$$S' = .00012$$