TECHNICAL MEMORANDUM CH2MHILL

Pre-Feasibility Study Field Activities and Results, Site 17, Indian Head Division-NSWC, Indian Head, Maryland

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This technical memorandum (memo) describes the activities performed to collect additional data for the feasibility study (FS) at Site 17 at the Indian Head Division-NSWC as described in the work plan (CH2M HILL, 2002). This memo also presents the results of the investigation.

The remedial investigation (RI) conducted at the site identified contaminants of concern in groundwater (CH2M HILL, 2002). Additional data needs were identified in order to evaluate potential remedial alternatives. This investigation was undertaken to address those needs and meet the following specific objectives:

- More fully define the distribution of contaminants in groundwater.
- Determine whether or not volatile organic compounds (VOCs) in groundwater are impacting Mattawoman Creek.
- Generate data to assess the viability of monitored natural attenuation (MNA) as a remedial alternative.
- Determine the influence of Mattawoman Creek's tidal cycle on shallow groundwater.
- Estimate the hydraulic conductivity of the subsurface.

In order to meet these objectives, the investigation was performed in two phases, the investigation of groundwater contamination and tidal monitoring, which are discussed below.

Investigation of Groundwater Contamination

Groundwater sampling conducted at Site 17 during the initial field effort (October, 2000) detected VOCs in groundwater. Specifically, the groundwater sample collected from monitoring well IS17MW02 contained cis-1,2-dichloroethene (cis-DCE) at 4,200 micrograms per liter (µg/l) and vinyl chloride (VC) at 3,000 µg/l (Figure 1). Soil samples collected at Site 17 contained low levels of trichloroethene (TCE; Figures 2 and 3), the likely source of the cis-DCE and VC. Based on groundwater elevations measured at the three site wells, groundwater flows to the southeast and discharges to Mattawoman Creek (Figure 4).

This phase of the investigation was conducted to: 1) better define the distribution of contaminants in groundwater; 2) determine whether or not VOCs are impacting Mattawoman Creek; and 3) generate data to assess the viability MNA as a remedial alternative.

Field Activities

The following field activities were undertaken to meet the stated objectives:

- Membrane interface probe/electrical conductivity (MIP/EC) profiling
- *In situ* groundwater sampling
- Shelby-tube soil sampling
- Surface water sampling
- Monitoring well sampling

The field effort was conducted between June 24, 2002 and July 17, 2002.

MIP/EC Profiling and *In Situ* Groundwater Sampling

MIP/EC profiling and *in situ* groundwater sampling were performed in order to define the extent of contaminants in groundwater in an efficient and economical manner. This portion of the investigation utilized a direct-push rig to collect the samples and an onsite, mobile laboratory to perform the VOC analyses. The MIP/EC rig was utilized to collect qualitative VOC and lithologic data prior to groundwater sampling. Mobilizing the MIP/EC rig prior to the *in situ* groundwater sampling phase of the investigation provided data that focused the sampling effort without substantially increasing the length of the field effort. The MIP/EC data was also used to help determine the appropriate sampling depths by identifying areas of elevated VOC concentrations and lithologic variations in the subsurface.

Twelve *in situ* groundwater samples were collected at the locations shown in Figure 5. Nine of the samples were collected at locations along a transect parallel to Mattawoman Creek (normal to the direction of groundwater flow). These locations were designed to define the extent of VOCs along the northeast/southwest transect and to identify the source area assumed to be located near IS17MW02. The three additional samples were collected at locations upgradient of areas identified as containing VOCs from the samples collected along the initial transect. The two secondary transects created by the additional samples were designed to define the extent of VOCs in the northwest/southeast direction (along groundwater flow lines).

Prior to *in situ* groundwater sampling, MIP/EC borings were installed at each sampling location (Appendix A). The MIP data was used to help focus the groundwater sampling event by identifying areas of elevated VOC concentrations. The EC data was used to better define the lithology of the subsurface and to identify the depth to groundwater at Site 17.

With the exception of groundwater samples IS17GW04 (collected at a depth of 4-8 feet below ground surface [bgs]) and IS17GW05 (collected at a depth of 16-20 feet bgs), which were collected at the same location, one groundwater sample was collected at each location. Two samples were proposed at each location in the work plan; however, EC data indicated that, in the area of drum disposal, the water table was encountered approximately 3-5 feet bgs and an underlying confining layer was present at a depth between 8 feet bgs and 13 feet bgs. Therefore, the interval available for groundwater sampling was limited. All samples were analyzed for VOCs using United States Environmental Protection Agency (EPA) Method 8260.

Following the completion of the MIP/EC *in situ* and groundwater sampling portion of the investigation, all locations were horizontally located using the global position system (GPS). Additionally, investigation derived waste (IDW) was characterized and disposed of in accordance with state and federal regulations and IHDIV-NSWC Standard Operating Procedures (SOPs).

Results

The MIP/EC logs are presented in Appendix A. The results of *in situ* groundwater sampling are presented in Table 1 and Figure 6. Raw data are presented in Appendix B.

Lithology

A review of the EC logs suggests that, in the area of drum disposal, the subsurface is characterized by sands and silts (as represented by lower values of electrical conductivity) to a depth of approximately 10 feet bgs. Underlying the sands and silts is a layer dominated by clay (as represented by higher values of electrical conductivity). The layer appears continuous across the site; however, at some locations there appears to be a sharp contact between sand and clay (e.g., MIP 1 and MIP 10) and at other locations there appears to be a more gradational contact (e.g., MIP 2 and MIP 4). It should be noted that the clay was not observed at two locations, MIP 6 and MIP 8. However, at MIP 6 the boring was advanced to refusal, which occurred at only 15 feet bgs. This likely indicates that the clay was present beneath this depth but could not be penetrated. MIP 8 was advanced in an area upslope of the drum disposal area and was terminated at a depth of 15 feet bgs, likely too shallow to encounter the clay.

VOCs

VOC concentrations suggestive of the presence of a dense non-aqueous phase liquid (DNAPL) were detected in the source area; however, the areal distribution of VOCs is small. The groundwater sample collected in the source area (IS17GW02), located to the southwest of IS17MW02, contained TCE, cis-DCE, and VC at concentrations of 310,000 µg/l, 75,000 µg/l, and 50,000 µg/l, respectively. Chloroethane was also detected in groundwater sample IS17GW02 at a concentration of 28,000 µg/l. Total VOC concentrations decrease to below 600 µg/l within 60 feet to the southwest and to non-detect within 175 feet. To the northeast, VOC concentrations decrease to non-detect within 130 feet. Of note, one groundwater

sample, IS17GW06, collected 260 feet northeast of the source area, contained TCE, cis-DCE, and 1,1-dichloroethane (DCA) at concentrations of 240 µg/l, 20 µg/l, and 20 µg/l. Given the disposal history of the site, this anomalous detection is likely due to a small surface release from one of the drums in this area. To confirm this, a sample was collected further cross-gradient (to the northeast; IS17GW08) and upgradient (IS17GW10); VOCs were not detected at either of these locations.

As presented in the RI (CH2M HILL, 2002), VOCs were not detected at concentrations suggestive of a source in unsaturated soil; therefore, vertically, VOCs appear constrained between the water table and the underlying confining unit.

Shelby-Tube Soil Sampling

Shelby-tube soil samples were collected from MIP locations 1 (depth 9-11 feet bgs) and 7 (depth 13-15 feet bgs; Figure 5). The samples were not proposed in the work plan; however, as noted above, the EC logs suggested that a confining layer underlies the site (Appendix A). It was decided in the field that quantitative hydraulic conductivity data from this layer would be critical to the FS and future risk management decisions at the site. Therefore, the samples were collected and sent to a geotechnical laboratory for hydraulic conductivity testing.

Results

Hydraulic conductivity of the underlying confining unit = 6.5×10^{-4} feet per day, which is in the range reported by Domenico and Schwartz (1990) of a clay (Appendix C).

Surface Water Sampling

Concurrently with *in situ* groundwater sampling, three surface water samples were collected in Mattawoman Creek (Figure 5) to evaluate the impact of VOCs in groundwater on the creek. The samples were analyzed for Low Concentration (LC) VOCs using Contract Laboratory Program (CLP) Method OLC03 at a fixed-base laboratory.

Results

Analytical results of surface water sample are presented in Table 2 and Figure 7. Raw data are presented in Appendix B. It should be noted that because the VOCs discussed below are not the primary contaminants of concern and were not detected at concentrations above action levels, these compounds are not presented in Figure 7.

Three VOCs were detected at each of the 3 sampling locations: methyl-tert-butyl ether (MTBE), methylene chloride, and toluene. Concentrations of each are relatively consistent from sample to sample. Concentrations of MTBE range from 4 µg/l in IS17SW07 and IS17SW08 to 4.1 µg/l in IS17SW04. Concentrations of methylene chloride range from 0.18 µg/l in IS17SW08 to 0.22 µg/l in IS17SW04 and IS17MW07. Concentrations of toluene range from 0.12 µg/l in IS17SW07 and to 0.18 µg/l in the duplicate sample of IS17SW08. Neither TCE, cis-DCE, nor VC were detected in the samples.

Monitoring Well Sampling

Following the completion of *in situ* groundwater sampling, the three site monitoring wells were sampled. The data were collected to identify potential temporal changes in the VOC concentrations observed in the wells and to provide data to aid the evaluation of MNA as a remedial alternative. Additionally, perchlorate samples were collected to determine whether or not perchlorate may be present at the site. All three samples were analyzed for Target Compound List (TCL) VOCs (CLP Method OLM03.2), perchlorate (EPA Method 314.0), total organic carbon (TOC; EPA Method 415.1), sulfate (EPA Method 300.0), nitrate (EPA Method 300.0), chloride (EPA Method 300.0), methane, ethane and ethene (SW-846 Method RSK 175). All samples were analyzed at a fixed-base laboratory. Other *in situ*/MNA parameters including dissolved oxygen, pH, and oxidation/reduction potential (ORP) were determined onsite using a Horiba U-22® fitted with a flow-through cell. Ferrous iron (Fe^{2+}) concentrations were determined onsite using a Hach® kit.

Results

The results of monitoring well sampling are presented in Table 3 and Figure 7. Raw data are presented in Appendix B.

VOCs

VOCs were detected at reduced concentrations compared to those observed during the RI. The groundwater sample collected from IS17MW01 contained TCE, cis-DCE, and VC at concentrations of 0.24 µg/l, 4.9 µg/l, and 2.3 µg/l, respectively. The groundwater sample collected from IS17MW02 contained cis-DCE and VC at concentrations of 64 µg/l and 140 µg/l, respectively. TCE was not detected in the sample. The groundwater sample collected from IS17MW03 contained TCE at a concentration of 0.43 µg/l. Cis-DCE and VC were not detected in the sample. It should be noted that MTBE and toluene were detected in the duplicate sample collected from IS17MW01 at concentrations of 0.73 µg/l and 43 µg/l, respectively.

Perchlorate

Perchlorate was not detected in any of the monitoring wells at or above the laboratory detection limit.

MNA Parameters

TOC was detected in the samples collected from IS17MW01 and IS17MW02 at concentrations of 22.7 mg/l (28 mg/l in the duplicate sample) and 9.13 mg/l, respectively. TOC was not detected in the sample collected from IS17MW03.

Sulfate was detected in the samples collected from IS17MW02 and IS17MW03 at concentrations of 16.3 mg/l and 37.8 mg/l, respectively. Sulfate was not detected in the sample collected from IS17MW01.

Nitrate was not detected in any of the monitoring well samples.

Chloride was detected in the samples collected from IS17MW01, IS17MW02, and IS17MW03 at concentrations of 251 mg/l (214 mg/l in the duplicate sample), 70.4 mg/l, and 9.98 mg/l, respectively.

Methane was detected in the sample collected from IS17MW01 at a concentration of 1 μg/l; however, the duplicate sample contained a concentration of 540 μg/l. The reason for the discrepancy is not clear, although the higher value is likely more representative of subsurface conditions in the vicinity of IS17MW01, given the VOC concentrations observed nearby. Methane was also detected at IS17MWS02 and IS17MW03 at concentrations of 120 μg/l and 0.3 μg/l, respectively.

Ethane was detected in the sample collected from IS17MW02 and the duplicate sample collected from IS17MW01 at concentrations of 16 μg/l and 3 μg/l. Ethane was not detected in the sample collected from IS17MW03.

Ethene was detected in the sample collected from IS17MW02 at a concentration of 11 mg/l but not detected in the samples collected from IS17MW01 and IS17MW03.

In situ parameters including pH, oxidation-reduction potential, dissolved oxygen, and ferrous iron concentration are presented in Table 4.

Using these data to populate the EPA MNA screening table (USEPA, 1998; Table 5) returns a score of 26 for monitoring well IS17MW01. As noted in the referenced document, a score of greater than twenty is considered "strong evidence for anaerobic biodegradation (through reductive dechlorination) of chlorinated organics". However, it should be noted that assumptions were built in to this score: 1) IS17MW01 is cross-gradient from the source area as opposed to downgradient; 2) the value of 540 μg/l of methane was used in the calculation for the reason noted above; and 3) IS17MW02 was treated as the DNAPL source area although it is not at the location of highest concentrations as observed in the direst-push groundwater samples. These assumptions do not invalidate the score noted above; however, they will be considered further in the FS if MNA is evaluated as a remedial alternative.

Tidal Monitoring

Groundwater at Site 17 discharges to Mattawoman Creek, a tidal tributary of the Potomac River. Typically, when a water-bearing unit directly discharges to a tidal water body, the water table or potentiometric surface fluctuates in a harmonic motion. The fluctuation is a somewhat delayed and dampened reflection of the tidal fluctuation. The amplitude (or height) of the fluctuation decreases with increasing distance from the shoreline. The time between high tide and high water level also increases with increasing distance from the shore. Understanding the relationship between hydraulic head in Mattawoman Creek and groundwater at Site 17 is important from a remedial standpoint: if an active remediation (i.e., one that utilizes pumping) is required at Site 17, the groundwater flow regime needs to be well defined. This is because, as discussed below, it is likely that there are times during the tidal cycle when the hydraulic head in Mattawoman Creek is higher than the water table at Site 17 in the area near the shoreline; therefore, the design of any remedial system would need quantitative data pertaining to the tidal fluctuation of both Mattawoman Creek and the water table to avoid withdrawing creek water at these times. A quantitative analysis of the data can be used to estimate the hydraulic conductivity of the subsurface, as well.

This phase of the investigation was conducted to: 1) determine the influence of the tides on groundwater levels; and 2) estimate the hydraulic conductivity of the subsurface.

Field Activities

To quantify the relationship between hydraulic head in Mattawoman Creek and groundwater at Site 17, the tidal fluctuation in Mattawoman Creek and Site 17 monitoring wells were monitored over an entire lunar cycle (approximately one month). Monitoring was accomplished using InSitu MiniTrolls®. The Trolls, which are combination pressure transducers and data loggers, were installed in monitoring wells IS17MW02 and IS17MW03 and in Mattawoman Creek at a location that forms a line with the two wells normal to the shoreline (Figure 8). To facilitate data collection at the location in Mattawoman Creek, a temporary 'well' was installed at the desired location. The well consisted of a 2-inch inside diameter (ID), 4-foot long, stainless-steel screen with machined 0.010 slots. Following installation, its location was surveyed vertically and horizontally by a Maryland licensed surveyor. Data was collected between 1:00 PM on April 5, 2002 and 1:00 PM on May 5, 2002, at hourly intervals. Precipitation data for the monitored interval was provided by IHDIV-NSWC.

Results

The data were plotted graphically and reviewed to determine the relationship between hydraulic head in Mattawoman Creek and groundwater at Site 17. The mean hydraulic heads and in turn the mean hydraulic gradient were calculated using the method outlined in Serfes (1991) and the hydraulic conductivity of the subsurface was estimated using the stage-ratio and time-lag methods outlined in Ferris (1951).

The hydrographs of IS17TS01, IS17MW02, IS17MW03, and precipitation are presented in Figure 9. Mean head calculations are presented in Tables 4 through 6. The hydraulic conductivity calculations are presented in Tables 7 and 8. The hydrographs of the 71-hour intervals selected for the mean head and hydraulic conductivity calculations are presented in Appendix D. It should be noted that an explanation of the calculations presented in Tables 4 through 8 are beyond the scope of this memo. Detailed explanations are presented in the journal articles referenced above.

A review of the data presented in Figure 8 indicates that there are few periods when the gradient between IS17MW02 and Mattawoman Creek (as measured at IS17TS01) is reversed (i.e., the water level in Mattawoman Creek is higher that of IS17MW02); however, as determined from the mean head calculations, the mean head differential between these two locations is approximately 1 foot. This suggests that the gradient likely could be reversed by pumping as part of a future remedy. Additionally, pumping wells would need to be installed downgradient of the source area (located near IS17MW02), where the mean head is nearer to that of Mattawoman Creek and gradient reversals likely occur more often and with greater magnitude. The potential for gradient reversal and magnitude will be evaluated further in the FS.

Hydraulic conductivity was estimated at 729 feet per day using the stage-ratio method and 1,556 feet per day using the time-lag method; however, due to invalid assumptions built-in to the calculations, the hydraulic conductivity is thought to be significantly over estimated. In particular, the calculations assume that the fluctuation of hydraulic head in the surface water body is small relative to the thickness of the aquifer. As was determined from this investigation, the depth to water is approximately 1 foot bgs and the site is underlain by a thick clay layer at approximately 10 feet bgs, therefore, the average fluctuation in

Mattawoman Creek, approximately 1.5 feet, is approximately 17% of the saturated thickness of the subsurface, making the results of this analysis unreliable. Actual hydraulic conductivity is likely closer to values calculated at Site 47 using slug test data (CH2M HILL, 2002 unpublished data; approximately 3 feet per day).

It should be noted that the lack of accurate quantitative hydraulic conductivity data at Site 17 does not present an obstacle to proceeding to the FS. In the event that precise measurements of hydraulic conductivity are required to evaluate a set of remedial alternatives, a pump test would likely be required regardless of the quality of the data presented above.

Feasibility Study

It should be noted that the data presented above is not intended to constitute a recommendation as to a remedial action. The data presented herein will be included in the forthcoming FS, which will present quantitative evaluations of several remedial alternatives.

References

CH2M HILL. April 2002. *Work Plan for Pre-Feasibility Study Field Activities at Site 17 Indian Head Division-NSWC*, Indian Head, Maryland

CH2M HILL. August 2002. *Draft Final Remedial Investigation Report, Sites 11, 13, 17, 21, and 25, Indian Head Division–NSWC,* Indian Head, Maryland.

Domenico, P.A., and Schwartz, F.W. 1990. *Physical and Chemical Hydrogeology*. Second edition. John Wiley & Sons, Inc., New York.

Ferris, J.G., 1951. *Cyclic Water-Level Fluctuations as a Basis for Determining Aquifer Transmissibility*, International Association of Scientific Hydrology Publication, v. 33, p. 148-155.

Serfes, M.E., 1991. *Determining the Mean Hydraulic Gradient of Ground Water Affected by Tidal Fluctuations*, Ground Water, v. 29, no. 4, p. 549-555.

United States Environmental Protection Agency, Office of Research and Development. September 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater*. EPA/600/R-98/128.

Table 1
Detected Compounds in Direct-Push Groundwater Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17GW01		IS17GW02		IS17GW03				IS17GW04		IS17GW05		IS17GW06	
Sample ID	IS17GW010602		IS17GW020602		IS17GW030602		IS17GW030602P		IS17GW040602		IS17GW050602		IS17GW060602	
Sample Date	06/24/02		06/24/02		06/24/02		06/24/02		06/25/02		06/25/02		06/25/02	
Chemical Name														
Volatile Organic Compounds (µg/l)														
1,1-Dichloroethane							1	J					20	J
1,2-Dichloroethane					3	J								
Carbon tetrachloride														
Chloroethane	160	J	28,000	D										
Chloroform														
Toluene									1	J				
Trichloroethene			310,000	D									240	
Vinyl chloride	220		50,000	D										
cis-1,2-Dichloroethene	220		75,000	D					1	J			20	J
p-Isopropyltoluene									1	J				
tert-Butylbenzene														

D - Dilution result
J - Estimated

Table 1
Detected Compounds in Direct-Push Groundwater Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17GW07		IS17GW08		IS17GW09		IS17GW10		IS17GW11		IS17GW11		IS17GW12	
Sample ID	IS17GW070602		IS17GW080602		IS17GW090602		IS17GW100602		IS17GW110602		IS17GW110602P		IS17GW120602	
Sample Date	06/25/02		06/26/02		06/26/02		06/26/02		06/27/02		06/27/02		06/27/02	
Chemical Name														
Volatile Organic Compounds (µg/l)														
1,1-Dichloroethane														
1,2-Dichloroethane														
Carbon tetrachloride													2	
Chloroethane														
Chloroform													1	J
Toluene							8		2		2		1	J
Trichloroethene	3						2							
Vinyl chloride														
cis-1,2-Dichloroethene														
p-Isopropyltoluene													2	
tert-Butylbenzene													2	

D - Dilution result
J - Estimated

Table 2
Detected Compounds in Surface Water Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17SW04	IS17SW07	IS17SW08	
Sample ID	IS17SW040602	IS17SW070602	IS17SW080602	IS17SW080602P
Sample Date	06/24/02	06/24/02	06/24/02	06/24/02
Chemical Name				
Volatile Organic Compounds (μg/l)				
Methyl-tert-butyl ether (MTBE)	4.1	4	4	4.1
Methylene chloride	0.22 J	0.22 J	0.18 J	0.21 J
Toluene	0.16 J	0.12 J	0.13 J	0.18 J

J - Estimated

Table 3
Detected Compounds in Monitoring Well Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17MW01		IS17MW02	IS17MW03
Sample ID	IS17MW01071702	IS17MW01071702P	IS17MW02071702	IS17MW03071702
Sample Date	07/17/02	07/17/02	07/17/02	07/17/02
Chemical Name				
Volatile Organic Compounds (μg/l)				
1,1-Dichloroethane		0.22 J	6 J	
1,1-Dichloroethene		0.12 J		
Benzene		0.18 J		
Chloroethane			2 J	
Chloromethane		0.18 J		0.12 J
Ethylbenzene	89	89		
Methyl-tert-butyl ether (MTBE)	0.64	0.73		
Styrene	0.7			
Toluene	37	43		
Trichloroethene	0.2 J	0.24 J		0.43 J
Vinyl chloride	2.3	2 J	140	
Xylene, total	1 J	0.22 J		
cis-1,2-Dichloroethene	4.9	4.8	64	
trans-1,2-Dichloroethene	0.15 J	0.13 J		
Energetics				
Perchlorate				
MNA Parameters (μg/l)				
Methane	1	540	120	0.3 J
Ethane		3 J	16 J	
Ethene			11 J	
MNA Parameters (mg/l)				
Carbon	22.7	28	9.13	
Chloride	251	214	70.4	9.98
Sulfate			16.3	37.8

J - Estimated

Table 4
***In Situ* Groundwater Parameters**
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Parameter	**Monitoring Well** IS17MW01	IS17MW02	IS17MW03
pH	6.1	6.2	5.0
Temperature(^{o}C)	23.0	21.7	21.7
Conductivity(millisiemens/meter)	1.43	0.626	0.161
Oxidation/Reduction Potential (millivolts)	-143	-103	143
Dissolved Oxygen (mg/l)	0.40	0.42	0.60
Turbidity (NTUs)	35	12	174
Ferrous Iron (mg/l)	3.6	3.2	0.6

Table 5
Natural Attenuation Protcol Worksheet
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Analysis	Concentration in the most Contaminated zone	Point Value	Concentration: Background Well#	Concentration: NAPL Source Area	Concentration: Well	Concentration: Well	Point Value: NAPL Source Area	Point Value: Well	Point Value: Well
Oxygen*	<0.5 mg/L	3	0.6	0.4	0.4		3	3	0
	>5 mg/L	-3							
Nitrate*	<1mg/L	2	0.001	0.001	0.001		2	2	0
Iron II*	>1 mg/L	3	0.6	3.2	3.6		3	3	0
Sulfate*	<20 mg/L	2	37.8	16.3	0.001		2	2	0
Sulfide*	>1mg/L	3					0	0	0
Methane[1]	<0.5 mg/L	0	0	0.12	0.54		0	3	0
	>0.5 mg/L	3							
ORP	<50 mV	1	143	-103	-143		2	2	0
	<-100mV	2							
pH*	5<pH<9	0	5.01	6.2	6.06		0	0	0
	5>pH>9	-2							
TOC	>20 mg/L	2	0	9.13	22.7		0	2	0
Temperature*	>20° C	1	21.7	21.7	23		1	1	0
Carbon Dioxide	>2x background	1					0	0	0
Alkalinity	>2x background	1					0	0	0
Chloride*	>2x background	2	9.98	70.4	251		2	2	0
Hydrogen	>1nM	3							
	<1nM	0					0	0	0
Volatile Fatty Acids	>0.1 mg/L	2					0	0	0
BTEX*	>0.1 mg/L	2					0	0	0
PCE*	Material Released	0							
TCE*	Material Released	0							
TCE*	Daughter Product of PCE	2[2]					0	0	0
DCE*	Material Released	0							
DCE*	Daughter Product of TCE	2[2]	0	64	4.9		2	2	0
VC*	Material Released	0							
VC*	Daughter Product of DCE	2[2]	0	140	2.3		2	2	0
Ethene/Ethane	>0.01 mg/L (Daughter Product)	2	0	0.011	0		2	0	0
Ethene/Ethane	>0.1 mg/L	3					0	0	0
Chloroethane*	Daughter Product	2[2]					0	0	0
1,1-DCE*		2[2]	0	0	0.12		0	2	0
TOTAL SCORE							**21**	**26**	**0**

* = Required analysis
1 = Based on duplicate sample
2 = Points awarded only if it can be shown that the compound is a daughter product

Table 6
Mean Hydraulic Head Calculations IS17TS01
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Date & Time	Hour	Head O(K)	O(K)/24	Xi	Xi/24	Yj	M
04/10/02 12:00:00 PM	1	-0.73	-0.03	-0.02	0.00	0.34	**0.62**
	2	-0.74	-0.03	-0.01	0.00	0.37	
	3	-0.61	-0.03	0.00	0.00	0.40	
	4	-0.30	-0.01	0.02	0.00	0.43	
	5	0.03	0.00	0.05	0.00	0.46	
	6	0.21	0.01	0.08	0.00	0.49	
	7	0.28	0.01	0.12	0.00	0.52	
	8	0.19	0.01	0.16	0.01	0.55	
	9	0.00	0.00	0.21	0.01	0.57	
	10	-0.30	-0.01	0.27	0.01	0.60	
	11	-0.60	-0.03	0.32	0.01	0.62	
	12	-0.72	-0.03	0.37	0.02	0.64	
	13	-0.74	-0.03	0.42	0.02	0.66	
	14	-0.61	-0.03	0.45	0.02	0.67	
	15	-0.18	-0.01	0.48	0.02	0.69	
	16	0.21	0.01	0.50	0.02	0.70	
	17	0.54	0.02	0.52	0.02	0.71	
	18	0.79	0.03	0.54	0.02	0.72	
	19	0.99	0.04	0.56	0.02	0.73	
	20	0.93	0.04	0.58	0.02	0.74	
	21	0.72	0.03	0.60	0.02	0.75	
	22	0.35	0.01	0.63	0.03	0.76	
	23	-0.01	0.00	0.66	0.03	0.76	
	24	-0.30	-0.01	0.68	0.03	0.77	
04/11/02 12:00:00 PM	25	-0.47	-0.02	0.71	0.03	0.77	
	26	-0.44	-0.02	0.74	0.03		
	27	-0.09	0.00	0.75	0.03		
	28	0.38	0.02	0.76	0.03		
	29	0.75	0.03	0.76	0.03		
	30	1.11	0.05	0.76	0.03		
	31	1.34	0.06	0.77	0.03		
	32	1.41	0.06	0.77	0.03		
	33	1.29	0.05	0.78	0.03		
	34	0.98	0.04	0.78	0.03		
	35	0.65	0.03	0.79	0.03		
	36	0.34	0.01	0.80	0.03		
	37	0.11	0.00	0.80	0.03		
	38	0.04	0.00	0.80	0.03		
	39	0.30	0.01	0.80	0.03		
	40	0.67	0.03	0.78	0.03		
	41	1.02	0.04	0.77	0.03		
	42	1.27	0.05	0.76	0.03		
	43	1.43	0.06	0.76	0.03		
	44	1.49	0.06	0.76	0.03		
	45	1.37	0.06	0.77	0.03		
	46	1.06	0.04	0.77	0.03		
	47	0.69	0.03	0.79	0.03		
	48	0.36	0.02	0.80	0.03		
04/12/02 12:00:00 PM	49	0.09	0.00				
	50	-0.06	0.00				
	51	0.04	0.00				
	52	0.45	0.02				
	53	0.85	0.04				
	54	1.22	0.05				
	55	1.46	0.06				
	56	1.54	0.06				
	57	1.45	0.06				
	58	1.17	0.05				
	59	0.81	0.03				
	60	0.44	0.02				
	61	0.12	0.00				
	62	-0.11	0.00				
	63	-0.06	0.00				
	64	0.35	0.01				
	65	0.82	0.03				
	66	1.20	0.05				
	67	1.48	0.06				
	68	1.63	0.07				
	69	1.61	0.07				
	70	1.37	0.06				
	71	0.99	0.04				

Table 7
Mean Hydraulic Head Calculations IS17MW02
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Date & Time	Hour	Head O(K)	O(K)/24	Xi	Xi/24	Yj	M
04/10/02 12:00:00 PM	1	1.62	0.07	1.60	0.07	1.60	**1.60**
	2	1.62	0.07	1.60	0.07	1.60	
	3	1.63	0.07	1.60	0.07	1.60	
	4	1.64	0.07	1.60	0.07	1.60	
	5	1.64	0.07	1.60	0.07	1.60	
	6	1.64	0.07	1.60	0.07	1.60	
	7	1.63	0.07	1.60	0.07	1.60	
	8	1.62	0.07	1.60	0.07	1.60	
	9	1.61	0.07	1.60	0.07	1.60	
	10	1.60	0.07	1.59	0.07	1.60	
	11	1.59	0.07	1.59	0.07	1.60	
	12	1.59	0.07	1.59	0.07	1.60	
	13	1.59	0.07	1.59	0.07	1.60	
	14	1.59	0.07	1.59	0.07	1.60	
	15	1.60	0.07	1.59	0.07	1.61	
	16	1.60	0.07	1.59	0.07	1.61	
	17	1.60	0.07	1.59	0.07	1.61	
	18	1.60	0.07	1.59	0.07	1.61	
	19	1.60	0.07	1.60	0.07	1.61	
	20	1.59	0.07	1.60	0.07	1.61	
	21	1.58	0.07	1.60	0.07	1.61	
	22	1.58	0.07	1.60	0.07	1.61	
	23	1.57	0.07	1.60	0.07	1.62	
	24	1.57	0.07	1.60	0.07	1.62	
04/11/02 12:00:00 PM	25	1.58	0.07	1.60	0.07	1.62	
	26	1.58	0.07	1.60	0.07		
	27	1.59	0.07	1.61	0.07		
	28	1.60	0.07	1.61	0.07		
	29	1.61	0.07	1.61	0.07		
	30	1.62	0.07	1.61	0.07		
	31	1.62	0.07	1.61	0.07		
	32	1.61	0.07	1.61	0.07		
	33	1.60	0.07	1.61	0.07		
	34	1.59	0.07	1.61	0.07		
	35	1.59	0.07	1.62	0.07		
	36	1.59	0.07	1.62	0.07		
	37	1.59	0.07	1.62	0.07		
	38	1.58	0.07	1.62	0.07		
	39	1.60	0.07	1.62	0.07		
	40	1.61	0.07	1.62	0.07		
	41	1.62	0.07	1.62	0.07		
	42	1.62	0.07	1.63	0.07		
	43	1.62	0.07	1.63	0.07		
	44	1.62	0.07	1.63	0.07		
	45	1.61	0.07	1.63	0.07		
	46	1.61	0.07	1.63	0.07		
	47	1.60	0.07	1.63	0.07		
	48	1.60	0.07	1.63	0.07		
04/12/02 12:00:00 PM	49	1.61	0.07				
	50	1.61	0.07				
	51	1.62	0.07				
	52	1.63	0.07				
	53	1.64	0.07				
	54	1.65	0.07				
	55	1.65	0.07				
	56	1.65	0.07				
	57	1.64	0.07				
	58	1.64	0.07				
	59	1.63	0.07				
	60	1.62	0.07				
	61	1.62	0.07				
	62	1.62	0.07				
	63	1.63	0.07				
	64	1.63	0.07				
	65	1.64	0.07				
	66	1.64	0.07				
	67	1.64	0.07				
	68	1.64	0.07				
	69	1.64	0.07				
	70	1.64	0.07				
	71	1.63	0.07				

Table 8
Mean Hydraulic Head Calculations IS17MW03
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Date & Time	Hour	Head O(K)	O(K)/24	Xi	Xi/24	Yj	M
04/10/02 12:00:00 PM	1	6.23	0.26	6.20	0.26	6.17	**6.19**
	2	6.24	0.26	6.20	0.26	6.17	
	3	6.26	0.26	6.19	0.26	6.17	
	4	6.28	0.26	6.19	0.26	6.17	
	5	6.28	0.26	6.18	0.26	6.17	
	6	6.28	0.26	6.18	0.26	6.17	
	7	6.28	0.26	6.18	0.26	6.17	
	8	6.26	0.26	6.17	0.26	6.17	
	9	6.23	0.26	6.17	0.26	6.17	
	10	6.21	0.26	6.17	0.26	6.17	
	11	6.20	0.26	6.17	0.26	6.18	
	12	6.19	0.26	6.17	0.26	6.18	
	13	6.18	0.26	6.16	0.26	6.18	
	14	6.18	0.26	6.16	0.26	6.18	
	15	6.19	0.26	6.16	0.26	6.19	
	16	6.19	0.26	6.16	0.26	6.19	
	17	6.19	0.26	6.16	0.26	6.19	
	18	6.19	0.26	6.16	0.26	6.20	
	19	6.17	0.26	6.16	0.26	6.20	
	20	6.15	0.26	6.16	0.26	6.21	
	21	6.13	0.26	6.16	0.26	6.21	
	22	6.11	0.25	6.17	0.26	6.21	
	23	6.10	0.25	6.17	0.26	6.22	
	24	6.10	0.25	6.17	0.26	6.22	
04/11/02 12:00:00 PM	25	6.11	0.25	6.18	0.26	6.23	
	26	6.13	0.26	6.18	0.26		
	27	6.16	0.26	6.18	0.26		
	28	6.18	0.26	6.19	0.26		
	29	6.20	0.26	6.19	0.26		
	30	6.21	0.26	6.19	0.26		
	31	6.21	0.26	6.20	0.26		
	32	6.20	0.26	6.20	0.26		
	33	6.18	0.26	6.21	0.26		
	34	6.16	0.26	6.21	0.26		
	35	6.15	0.26	6.22	0.26		
	36	6.14	0.26	6.22	0.26		
	37	6.14	0.26	6.23	0.26		
	38	6.15	0.26	6.24	0.26		
	39	6.17	0.26	6.24	0.26		
	40	6.19	0.26	6.25	0.26		
	41	6.20	0.26	6.25	0.26		
	42	6.21	0.26	6.26	0.26		
	43	6.20	0.26	6.26	0.26		
	44	6.20	0.26	6.27	0.26		
	45	6.19	0.26	6.27	0.26		
	46	6.19	0.26	6.28	0.26		
	47	6.18	0.26	6.28	0.26		
	48	6.18	0.26	6.29	0.26		
04/12/02 12:00:00 PM	49	6.20	0.26				
	50	6.21	0.26				
	51	6.24	0.26				
	52	6.26	0.26				
	53	6.28	0.26				
	54	6.30	0.26				
	55	6.30	0.26				
	56	6.31	0.26				
	57	6.31	0.26				
	58	6.30	0.26				
	59	6.30	0.26				
	60	6.29	0.26				
	61	6.29	0.26				
	62	6.29	0.26				
	63	6.30	0.26				
	64	6.32	0.26				
	65	6.33	0.26				
	66	6.34	0.26				
	67	6.33	0.26				
	68	6.32	0.26				
	69	6.32	0.26				
	70	6.31	0.26				
	71	6.31	0.26				

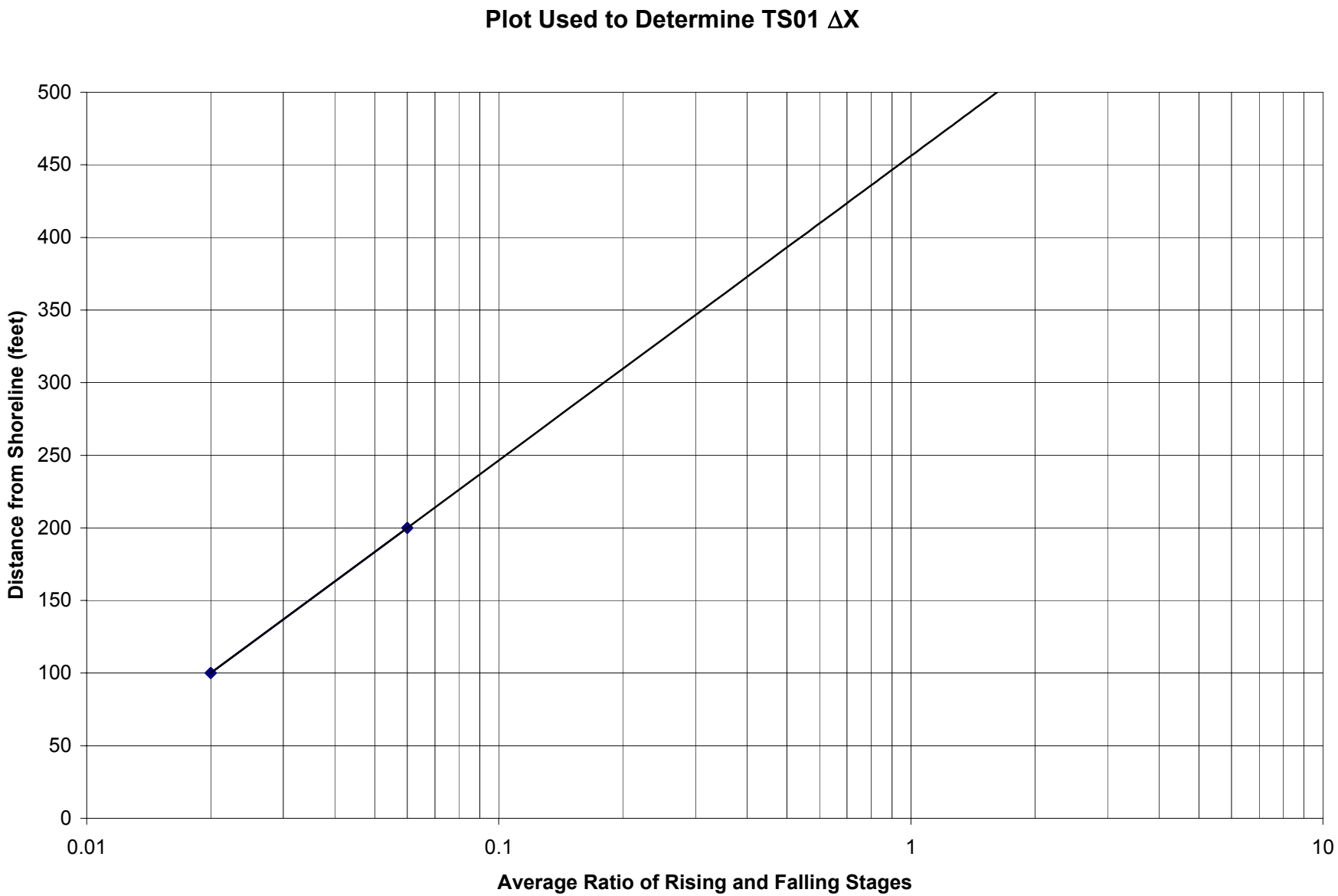
Plot Used to Determine TS01 ΔX
Distance from Shoreline (feet)
500
450
400
350
300
250
200
150
100
50
0
0.01
0.1
1
10
Average Ratio of Rising and Falling Stages

Table 9
Stage Ratio Method of Determining Hydraulic Conductivity
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

IS17TS01

Stage	Head Ft. MSL	Delta Head Feet		Time Hours	Delta Time Hours	
1	0.28			1		
2	-0.74	1-2	1.02	7	1-2	6
3	0.99	2-3	1.73	13	2-3	6
4	-0.47	3-4	1.46	19	3-4	6
5	1.41	4-5	1.88	26	4-5	7
6	0.04	5-6	1.37	32	5-6	6
				Average =		6.2

IS17MW02

Stage	Head Ft. MSL	Delta Head Feet	
1	1.6		
2	1.57	1-2	0.03
3	1.62	2-3	0.05
4	1.58	3-4	0.04
5	1.62	4-5	0.04
6	1.6	5-6	0.02

IS17MW03

Stage	Head Ft. MSL	Delta Head		**Ratio MW02/TS01**	**Ratio MW03/TS01**
1	6.2				
2	6.1	1-2	0.1	0.029	0.098
3	6.2	2-3	0.1	0.029	0.058
4	6.1	3-4	0.1	0.027	0.068
5	6.2	4-5	0.1	0.021	0.053
6	6.2	5-6	0	0.015	0.000
			Average =	0.024	Average = 0.056

Plot Data

100	0.02
200	0.06

$$T = \left[\frac{4.4\Delta X^2}{t_0}\right]S$$

ΔX = 210 feet
t0 = 12.4 hours

T =	38808 g/d/ft	5188.235 ft^2/day	(S=0.1)	
	77616 g/d/ft	10376.47 ft^2/day	(S=0.2)	
	116424 g/d/ft	15564.71 ft^2/day	(S=0.3)	

K =	**519 feet/day**	1.83E-01 cm/sec	(S=0.1)
	1038 feet/day	3.66E-01 cm/sec	(S=0.2)
	1556 feet/day	5.49E-01 cm/sec	(S=0.3)

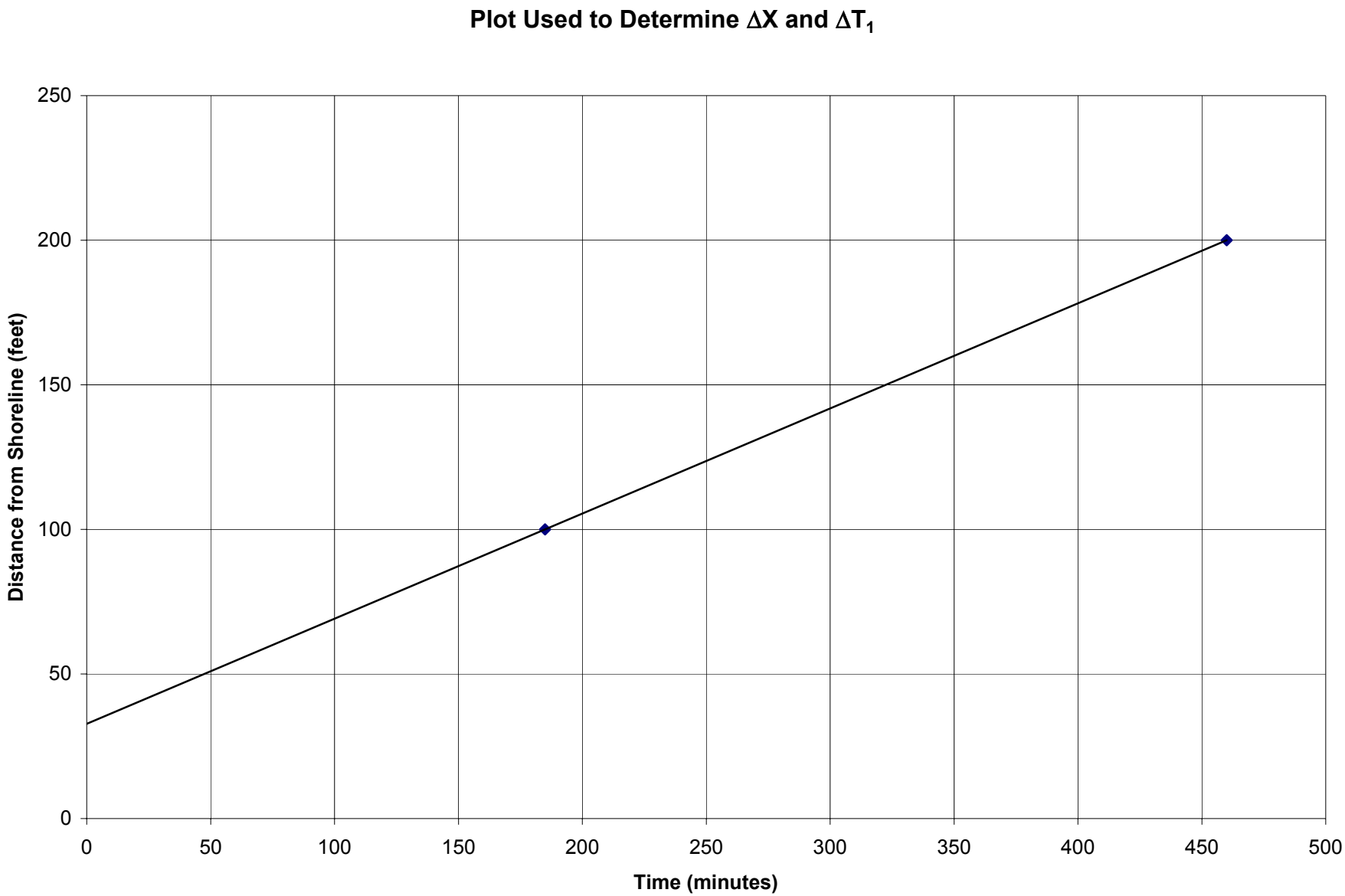
Plot Used to Determine ΔX and ΔT1
Distance from Shoreline (feet)
Time (minutes)
0
50
100
150
200
250
300
350
400
450
500

Table 10
Time Lag Method of Determining Hydraulic Conductivity
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Raw Data

IS17TS01		IS17MW02		IS17MW03	
Stage	Time Minutes	Stage	Time Minutes	Stage	Time Minutes
1	10820	1	10970	1	11120
2	11180	2	11270	2	11600
3	11600	3	11720	3	11960
4	11900	4	11990	4	12320
5	12320	5	12500	5	12740
6	12260	6	12740	6	13100

Time Lag

IS17TS01 - IS17MW02		IS17TS01 - IS17MW03	
Stage	Time Lag Minutes	Stage	Time Lag Minutes
1	150	1	300
2	90	2	420
3	120	3	360
4	90	4	420
5	180	5	420
6	480	6	840
Average =	185	Average =	460

Plot data

100	185
200	460

$$T = \left[\frac{0.6 \Delta X^2 t_0}{\Delta t_1} \right] S$$

X^2 = 100
T1 = 185

T =	18176	g/d/ft	2430	ft^2/day	(S=0.1)	**K =**	**243**	**feet/day**	8.57E-02 cm/sec (S=0.1)
	36352	g/d/ft	4860	ft^2/day	(S=0.2)		**486**	**feet/day**	1.71E-01 cm/sec (S=0.2)
	54529	g/d/ft	7290	ft^2/day	(S=0.3)		**729**	**feet/day**	2.57E-01 cm/sec (S=0.3)

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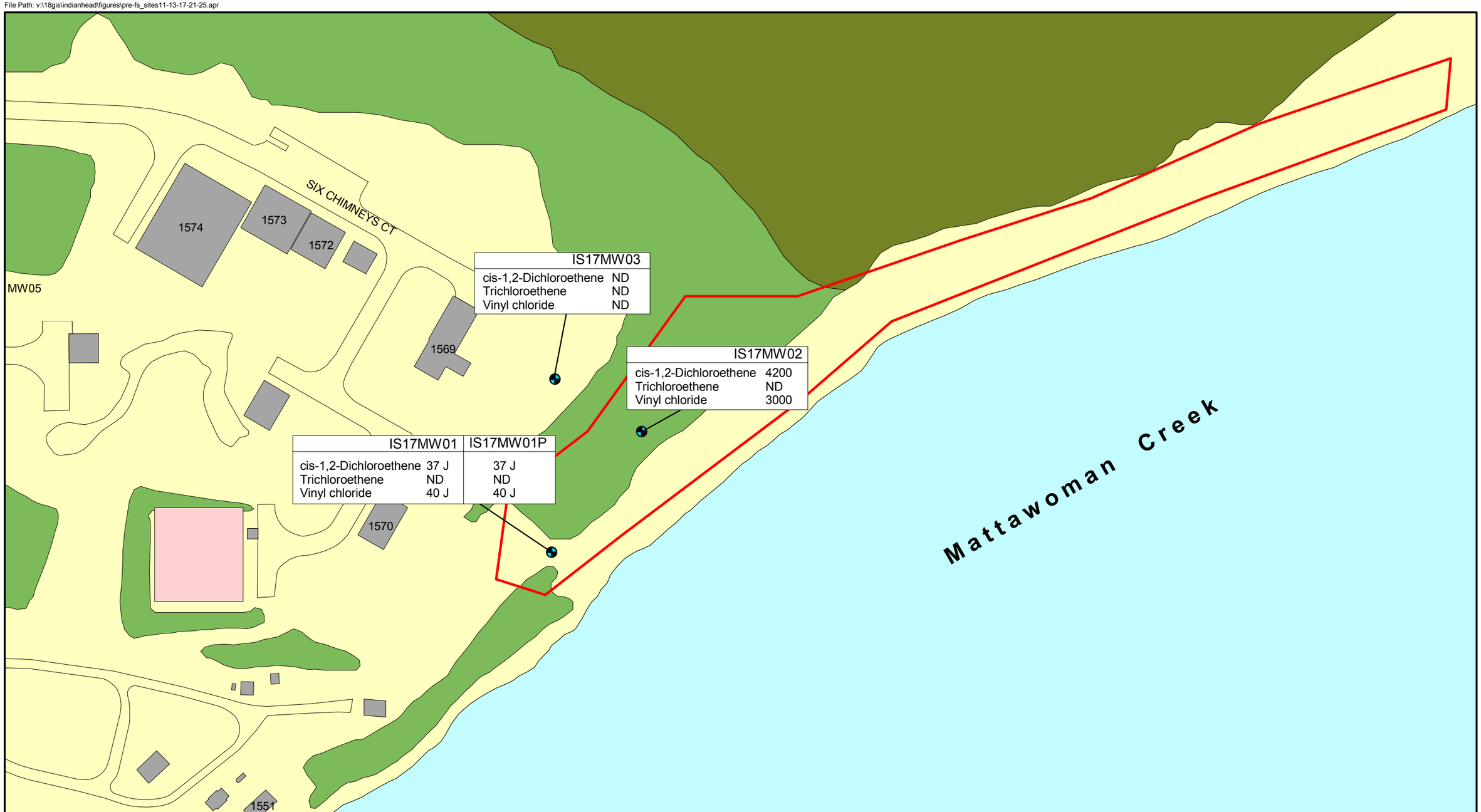


LEGEND

- Monitoring Wells
- IR Sites
- Buildings
- Demolished Buildings
- Wooded Area
- Dense Wooded Area
- Road

Note: All concentrations are measured in micrograms per liter (ug/l)

ND = Non Detect

J = Estimated Value Below the Detection Limit

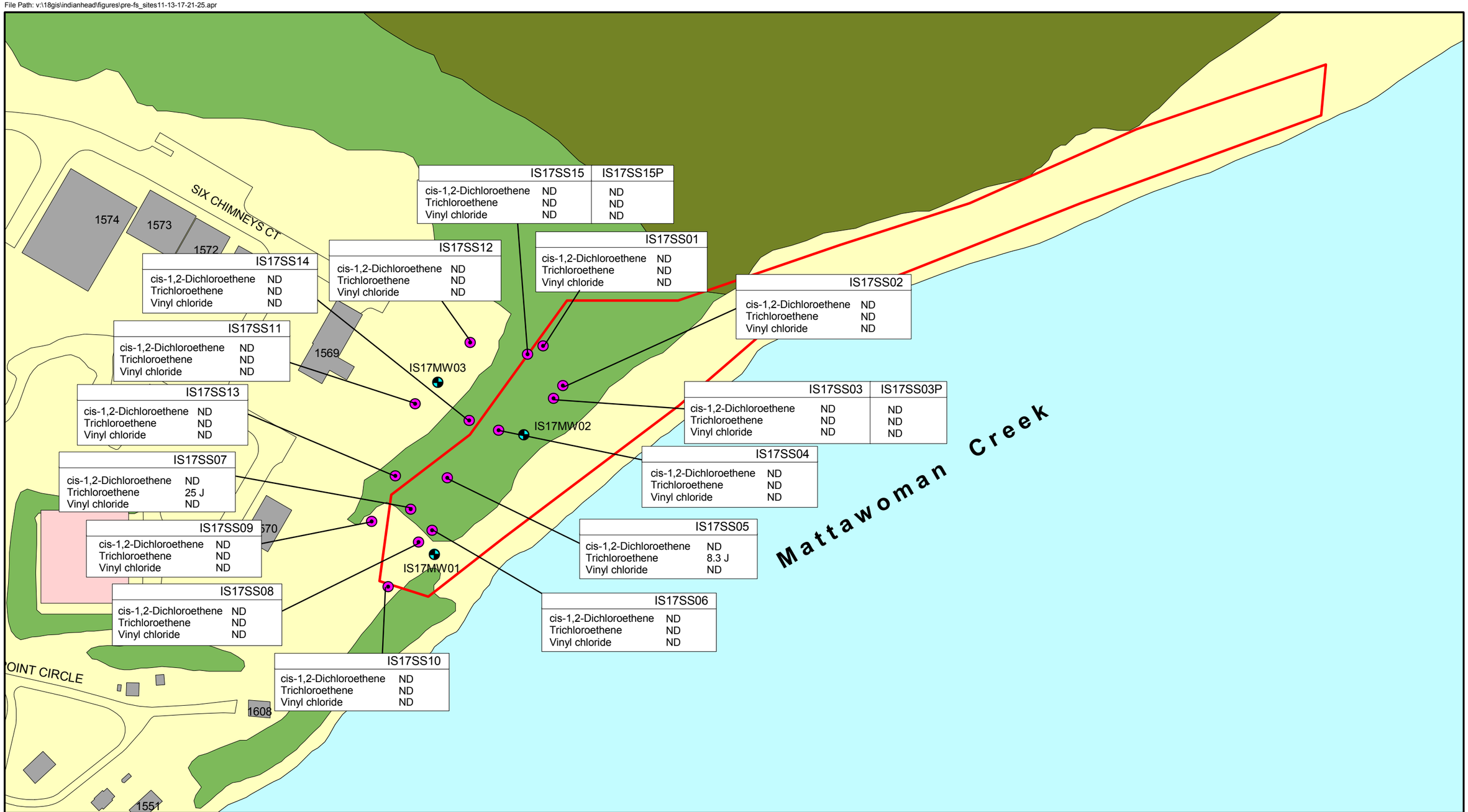
N

100 0 100 200 Feet

Figure 1
Selected VOCs in Groundwater - October 2000
Site 17 Pre-FS Investigation
IHDIV-NSWC, Indian Head, Maryland

CH2MHILL

File Path: v:\18gis\indianhead\figures\pre-fs_sites11-13-17-21-25.apr



LEGEND

- Surface Soil
- Monitoring Wells
- IR Sites
- Buildings
- Demolished Buildings
- Wooded Area
- Dense Wooded Area
- Road

Note: All concentrations are measured in micrograms per kilogram (ug/kg)

ND = Non Detect

J = Estimated Value Below the Detection Limit

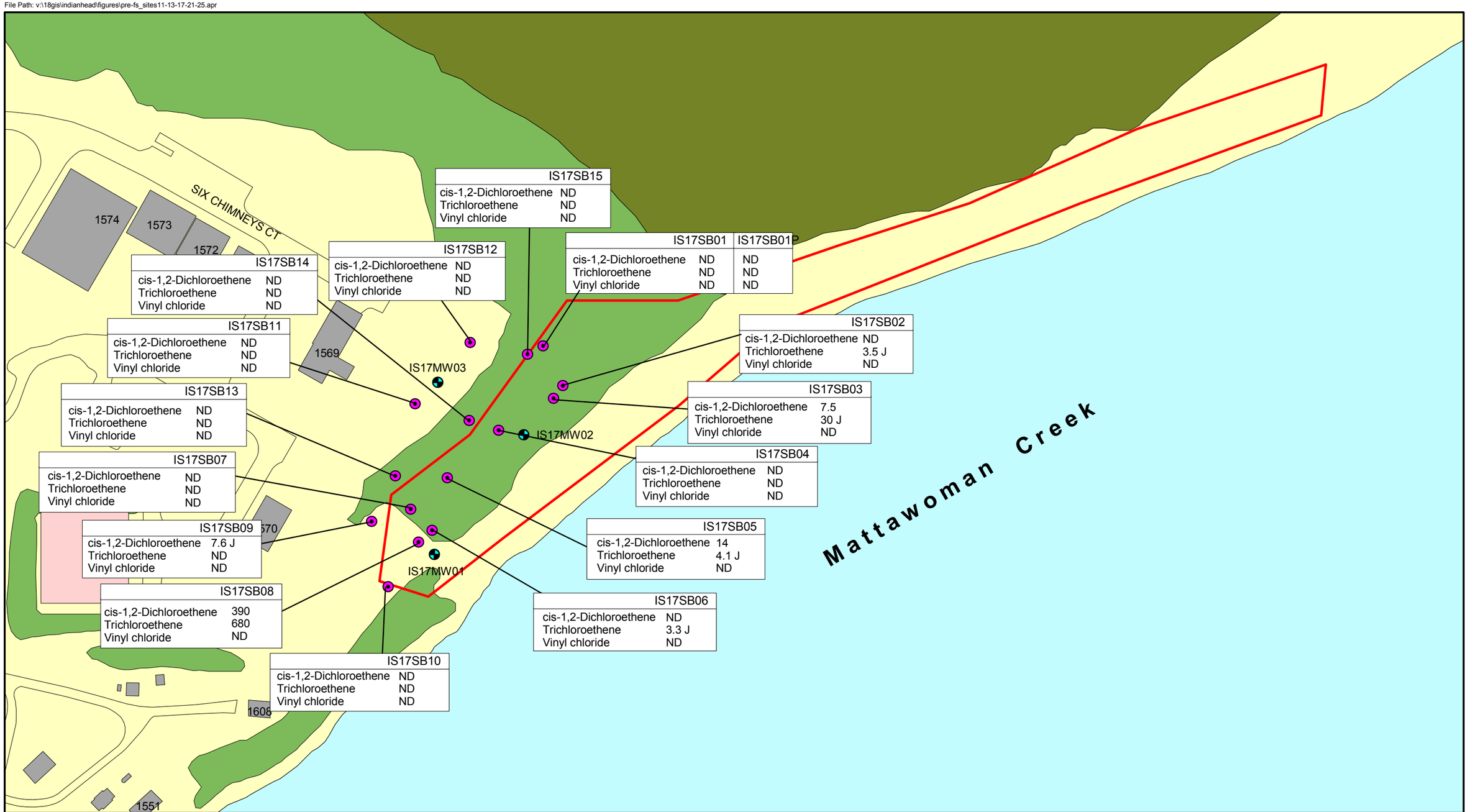
N

100 0 100 200 Feet

Figure 2
Selected VOCs In Surface Soil - October 2000
Site 17 Pre-FS Investigation
IHDIV-NSWC, Indian Head, Maryland

CH2MHILL

File Path: v:\18gis\indianhead\figures\pre-fs_sites11-13-17-21-25.apr



LEGEND
- Subsurface Soil
- Monitoring Wells
- IR Sites
- Buildings
- Demolished Buildings
- Wooded Area
- Dense Wooded Area
- Road

Note: All concentrations are measured in micrograms per kilogram (ug/kg)

ND = Non Detect

J = Estimated Value Below the Detection Limit

N

100 0 100 200 Feet

Figure 3
Selected VOCs In Subsurface Soil - October 2000
Site 17 Pre-FS Investigation
IHDIV-NSWC, Indian Head, Maryland

CH2MHILL

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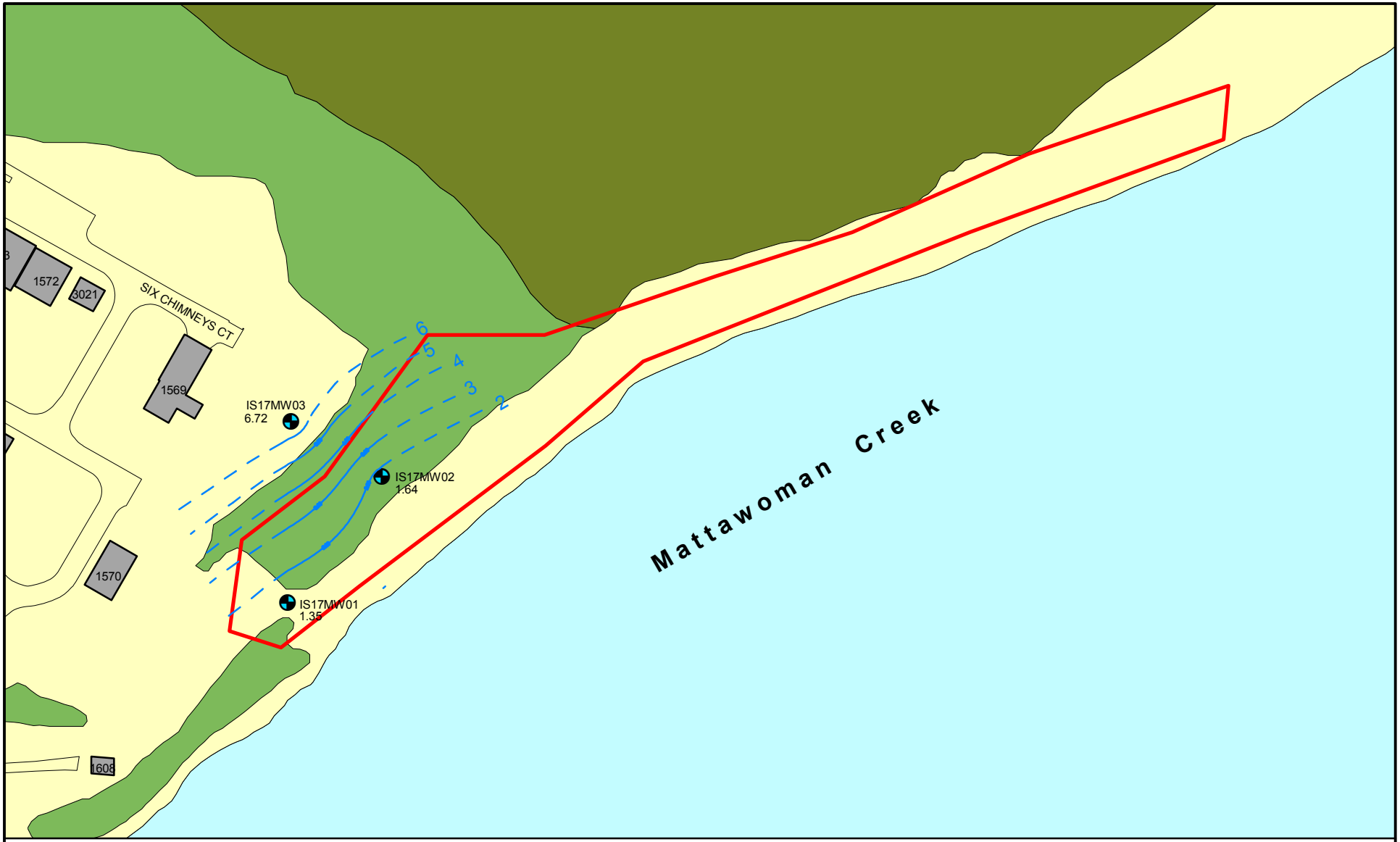

LEGEND

- Monitoring Wells
- Interpolated Groundwater Contours
- Inferred Groundwater Contours
- IR Site Boundary
- Buildings

1.35 = Feet above mean sea level

- Wooded Area
- Dense Wooded Area

N

70 0 70 140 Feet

Figure 4
Groundwater Contours - October 2000
Site 17 Pre-FS Investigation
IHDIV-NSWC, Indian Head, Maryland

CH2MHILL

File Path: v:\18gis\indianhead\figures\pre-fs_sites11-13-17-21-25.apr

LEGEND

- Monitoring Wells
- MIP/Direct Push Sample Locations
- MIP/Direct Push and Shelby Tube Sample Locations
- Surface Water Sample Locations
- IR Sites
- Buildings
- Wooded Area
- Dense Wooded Area
- Road

N

100 0 100 200 Feet

Figure 5
MIP/EC/Direct Push Groundwater
and Surface Water Sampling Locations
Site 17 Pre-FS Investigation
IHDIV-NSWC, Indian Head, Maryland

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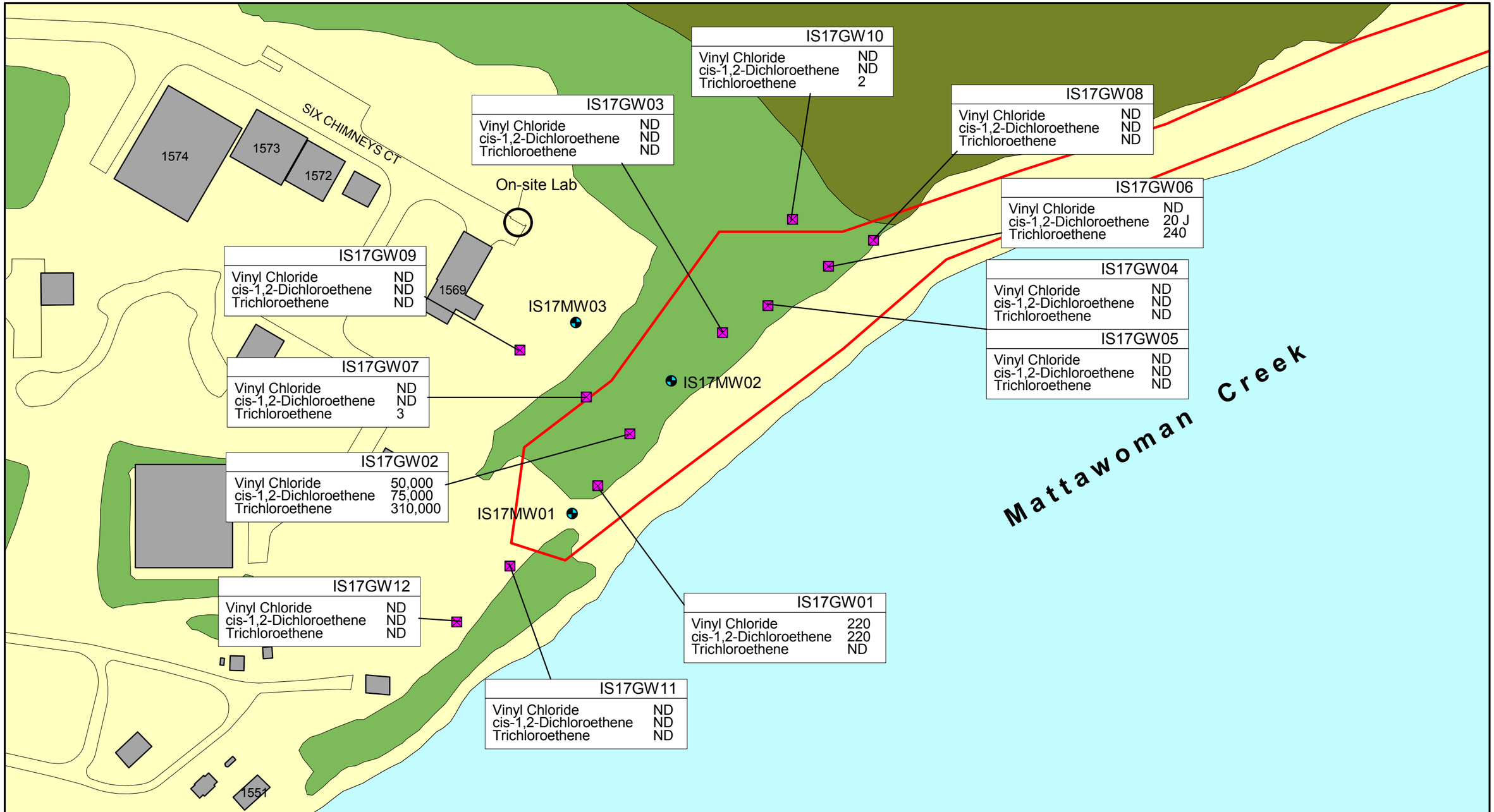

LEGEND

- Monitoring Wells
- MIP/Direct Push Sample Locations
- IR Sites
- Buildings

Note: All concentrations are measured in micrograms per liter (ug/l).

- Wooded Area
- Dense Wooded Area
- Road

ND = Non Detect

J = Estimated Value Below the Detection Limit

N

70 0 70 140 Feet

Figure 6
Selected VOCs in Direct Push Groundwater Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC, Indian Head, Maryland

CH2MHILL

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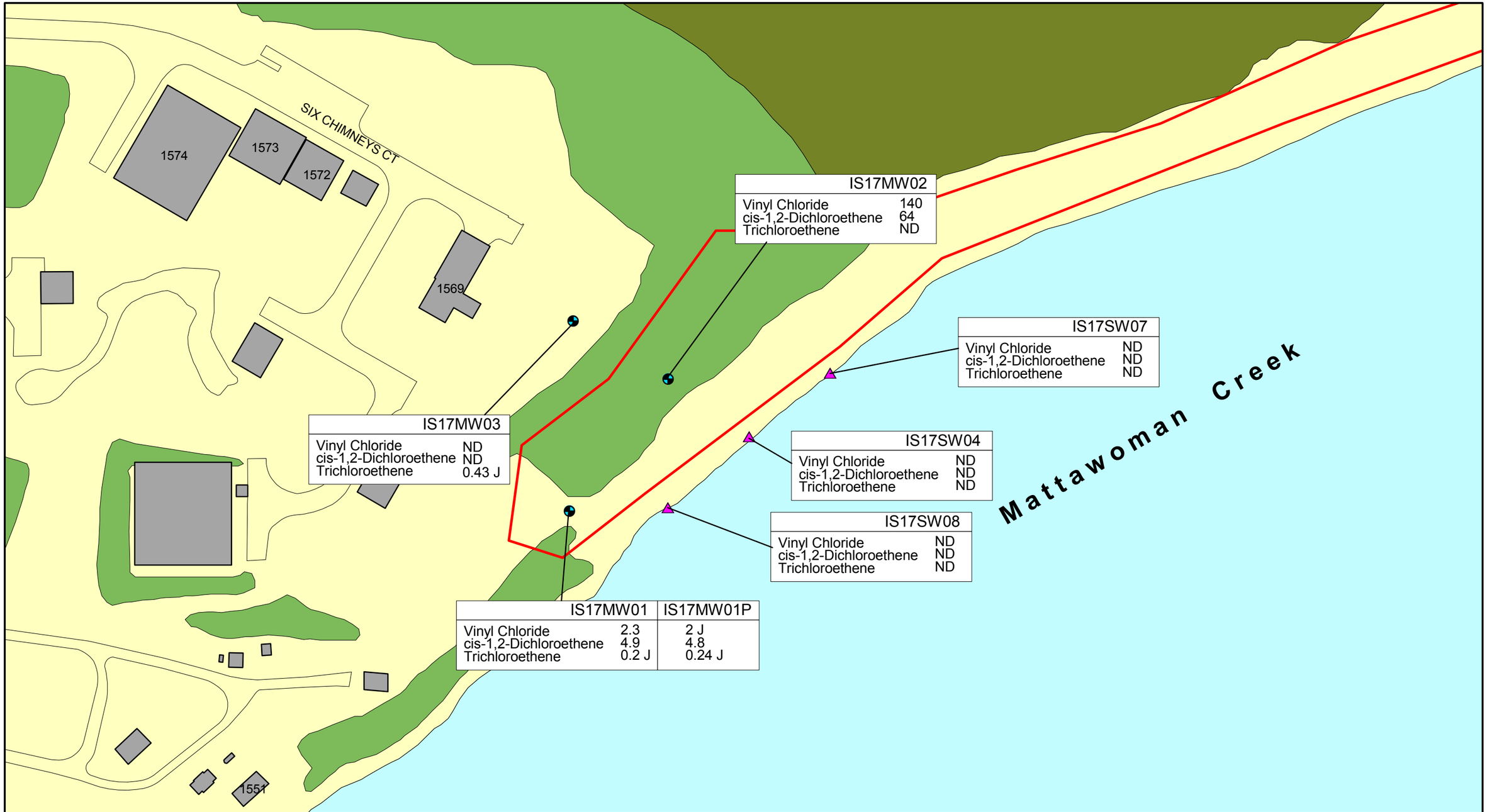


LEGEND

- Monitoring Wells
- Surface Water Sample Locations
- IR Sites
- Buildings

Note: All concentrations are measured in micrograms per liter (ug/l).

- Wooded Area
- Dense Wooded Area
- Road

ND = Non Detect

J = Estimated Value Below the Detection Limit

N

70 0 70 140 Feet

Figure 7
Selected VOCs in Groundwater and Surface Water Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC, Indian Head, Maryland

CH2MHILL

File Path: v:\18gis\indianhead\figures\dave_site11-13-17-21-25.apr

LEGEND

- Monitoring Well
- Temporary "Monitoring Well"
- Interpolated Groundwater Contours
- Inferred Groundwater Contours
- IR Site Boundary

1.35 = Feet above mean sea level

- Wooded Area
- Dense Wooded Area
- Buildings

N

70 0 70 140 Feet

Figure 8
Tidal Monitoring Stations
Site 17 Pre-FS Investigation
IHDIV-NSWC, Indian Head, Maryland

CH2MHILL

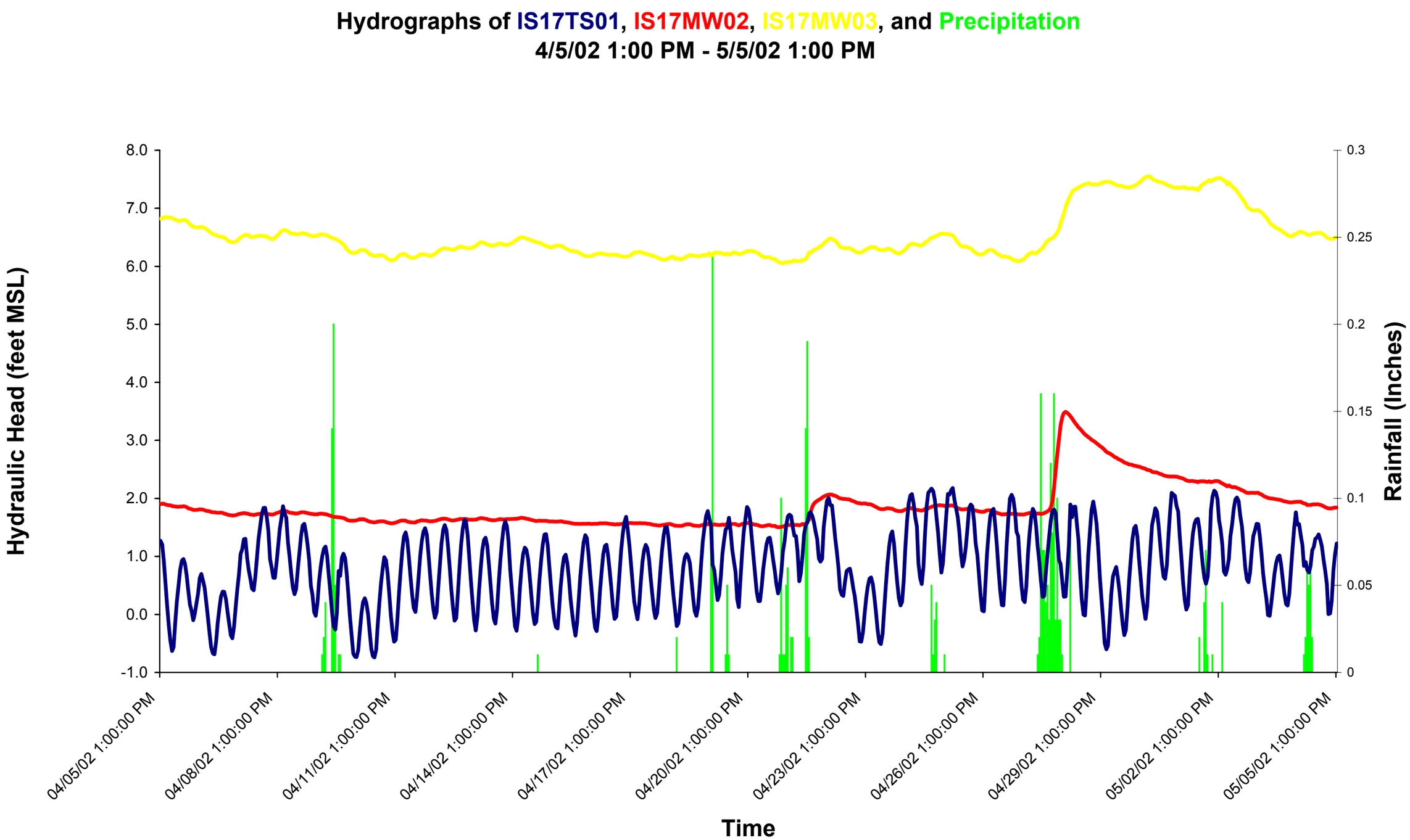
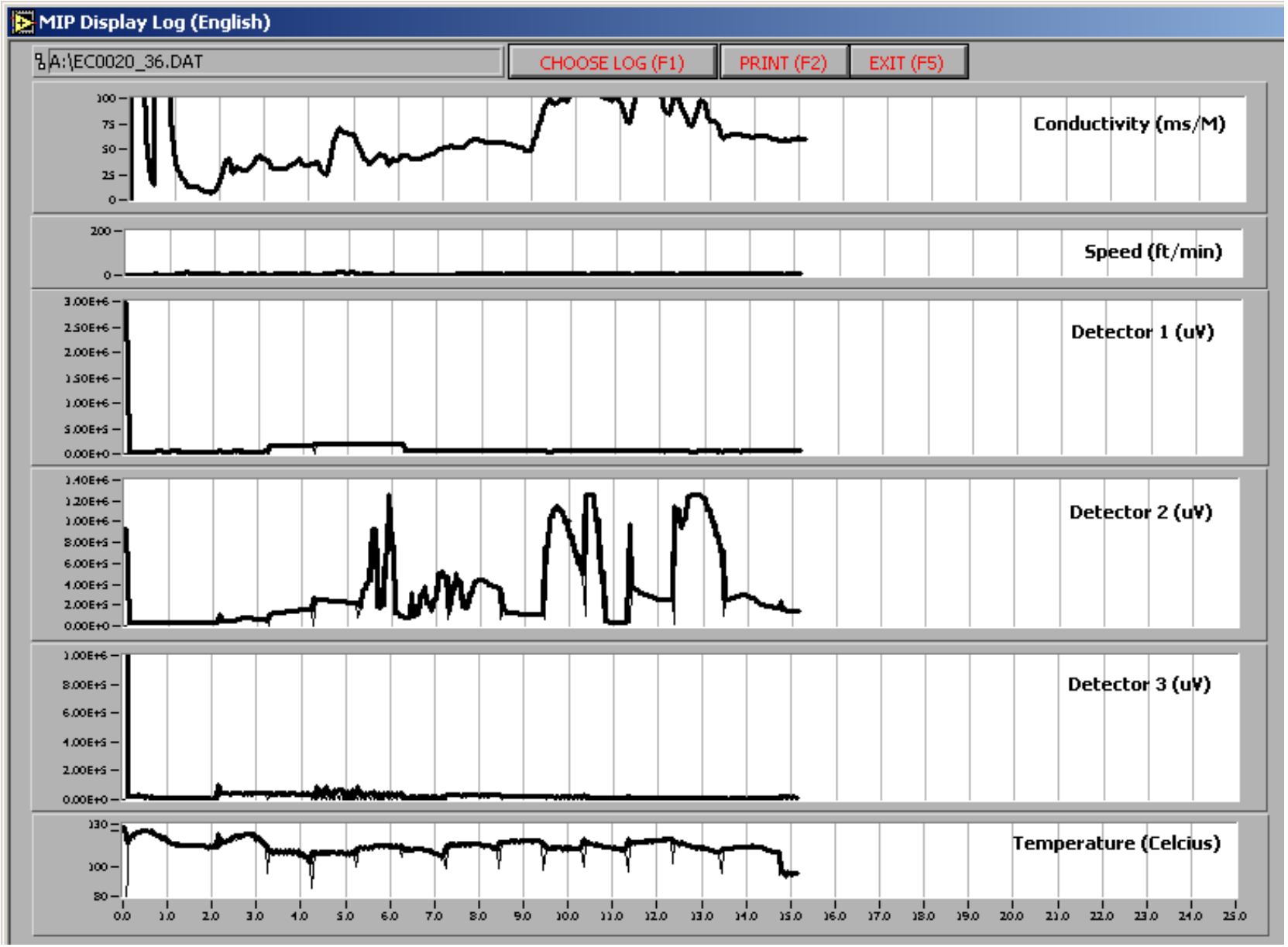
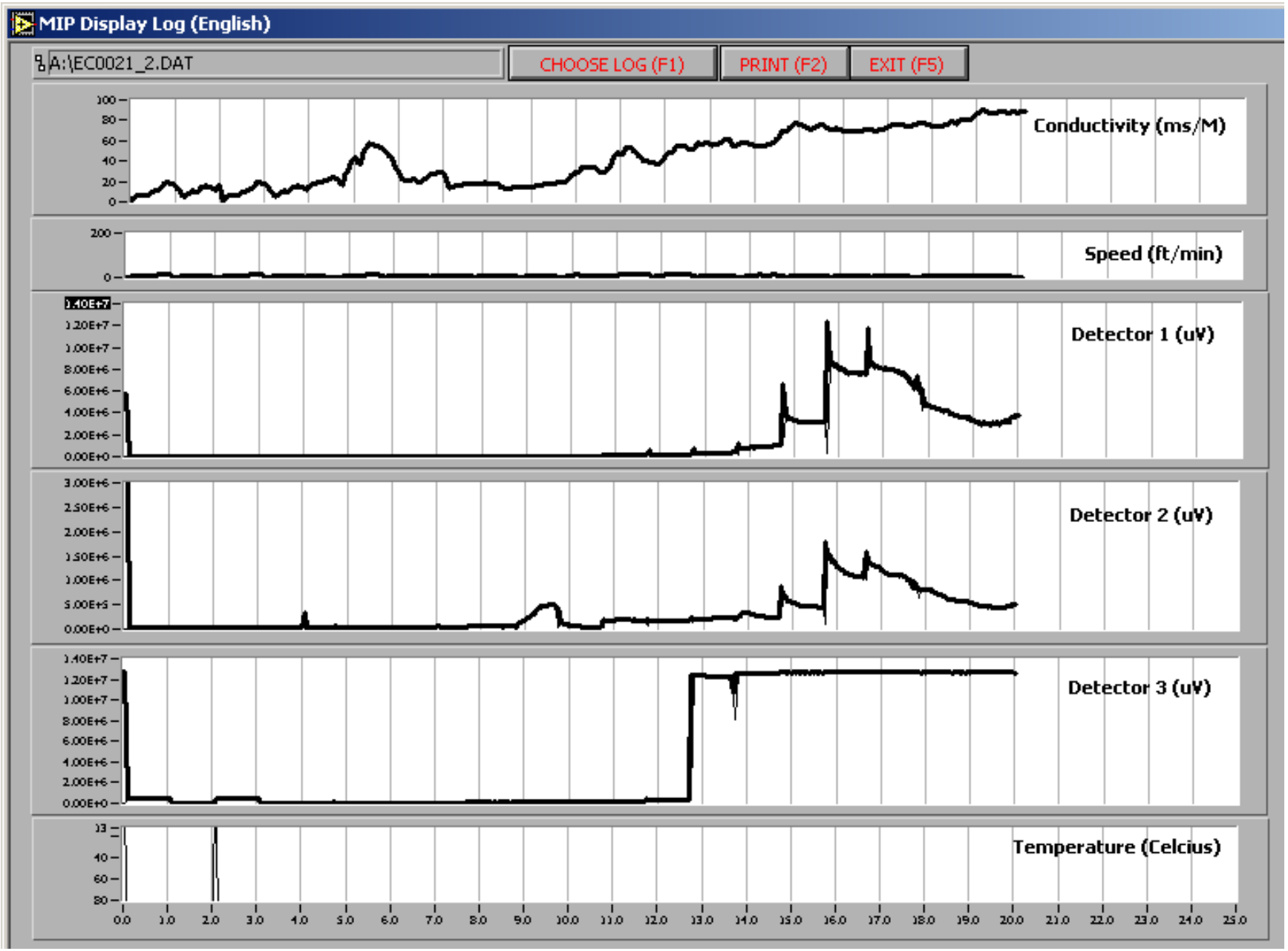


Figure 9
Tidal Study Hydrographs
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

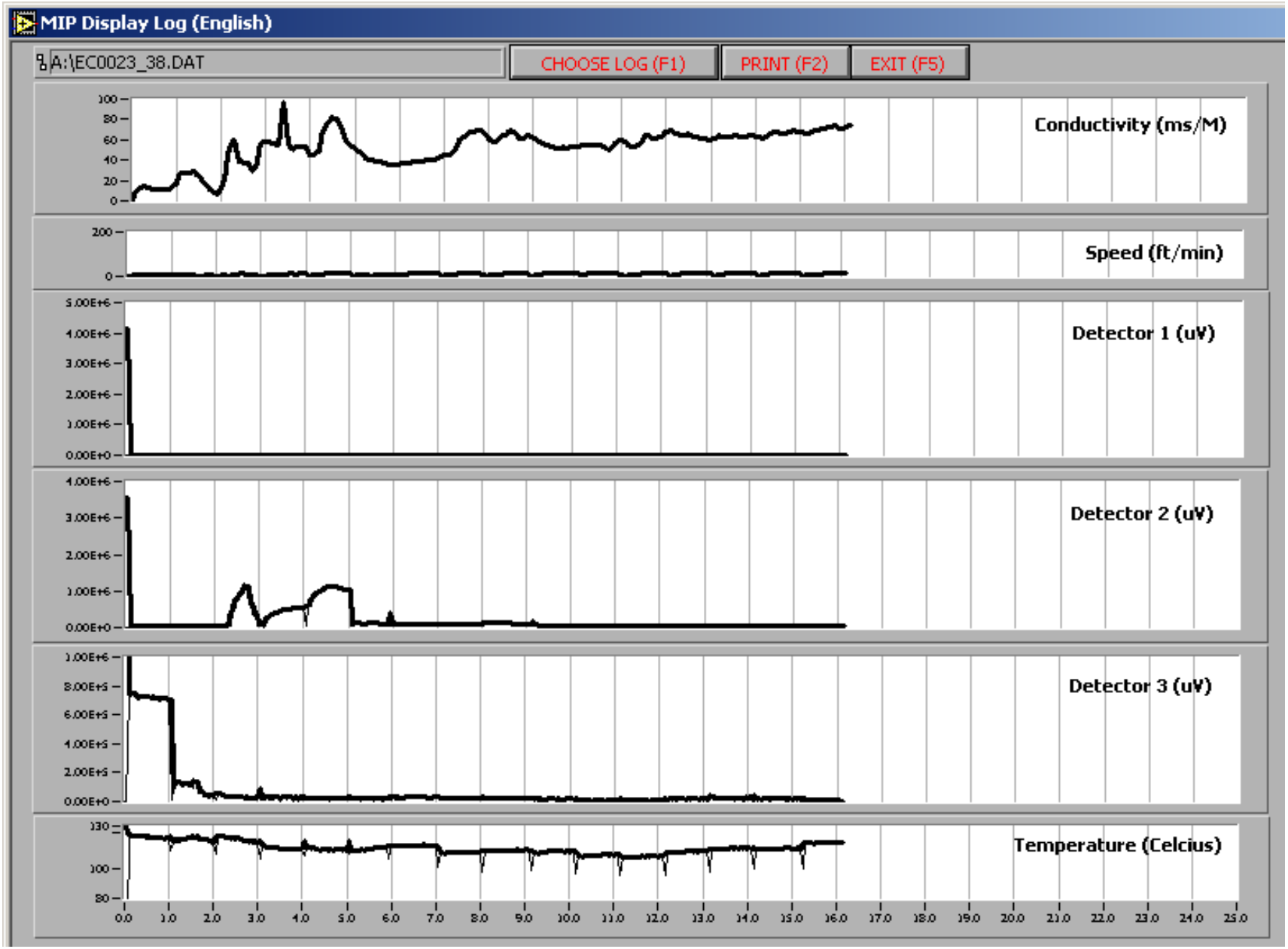
MIP1


MIP Display Log (English)
A:\EC0020_36.DAT
CHOOSE LOG (F1)
PRINT (F2)
EXIT (F5)
Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

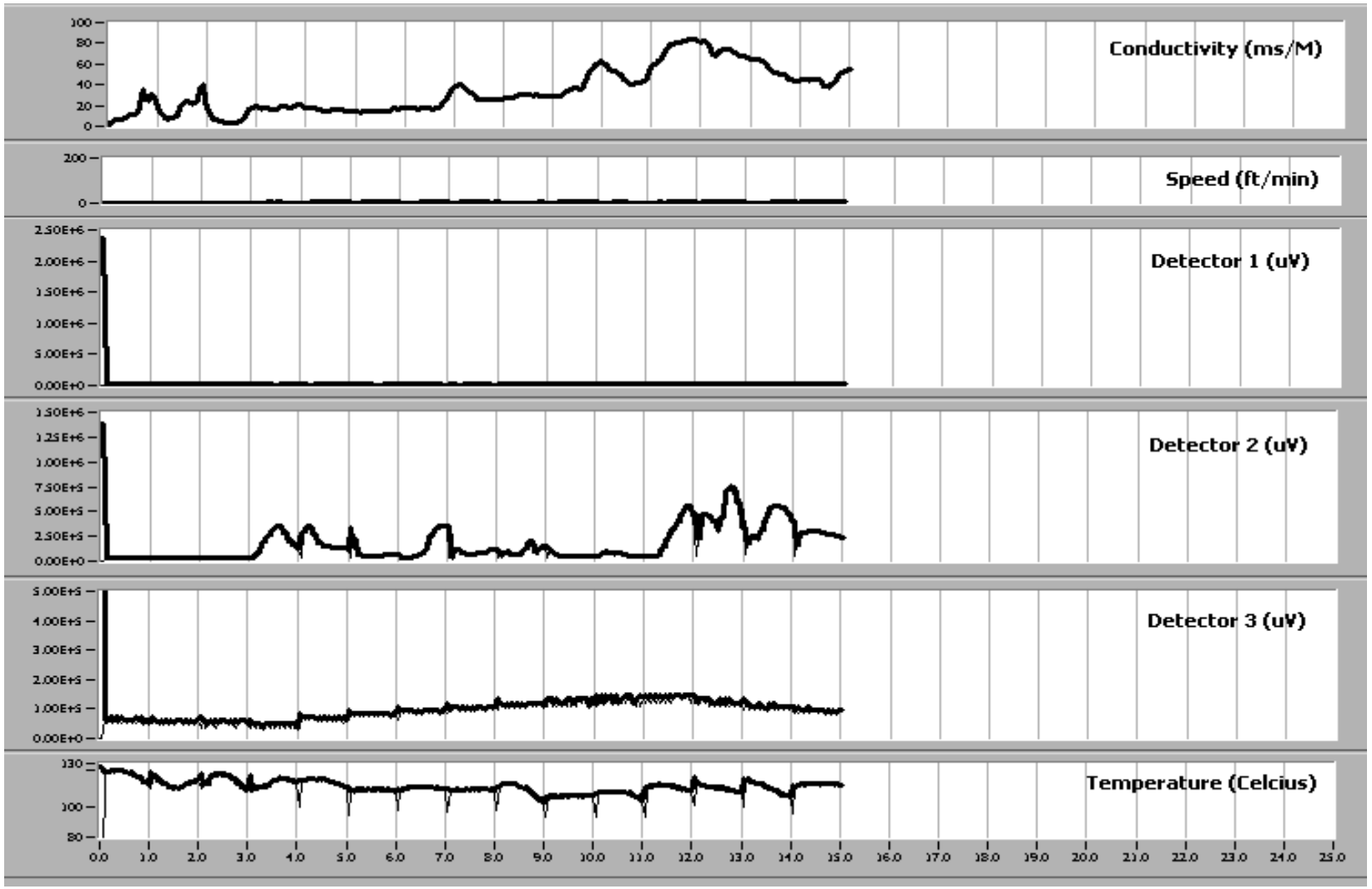
MIP2


MIP Display Log (English)
A:\EC0021_2.DAT
CHOOSE LOG (F1)
PRINT (F2)
EXIT (F5)
Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

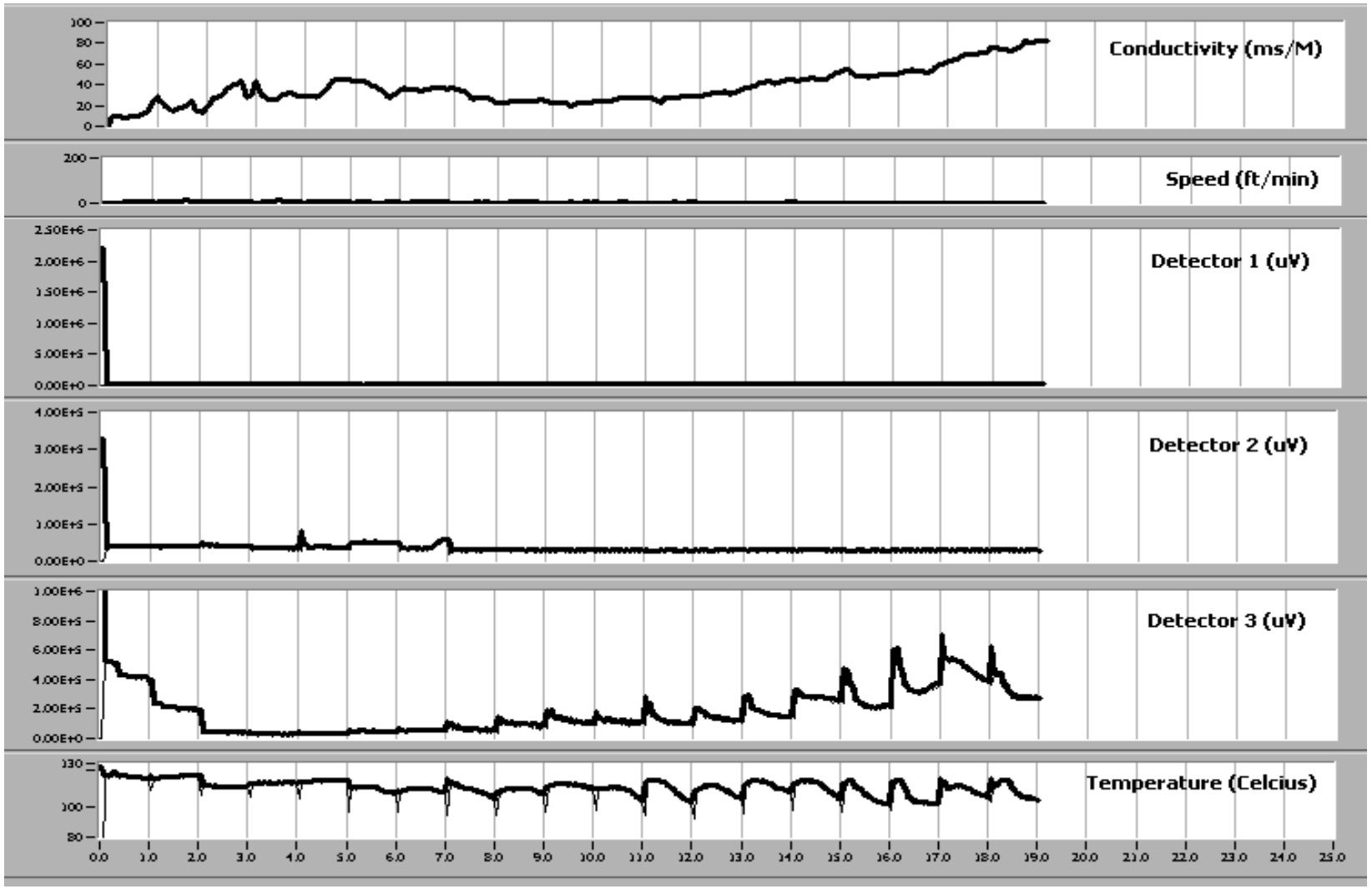
MIP3


MIP Display Log (English)
A:\EC0023_38.DAT
CHOOSE LOG (F1)
PRINT (F2)
EXIT (F5)
Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

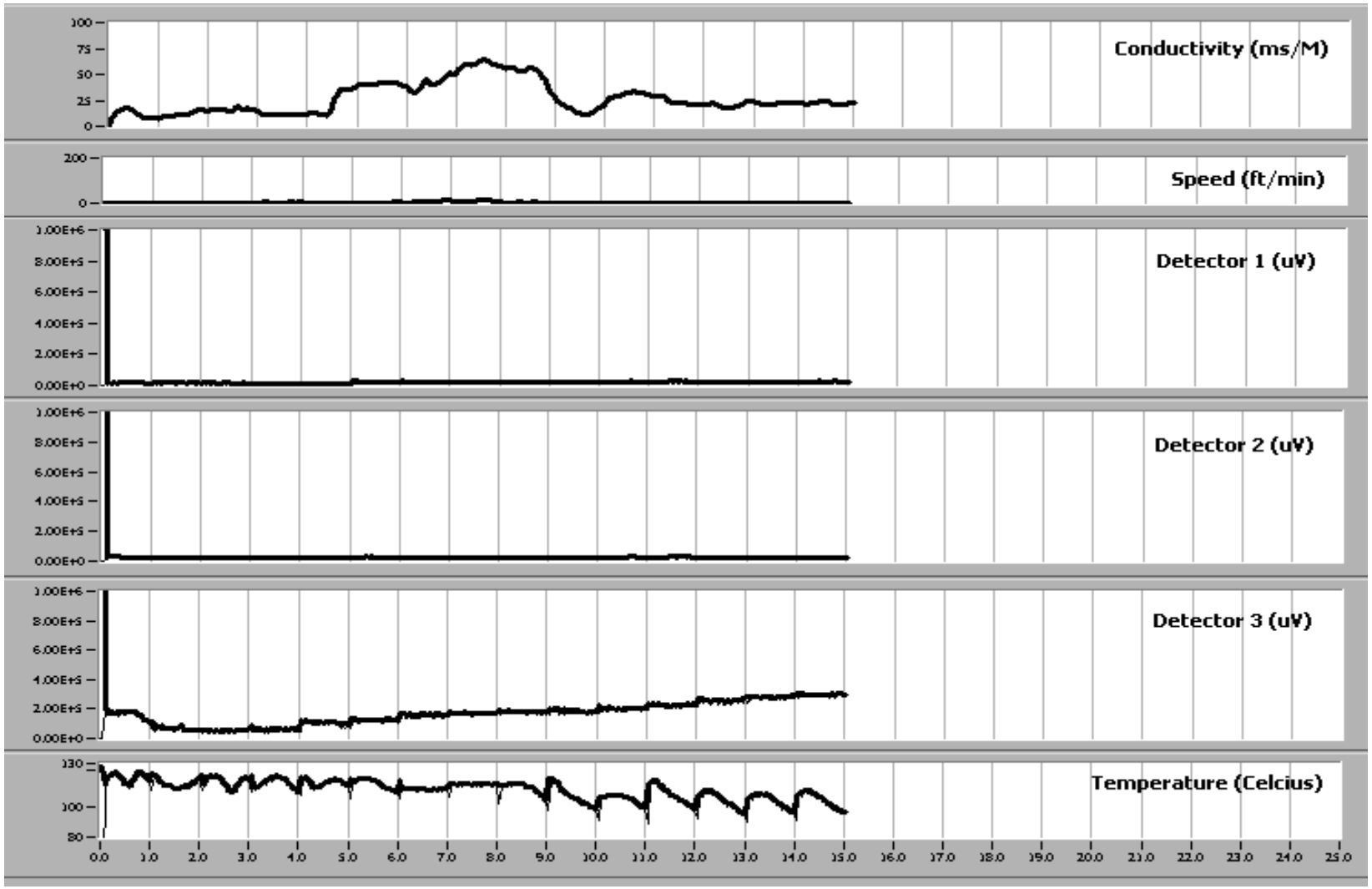
MIP4


Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

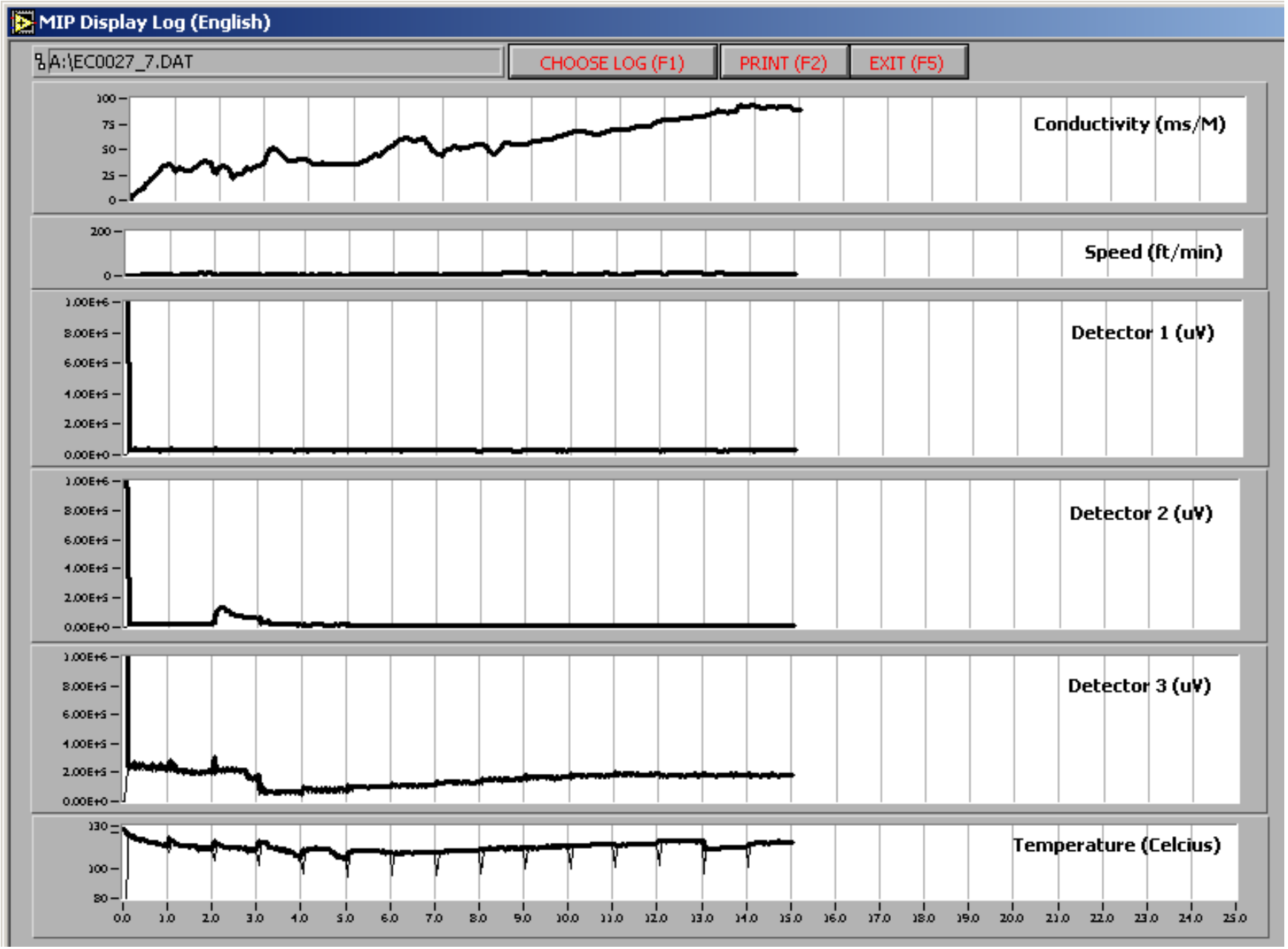
MIP5


Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

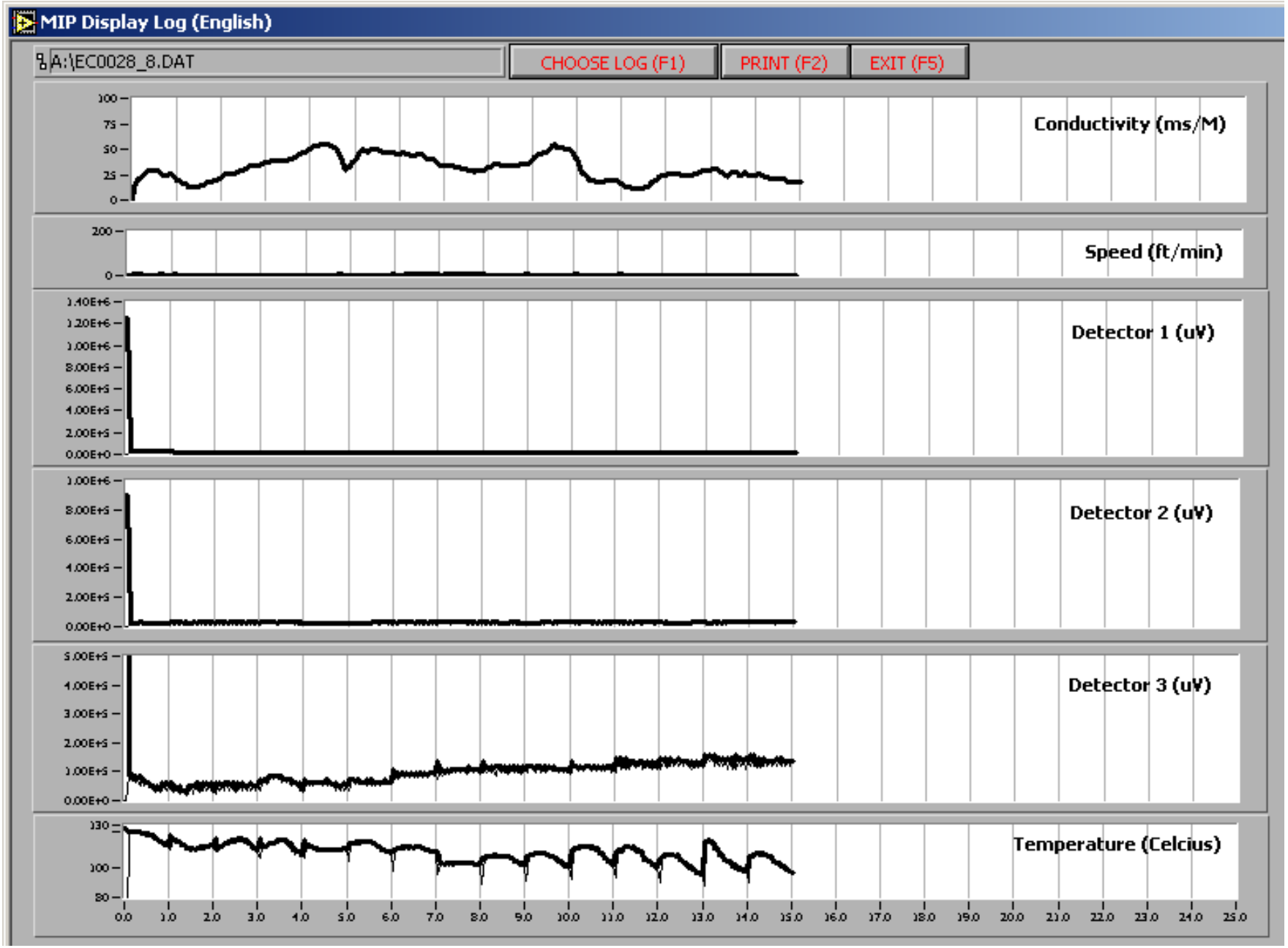
MIP6


Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

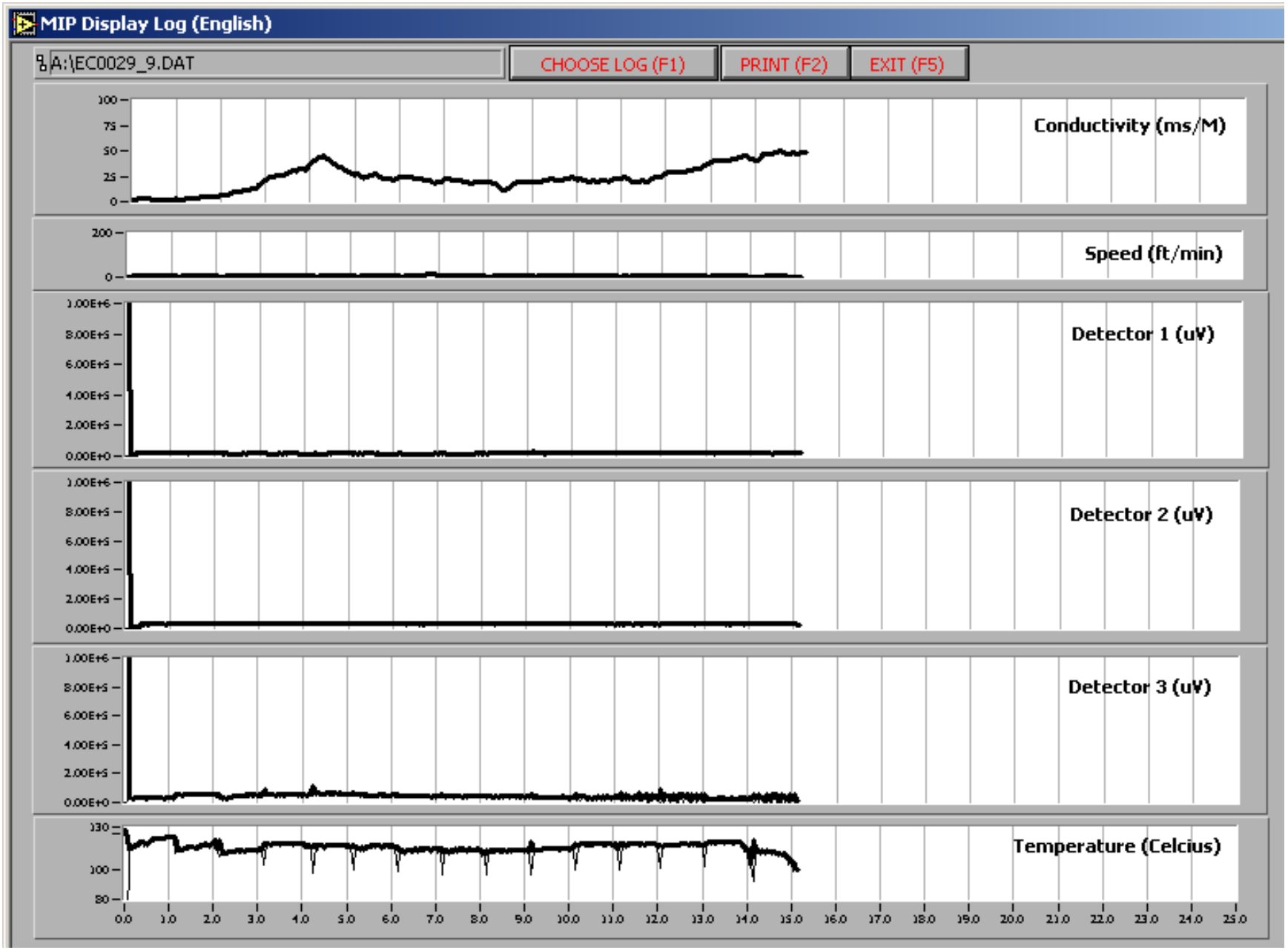
MIP7


MIP Display Log (English)
A:\EC0027_7.DAT
CHOOSE LOG (F1)
PRINT (F2)
EXIT (F5)
Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

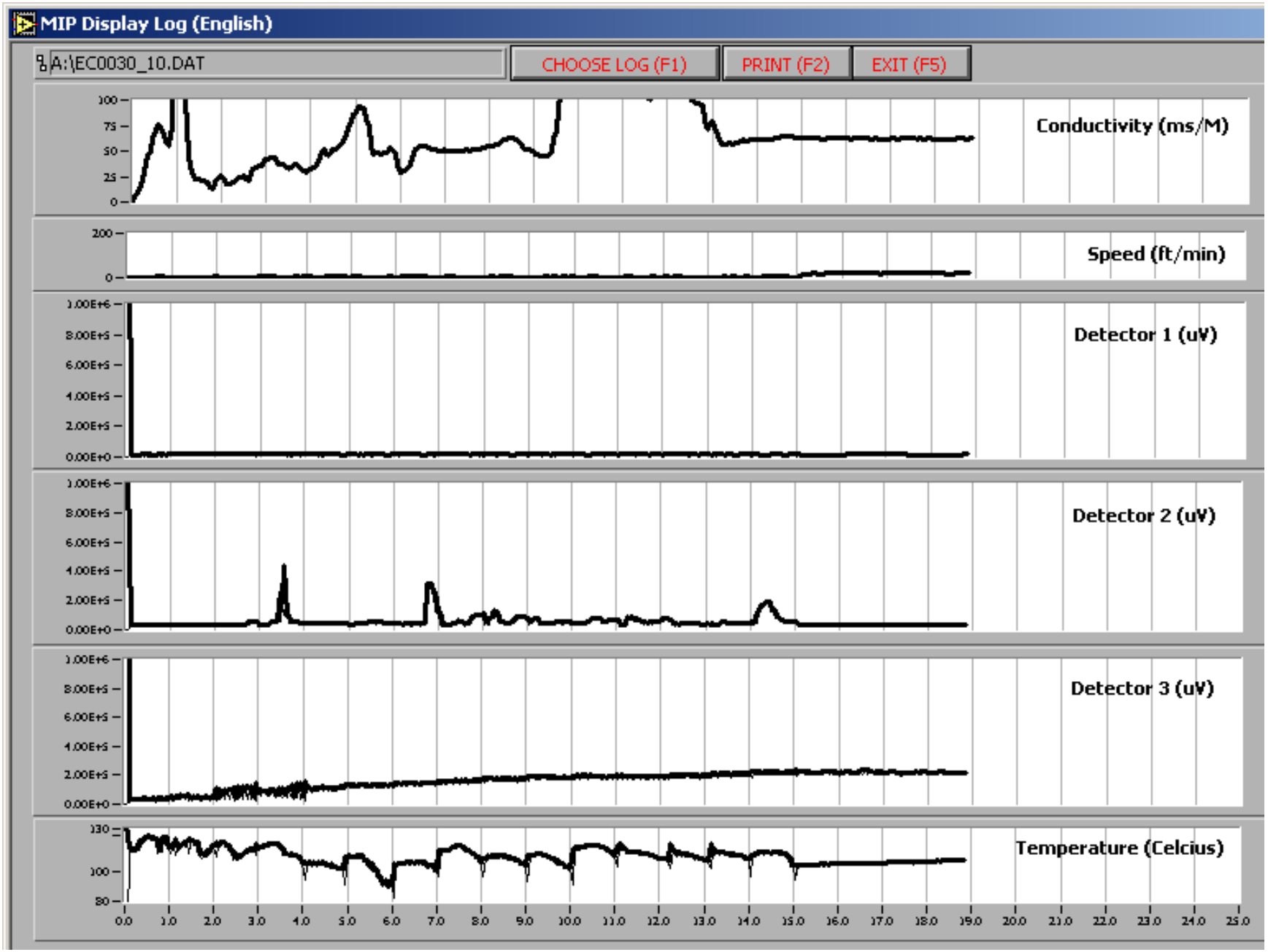
MIP8


MIP Display Log (English)
A:\EC0028_8.DAT
CHOOSE LOG (F1)
PRINT (F2)
EXIT (F5)
Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

MIP9


MIP Display Log (English)
A:\EC0029_9.DAT
CHOOSE LOG (F1)
PRINT (F2)
EXIT (F5)
Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

MIP10


MIP Display Log (English)
A:\EC0030_10.DAT
CHOOSE LOG (F1)
PRINT (F2)
EXIT (F5)
Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

MIP11

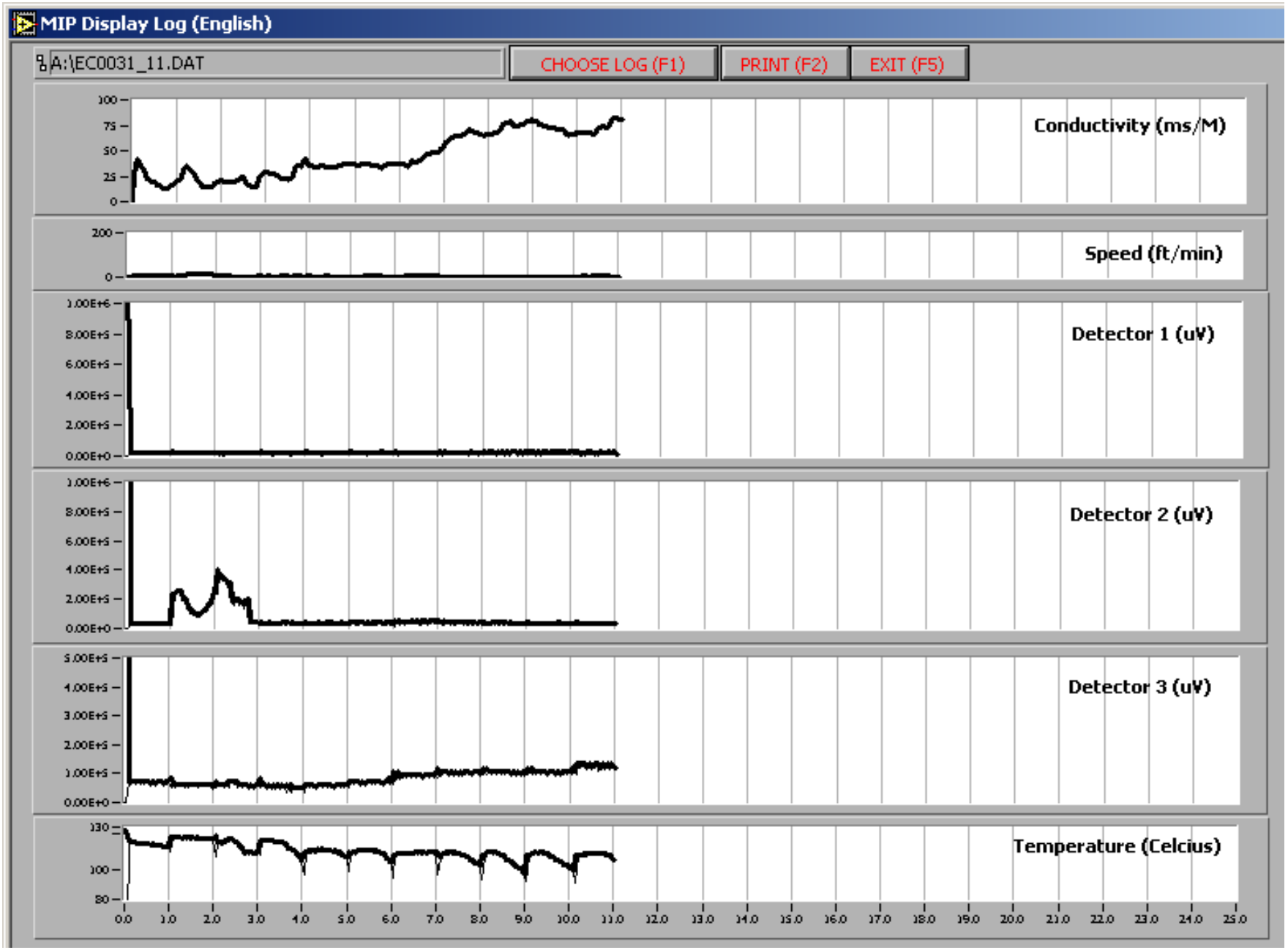

MIP Display Log (English)
A:\EC0031_11.DAT
CHOOSE LOG (F1)
PRINT (F2)
EXIT (F5)
Conductivity (ms/M)
Speed (ft/min)
Detector 1 (uV)
Detector 2 (uV)
Detector 3 (uV)
Temperature (Celcius)

Table B-1
Raw Data Direct-Push Groundwater Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17GW01	IS17GW02	IS17GW03		IS17GW04	IS17GW05	IS17GW06
Sample ID	IS17GW010602	IS17GW020602	IS17GW030602	IS17GW030602P	IS17GW040602	IS17GW050602	IS17GW060602
Sample Date	06/24/02	06/24/02	06/24/02	06/24/02	06/25/02	06/25/02	06/25/02
Chemical Name							
Volatile Organic Compounds (UG/L)							
1,1,1-Trichloroethane	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,1,2-Trichloroethane	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,1-Dichloroethane	200 U	1,000 U	2 U	1 J	2 U	2 U	20 J
1,1-Dichloroethene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,2,3-Trichlorobenzene	300 U	1,500 U	3 U	3 U	3 U	3 U	60 U
1,2,4-Trichlorobenzene	300 U	1,500 U	3 U	3 U	3 U	3 U	60 U
1,2,4-Trimethylbenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,2-Dibromoethane	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,2-Dichlorobenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,2-Dichloroethane	300 U	1,500 U	3 J	3 U	3 U	3 U	60 U
1,2-Dichloropropane	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,3,5-Trimethylbenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,3-Dichlorobenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
1,3-Dichloropropane	300 U	1,500 U	3 U	3 U	3 U	3 U	60 U
1,4-Dichlorobenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Benzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Bromodichloromethane	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Bromoform	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Bromomethane	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Carbon tetrachloride	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Chlorobenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Chloroethane	160 J	28,000 D	2 U	2 U	2 U	2 U	40 U
Chloroform	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Chloromethane	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U

NA - Not analyzed
D - Dilution result
J - Estimated
JB - Below detection limit, estimated
U - Undetected

Table B-1
Raw Data Direct-Push Groundwater Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17GW01	IS17GW02	IS17GW03		IS17GW04	IS17GW05	IS17GW06
Sample ID	IS17GW010602	IS17GW020602	IS17GW030602	IS17GW030602P	IS17GW040602	IS17GW050602	IS17GW060602
Sample Date	06/24/02	06/24/02	06/24/02	06/24/02	06/25/02	06/25/02	06/25/02
Cumene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Dibromochloromethane	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Dichlorodifluoromethane(Freon-12)	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Ethylbenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Hexachlorobutadiene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Methylene chloride	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Naphthalene	300 U	1,500 U	3 U	3 U	3 U	3 U	60 U
Styrene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Tetrachloroethene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Toluene	200 U	1,000 U	2 U	2 U	1 J	2 U	40 U
Trichloroethene	200 U	310,000 D	2 U	2 U	2 U	2 U	240
Trichlorofluoromethane(Freon-11)	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
Vinyl chloride	220	50,000 D	2 U	2 U	2 U	2 U	40 U
cis-1,2-Dichloroethene	220	75,000 D	2 U	2 U	1 J	2 U	20 J
cis-1,3-Dichloropropene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
m- and p-Xylene	400 U	2,000 U	4 U	4 U	4 U	4 U	80 U
n-Butylbenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
n-Propylbenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
o-Xylene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
p-Isopropyltoluene	200 U	1,000 U	2 U	2 U	1 J	2 U	40 U
sec-Butylbenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
tert-Butylbenzene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U
trans-1,2-Dichloroethene	200 U	500 JB	2 U	2 U	2 U	2 U	40 U
trans-1,3-Dichloropropene	200 U	1,000 U	2 U	2 U	2 U	2 U	40 U

NA - Not analyzed
D - Dilution result
J - Estimated
JB - Below detection limit, estimated
U - Undetected

Table B-1
Raw Data Direct-Push Groundwater Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17GW07	IS17GW08	IS17GW09	IS17GW10	IS17GW11		IS17GW12
Sample ID	IS17GW070602	IS17GW080602	IS17GW090602	IS17GW100602	IS17GW110602	IS17GW110602P	IS17GW120602
Sample Date	06/25/02	06/26/02	06/26/02	06/26/02	06/27/02	06/27/02	06/27/02
Chemical Name							
Volatile Organic Compounds (UG/L)							
1,1,1-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,2,4-Trichlorobenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,2,4-Trimethylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromoethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,2-Dichloropropane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3,5-Trimethylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3-Dichloropropane	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,4-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Benzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromomethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Carbon tetrachloride	2 U	2 U	2 U	2 U	2 U	2 U	2
Chlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloroform	2 U	2 U	2 U	2 U	2 U	2 U	1 J
Chloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U

NA - Not analyzed
D - Dilution result
J - Estimated
JB - Below detection limit, estimated
U - Undetected

Table B-1
Raw Data Direct-Push Groundwater Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17GW07	IS17GW08	IS17GW09	IS17GW10	IS17GW11		IS17GW12
Sample ID	IS17GW070602	IS17GW080602	IS17GW090602	IS17GW100602	IS17GW110602	IS17GW110602P	IS17GW120602
Sample Date	06/25/02	06/26/02	06/26/02	06/26/02	06/27/02	06/27/02	06/27/02
Cumene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dibromochloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dichlorodifluoromethane(Freon-12)	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Hexachlorobutadiene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methylene chloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Naphthalene	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Styrene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Toluene	2 U	2 U	2 U	8	2	2	1 J
Trichloroethene	3	2 U	2 U	2	2 U	2 U	2 U
Trichlorofluoromethane(Freon-11)	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl chloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
cis-1,3-Dichloropropene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
m- and p-Xylene	4 U	4 U	4 U	4 U	4 U	4 U	4 U
n-Butylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
n-Propylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
p-Isopropyltoluene	2 U	2 U	2 U	2 U	2 U	2 U	2
sec-Butylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
tert-Butylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2
trans-1,2-Dichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
trans-1,3-Dichloropropene	2 U	2 U	2 U	2 U	2 U	2 U	2 U

NA - Not analyzed
D - Dilution result
J - Estimated
JB - Below detection limit, estimated
U - Undetected

Table B-2
Raw Data Surface Water Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17SW04		IS17SW07		IS17SW08			
Sample ID	IS17SW040602		IS17SW070602		IS17SW080602		IS17SW080602P	
Sample Date	06/24/02		06/24/02		06/24/02		06/24/02	
Chemical Name								
Volatile Organic Compounds (µg/l)								
1,1,1-Trichloroethane	0.5	U	0.5	U	0.5	U	0.5	U
1,1,2,2-Tetrachloroethane	0.5	U	0.5	U	0.5	U	0.5	U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.5	U	0.5	U	0.5	U	0.5	U
1,1,2-Trichloroethane	0.5	U	0.5	U	0.5	U	0.5	U
1,1-Dichloroethane	0.5	U	0.5	U	0.5	U	0.5	U
1,1-Dichloroethene	0.5	U	0.5	U	0.5	U	0.5	U
1,2,3-Trichlorobenzene	0.5	U	0.5	U	0.5	U	0.5	U
1,2,4-Trichlorobenzene	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dibromo-3-chloropropane	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dibromoethane	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dichlorobenzene	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dichloroethane	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dichloropropane	0.5	U	0.5	U	0.5	U	0.5	U
1,3-Dichlorobenzene	0.5	U	0.5	U	0.5	U	0.5	U
1,4-Dichlorobenzene	0.5	U	0.5	U	0.5	U	0.5	U
2-Butanone	5	U	5	U	5	U	5	U
2-Hexanone	5	U	5	U	5	U	5	U
4-Methyl-2-pentanone	5	U	5	U	5	U	5	U
Acetone	4.2	B	4.4	B	2.6	B	3.4	B
Benzene	0.5	U	0.5	U	0.5	U	0.5	U
Bromochloromethane	0.5	U	0.5	U	0.5	U	0.5	U
Bromodichloromethane	0.5	U	0.5	U	0.5	U	0.5	U
Bromoform	0.2	B	0.17	B	0.25	B	0.18	B
Bromomethane	0.5	U	0.5	U	0.5	U	0.5	U
Carbon disulfide	0.5	U	0.5	U	0.5	U	0.5	U
Carbon tetrachloride	0.5	U	0.5	U	0.5	U	0.5	U
Chlorobenzene	0.5	U	0.5	U	0.5	U	0.5	U
Chloroethane	0.5	U	0.5	U	0.5	U	0.5	U

NA - Not analyzed
B - Blank contamination
J - Estimated
U - Undetected

Table B-2
Raw Data Surface Water Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17SW04		IS17SW07		IS17SW08			
Sample ID	IS17SW040602		IS17SW070602		IS17SW080602		IS17SW080602P	
Sample Date	06/24/02		06/24/02		06/24/02		06/24/02	
Chemical Name								
Chloroform	0.5	U	0.5	U	0.5	U	0.5	U
Chloromethane	0.5	U	0.5	U	0.5	U	0.5	U
Cumene	0.5	U	0.5	U	0.5	U	0.5	U
Cyclohexane	0.5	U	0.5	U	0.5	U	0.5	U
Dibromochloromethane	0.5	U	0.5	U	0.5	U	0.5	U
Dichlorodifluoromethane(Freon-12)	0.5	U	0.5	U	0.5	U	0.5	U
Ethylbenzene	0.5	U	0.5	U	0.5	U	0.5	U
Methyl acetate	0.5	U	0.5	U	0.5	U	0.5	U
Methyl-tert-butyl ether (MTBE)	4.1		4		4		4.1	
Methylcyclohexane	0.5	U	0.5	U	0.5	U	0.5	U
Methylene chloride	0.22	J	0.22	J	0.18	J	0.21	J
Styrene	0.5	U	0.5	U	0.5	U	0.5	U
Tetrachloroethene	0.5	U	0.5	U	0.5	U	0.5	U
Toluene	0.16	J	0.12	J	0.13	J	0.18	J
Trichloroethene	0.5	U	0.5	U	0.5	U	0.5	U
Trichlorofluoromethane(Freon-11)	0.5	U	0.5	U	0.5	U	0.5	U
Vinyl chloride	0.5	U	0.5	U	0.5	U	0.5	U
Xylene, total	0.5	U	0.5	U	0.5	U	0.5	U
cis-1,2-Dichloroethene	0.5	U	0.5	U	0.5	U	0.5	U
cis-1,3-Dichloropropene	0.5	U	0.5	U	0.5	U	0.5	U
trans-1,2-Dichloroethene	0.5	U	0.5	U	0.5	U	0.5	U
trans-1,3-Dichloropropene	0.5	U	0.5	U	0.5	U	0.5	U

NA - Not analyzed
B - Blank contamination
J - Estimated
U - Undetected

Table B-3
Raw Data Monitoring Well Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17MW01				IS17MW02		IS17MW03	
Sample ID	IS17MW01071702		IS17MW01071702P		IS17MW02071702		IS17MW03071702	
Sample Date	07/17/02		07/17/02		07/17/02		07/17/02	
Chemical Name								
Volatile Organic Compounds (μg/l)								
1,1,1-Trichloroethane	0.5	U	0.5	U	17	U	0.5	U
1,1,2,2-Tetrachloroethane	0.5	U	0.5	U	17	U	0.5	U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.5	U	0.5	U	17	U	0.5	U
1,1,2-Trichloroethane	0.5	U	0.5	U	17	U	0.5	U
1,1-Dichloroethane	0.23	U	0.22	J	6	J	0.5	U
1,1-Dichloroethene	0.5	U	0.12	J	17	U	0.5	U
1,2,3-Trichlorobenzene	0.5	U	0.5	U	NA		0.5	U
1,2,4-Trichlorobenzene	0.5	U	0.5	U	17	U	0.5	U
1,2-Dibromo-3-chloropropane	0.5	U	0.5	U	17	U	0.5	U
1,2-Dibromoethane	0.5	U	0.5	U	17	U	0.5	U
1,2-Dichlorobenzene	0.5	U	0.5	U	17	U	0.5	U
1,2-Dichloroethane	0.5	U	0.5	U	17	U	0.5	U
1,2-Dichloropropane	0.5	U	0.5	U	17	U	0.5	U
1,3-Dichlorobenzene	0.5	U	0.5	U	17	U	0.5	U
1,4-Dichlorobenzene	0.5	U	0.5	U	17	U	0.5	U
2-Butanone	5	U	5	U	17	U	5	U
2-Hexanone	10	U	10	U	17	U	5	R
4-Methyl-2-pentanone	5	U	5	U	17	U	5	U
Acetone	4.9	B	7.7	B	17	U	1.9	B
Benzene	0.5	U	0.18	J	17	U	0.5	U
Bromochloromethane	0.5	U	0.5	U	NA		0.5	U
Bromodichloromethane	0.5	U	0.5	U	17	U	0.5	U
Bromoform	0.5	U	0.14	B	17	U	0.5	U
Bromomethane	0.5	U	0.5	U	17	U	0.5	U
Carbon disulfide	0.5	U	0.5	U	17	U	0.5	U
Carbon tetrachloride	0.5	U	0.5	U	17	U	0.5	U
Chlorobenzene	0.5	U	0.5	U	17	U	0.5	U
Chloroethane	0.5	U	0.5	U	2	J	0.5	U

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Table B-3
Raw Data Monitoring Well Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17MW01		IS17MW01		IS17MW02		IS17MW03	
Sample ID	IS17MW01071702		IS17MW01071702P		IS17MW02071702		IS17MW03071702	
Sample Date	07/17/02		07/17/02		07/17/02		07/17/02	
Chemical Name								
Chloroform	0.5	U	0.5	U	17	U	0.5	U
Chloromethane	0.5	U	0.18	J	17	U	0.12	J
Cumene	0.5	U	0.5	U	17	U	0.5	U
Cyclohexane	0.5	U	0.5	U	17	U	0.5	U
Dibromochloromethane	0.5	U	0.5	U	17	U	0.5	U
Dichlorodifluoromethane(Freon-12)	0.5	U	0.5	U	17	U	0.5	U
Ethylbenzene	89		89		17	U	0.5	U
Methyl acetate	0.5	U	0.5	U	17	U	0.5	U
Methyl-tert-butyl ether (MTBE)	0.64		0.73		17	U	0.5	U
Methylcyclohexane	0.5	U	0.5	U	17	U	0.5	U
Methylene chloride	0.18	B	0.22	B	5	B	0.28	B
Styrene	0.7		0.5	U	17	U	0.5	U
Tetrachloroethene	0.5	U	0.5	U	2	B	0.5	U
Toluene	37		43		3	B	0.33	B
Trichloroethene	0.2	J	0.24	J	17	U	0.43	J
Trichlorofluoromethane(Freon-11)	0.5	U	0.5	U	17	U	0.5	U
Vinyl chloride	2.3		2	J	140		0.5	U
Xylene, total	1	J	0.22	J	17	U	0.5	U
cis-1,2-Dichloroethene	4.9		4.8		64		0.5	U
cis-1,3-Dichloropropene	0.5	U	0.12	B	17	U	0.11	B
trans-1,2-Dichloroethene	0.15	J	0.13	J	17	U	0.5	U
trans-1,3-Dichloropropene	0.5	U	0.5	U	17	U	0.5	U
Energetics								
Perchlorate	4	U	4	U	4	U	4	U
MNA Parameters (µg/l)								
Methane	1		540		120		0.3	J
Ethane	2	U	3	J	16	J	2	U
Ethene	2	U	75	U	11	J	2	U

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Table B-3
Raw Data Monitoring Well Samples
Site 17 Pre-FS Investigation
IHDIV-NSWC
Indian Head, Maryland

Station ID	IS17MW01		IS17MW01		IS17MW02		IS17MW03	
Sample ID	IS17MW01071702		IS17MW01071702P		IS17MW02071702		IS17MW03071702	
Sample Date	07/17/02		07/17/02		07/17/02		07/17/02	
Chemical Name								
MNA Parameters (mg/l)								
Carbon	22.7		28		9.13		5	U
Chloride	251		214		70.4		9.98	
Nitrate	0.05	U	0.05	U	0.05	U	0.05	U
Sulfate	5	U	5	U	16.3		37.8	

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U - Undetected

FACSIMILE TRANSMITTAL SHEET

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TRIAD ENGINEERING, INC.

Geotechnical, Civil, Construction and Environmental
Consulting Engineers, Land Surveyors and Geologists

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FACSIMILE NO: (540) 667-2260

DATE: July 16, 2002	TIME:
NUMBER OF PAGES (Including Cover): 3	

TO:	Anne Estabrook, P.E.
COMPANY:	CH2M HILL
FACSIMILE NO:	(703) 471-1508 7/19/02
FROM:	Lloyd C. Winters
REFERENCE:	

Results of gradation and permeability testing. Samples MIP #1 and #7.

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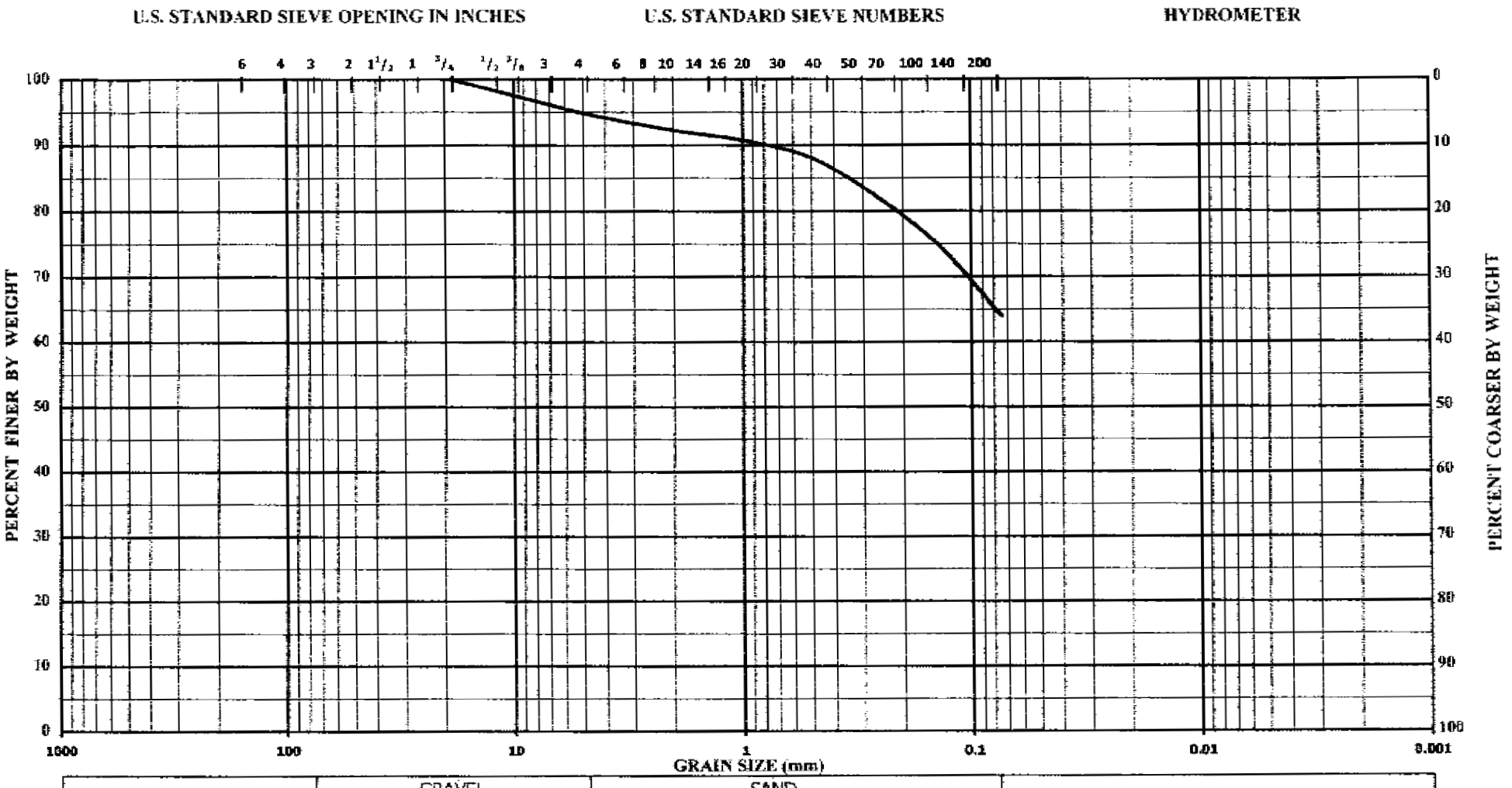

BORING OR SAMPLE NO.	ELEVATION OR DEPTH	SAMPLE DESCRIPTION	% GRAVEL	% SAND	% FINES	NATURAL % MOISTURE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	U.S.C.S. SYMBOL
MIP #1	9.0-11.0	Brown sandy SILT w/trace gravel	5	31	64	28.0	NT	NT	NT	
		K= 2.19 X10-7 (cm/sec) @ 86.0 pcf								

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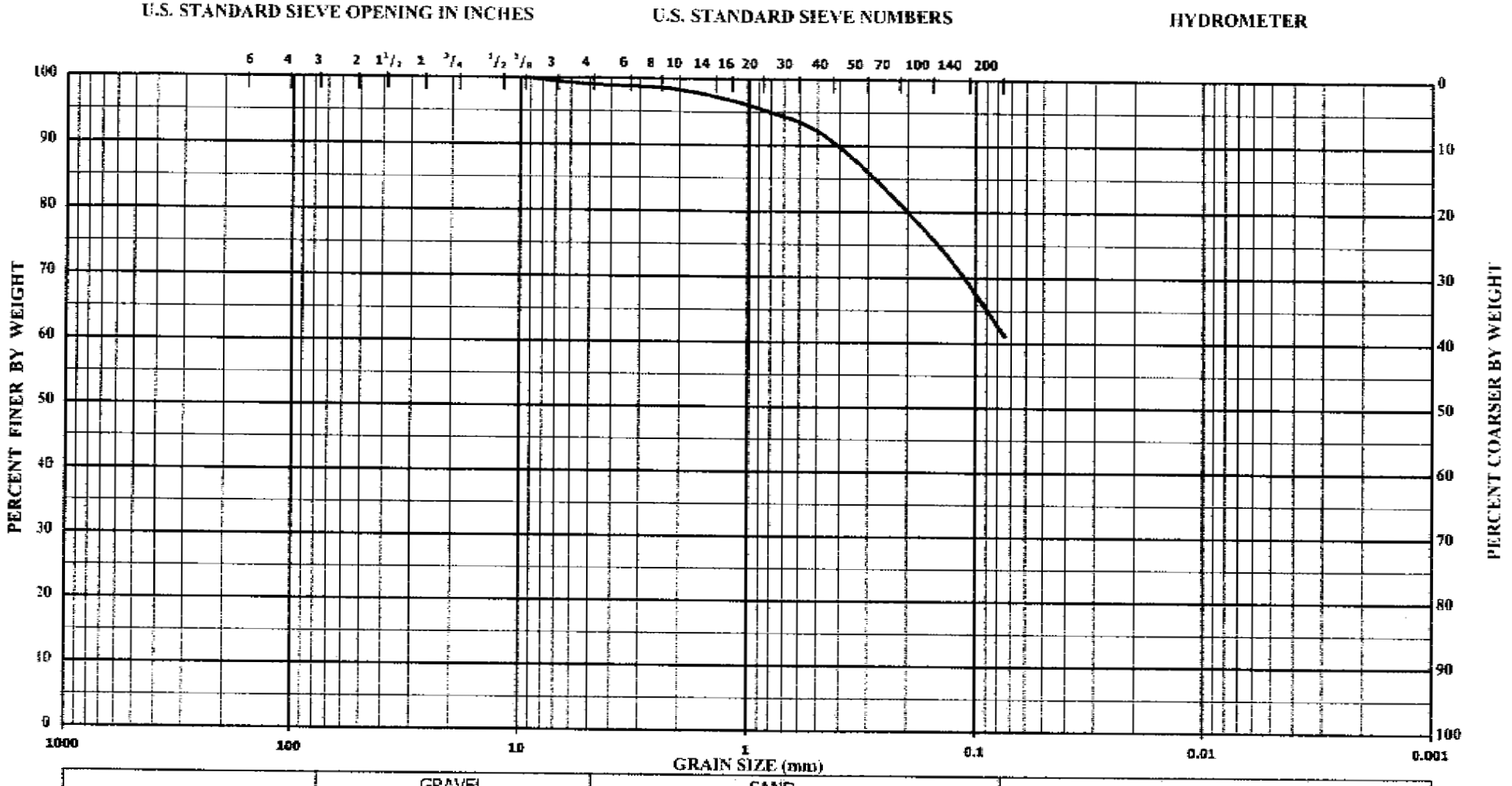
WINCHESTER, VA 22604

PROJECT NUMBER: 07-02-0156
PROJECT NAME:

GRAIN SIZE ANALYSIS TEST REPORT

PLATE C-1



BORING OR SAMPLE NO.	ELEVATION OR DEPTH	SAMPLE DESCRIPTION	% GRAVEL	% SAND	% FINES	NATURAL % MOISTURE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	U.S.C.S. SYMBOL
MIP #7	13.0-15.0	Brown sandy CLAY w/wood	1	38	61	17.1	NT	NT	NT	
		K= 2.40 X10-7 (cm/sec) @ 101.3 pcf								

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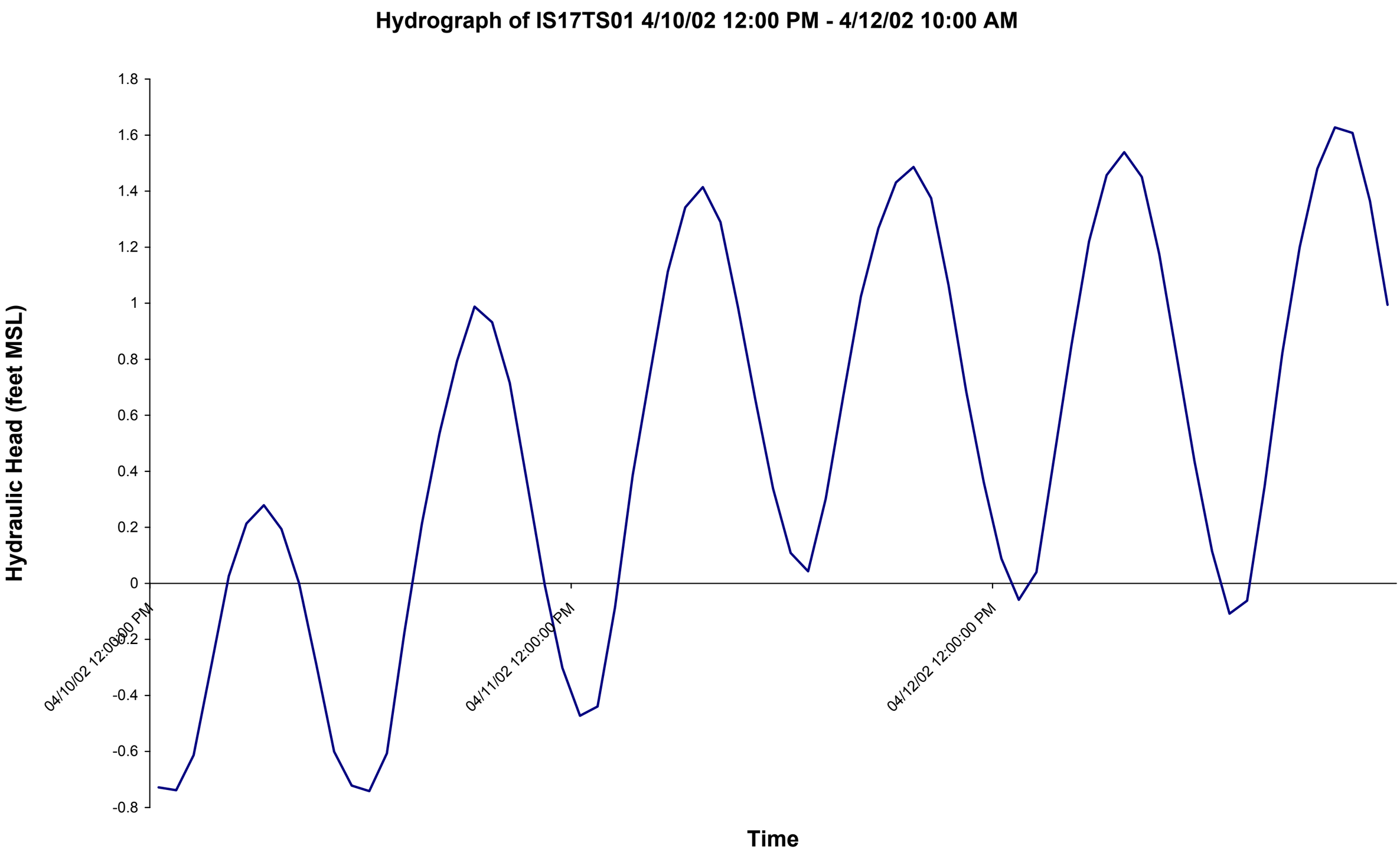
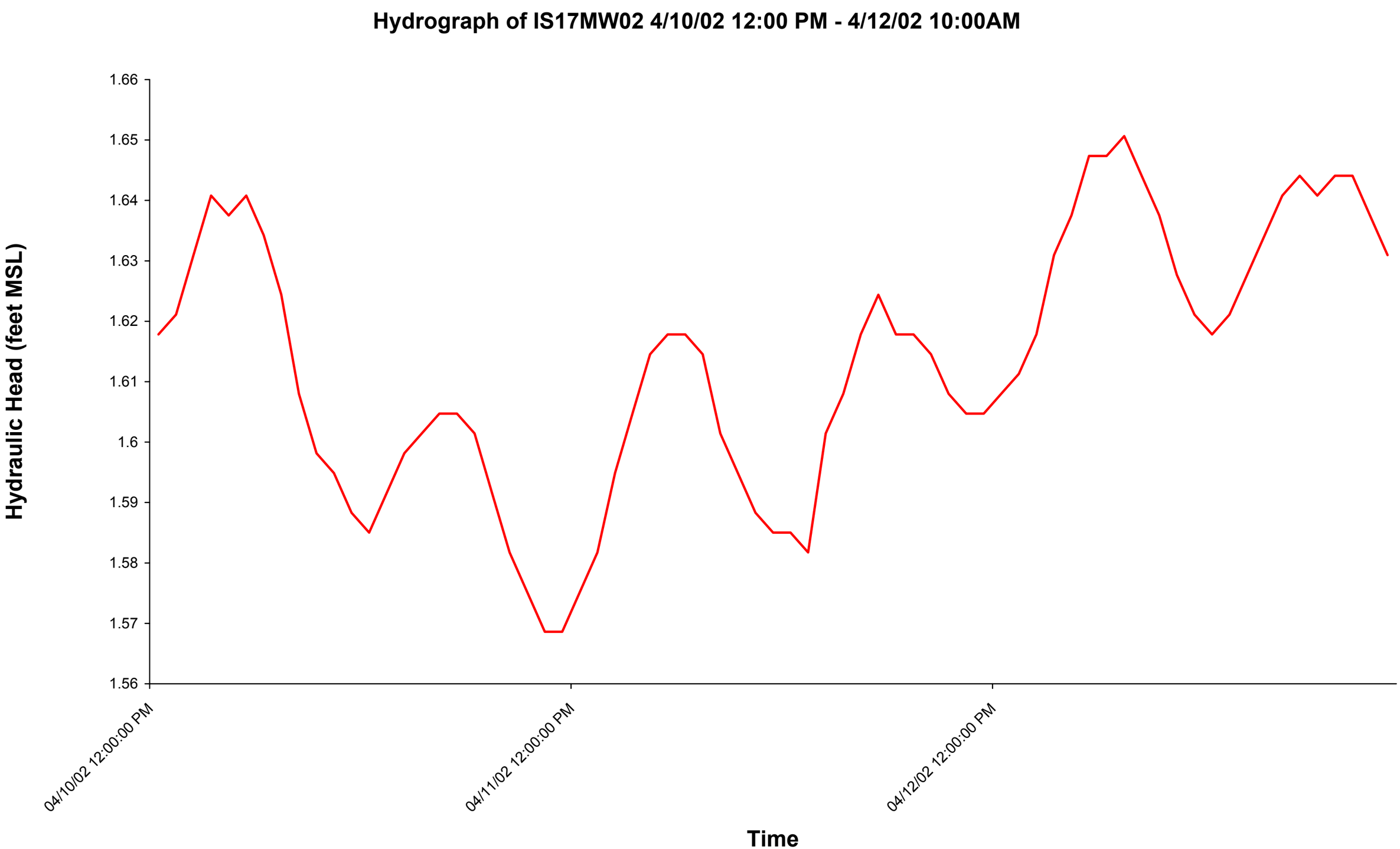
WINCHESTER, VA 22604

PROJECT NUMBER: 07-02-0156
PROJECT NAME:

GRAIN SIZE ANALYSIS TEST REPORT

PLATE C-2


Hydrograph of IS17TS01 4/10/02 12:00 PM - 4/12/02 10:00 AM
Hydraulic Head (feet MSL)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
04/10/02 12:00:00 PM
04/11/02 12:00:00 PM
04/12/02 12:00:00 PM
Time


Hydrograph of IS17MW02 4/10/02 12:00 PM - 4/12/02 10:00AM
Hydraulic Head (feet MSL)
1.66
1.65
1.64
1.63
1.62
1.61
1.6
1.59
1.58
1.57
1.56
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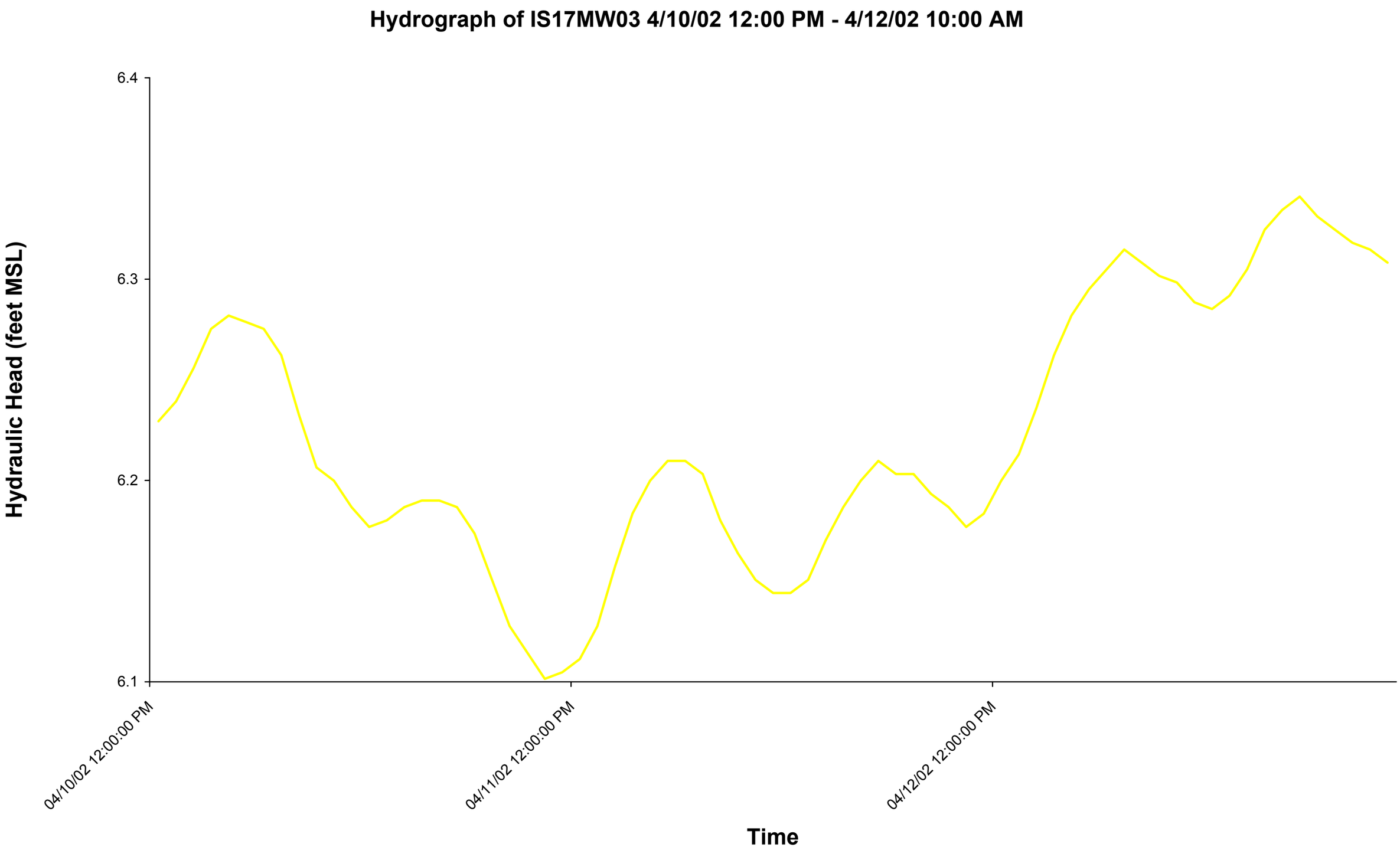
04/12/02 12:00:00 PM
Time


Hydrograph of IS17MW03 4/10/02 12:00 PM - 4/12/02 10:00 AM
Hydraulic Head (feet MSL)
6.4
6.3
6.2
6.1
04/10/02 12:00:00 PM
04/11/02 12:00:00 PM
04/12/02 12:00:00 PM
Time