

## **Appendix F: NAPL Study**

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August 20, 2004

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Subject: Lower Duwamish Waterway Superfund Site, T-117 Early Action Area – Results of Monitoring for LNAPL in Upland Shoreline Monitoring Wells.

## **Background and Purpose**

Planned groundwater observations sampling at the Terminal 117 (T117) Early Action Area (EAA) described in the original QAPP (Windward et al 2003) included monitoring for light non-aqueous phase liquids (LNAPL) using an interface probe during groundwater sampling in shoreline monitoring wells. Field deviations from the QAPP reported in the Draft Upland Sources Data Report (Windward et al 2004) noted that the interface probe was not used to check for the presence of NAPL in the monitoring wells immediately prior to sampling. The samplers believed it prudent not to introduce the interface probe into the wells immediately prior to sampling for chemical analysis, to minimize disturbance of the water column and increase the potential for cross-contamination.

The purpose of this supplemental field investigation was to address concerns regarding the potential presence of LNAPL at the site in the shoreline wells in light of the exception to the originally-planned field activities. This report describes the results of that effort.

## **Procedures**

Shoreline monitoring wells MW-2, MW-4, MW-5 and MW-6 at T117 were monitored for the presence of LNAPL in conjunction with water level measurements for a defined period during a negative tide event in the adjacent Duwamish River on August 15, 2004. These are the same four wells included in the original monitoring program as described in the QAPP (Windward et al

2003) and are defined as “sentry wells;” positioned along the T-117 shoreline in order to check for contaminants at the point where upland groundwater is flowing to the river shoreline area. Data obtained during the tidal study (Windward 2004) and subsequent analysis of lag response times in each of the shoreline served as a basis for identifying general monitoring timeframes. A negative 0.9 (-0.9) tide was predicted for the Duwamish River on Sunday, August 15 at 11:36 AM. Table 1 shows the predicted water level responses in the study wells used during this event as a guide for scheduling the monitoring.

Table 1. Estimated slack-water times in study monitoring wells

	Duwamish – West Waterway	MW-02	MW-04	MW-05	MW-06
Observed lag time of tidal influence in T117 monitoring wells (minutes)	0	95	184	119	30
Estimated slack water time (August 15, 2004)*	11:36	13:06	14:40	13:35	12:06

\* based on predicted low tide event at 11:36 in the Duwamish River.

Monitoring using an MMC Interface Probe was initiated 1 hour prior to the predicted low tide in the Duwamish Waterway. Checks for LNAPL and water level measurements were then made in each well on a rotating basis. The monitoring cycle was then repeated every 30 minutes and concluded at 15:40, one hour after the predicted occurrence of slack water in MW-4. Additional observations were also made as close as possible to the predicted slack water time for each well. Specific field procedures are described in the Proposed Procedures Memo (Onsite 2004).

**Results**

Monitoring for LNAPL and water level observations in the four shoreline wells at T117 were successfully completed without exception to the procedures in the proposed plan.

No LNAPL was observed in any of the wells during the monitoring event (see field forms, Attachment 1). Water levels in the wells fluctuated as expected, and the monitoring timeframe successfully captured the slack water response in each well to the low tide event in the Duwamish River (see graphs, Attachment 2).

A copy of the field log book pages is included in Attachment 3.

**References**

Onsite. 2004. Memo to Project Team: Lower Duwamish Waterway Superfund Site, T-117 Early Action Area - Proposed procedures to conduct LNAPL observations in upland shoreline monitoring wells originally included in the project QAPP (Windward 2003).

Windward, DOF, Onsite. 2003. Lower Duwamish Waterway Superfund site, Terminal 117 early action area. Quality assurance project plan. Prepared for the Port of Seattle. Windward Environmental LLC, Dalton, Olmstead & Fuglevand, Inc., and Onsite Enterprises, Inc., Seattle, WA.

Windward, DOF, Onsite. 2004. Lower Duwamish Waterway Superfund site, Terminal 117 early action area. T117 Upland Sources Data Report - Draft. Prepared for the Port of Seattle. Windward Environmental LLC, Dalton, Olmstead & Fuglevand, Inc., and Onsite Enterprises, Inc., Seattle, WA.



**FIELD DATA FORM  
T-117 LNAPL MONITORING**

Date	Time	Monitoring Well	LNAPL Thickness*	Depth to Water
8-15-04	10:36	MW-4	none	10.95
8-15-04	10:40	MW-5	none	11.11
8-15-04	10:45	MW-6	none	12.94
8-15-04	10:49	MW-2	none	10.58
8-15-04	11:06	MW-4	none	11.29
8-15-04	11:09	MW-5	none	11.42
8-15-04	11:13	MW-6	none	13.27
8-15-04	11:16	MW-2	none	11.03
8-15-04	11:36	MW-4	none	11.60
8-15-04	11:39	MW-5	none	11.70
8-15-04	11:42	MW-6	none	13.48
8-15-04	11:46	MW-2	none	11.44
8-15-04	12:06	MW-6	none	13.52
8-15-04	12:09	MW-4	none	11.89
8-15-04	12:12	MW-5	none	11.98
8-15-04	12:15	MW-6	none	13.50
8-15-04	12:18	MW-2	none	11.78
8-15-04	12:36	MW-4	none	12.10
8-15-04	12:39	MW-5	none	12.14

\* if none present, indicate "none."

**FIELD DATA FORM  
T-117 LNAPL MONITORING**

Date	Time	Monitoring Well	LNAPL Thickness*	Depth to Water
8-15-04	12:43	MW-6	none	13.38
8-15-04	12:46	MW-2	none	11.93
8-15-04	13:06	MW-2	none	11.97
8-15-04	13:09	MW-4	none	12.29
8-15-04	13:12	MW-5	none	12.25
8-15-04	13:15	MW-6	none	13.14
8-15-04	13:18	MW-2	none	11.96
8-15-04	13:35	MW-5	none	12.29
8-15-04	13:38	MW-4	none	12.42
8-15-04	13:41	MW-5	none	12.30
8-15-04	13:44	MW-6	none	12.85
8-15-04	13:47	MW-2	none	11.85
8-15-04	14:06	MW-4	none	12.48
8-15-04	14:09	MW-5	none	12.27
8-15-04	14:12	MW-6	none	12.46
8-15-04	14:15	MW-2	none	11.66
8-15-04	14:36	MW-4	none	12.49
8-15-04	14:40	MW-4	none	12.48
8-15-04	14:43	MW-5	none	12.16

\* if none present, indicate "none."

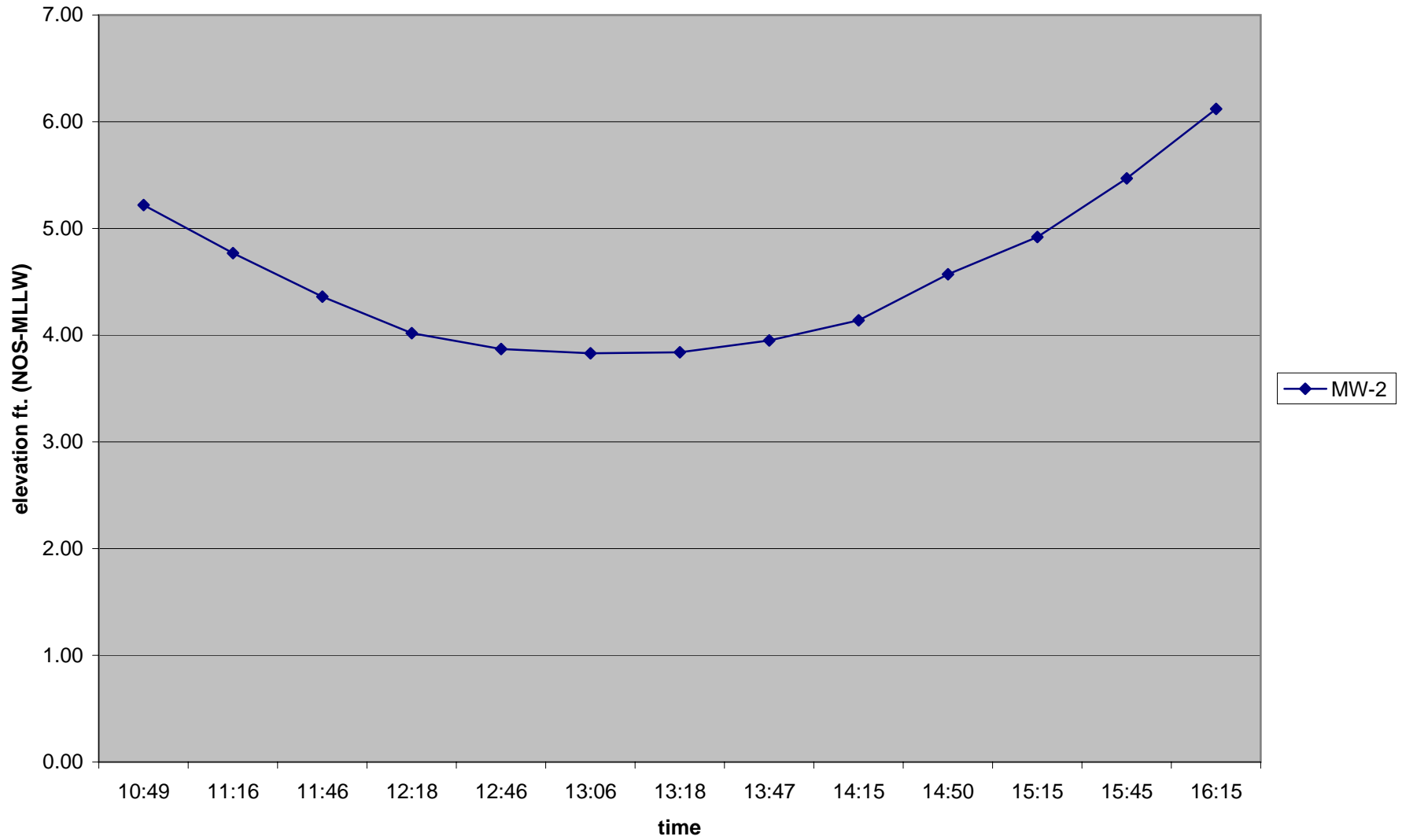
FIELD DATA FORM  
T-117 LNAPL MONITORING

Date	Time	Monitoring Well	LNAPL Thickness*	Depth to Water
8-15-04	14:47	MW-6	none	11.74
8-15-04	14:50	MW-2	none	10.23
8-15-04	15:06	MW-4	none	12.42
8-15-04	15:09	MW-5	none	12.02
8-15-04	15:12	MW-6	none	11.12
8-15-04	15:15	MW-2	none	10.88
8-15-04	15:36	MW-4	none	12.29
8-15-04	15:39	MW-5	none	11.77
8-15-04	15:42	MW-6	none	10.27
8-15-04	15:45	MW-2	none	10.33
8-15-04	16:06	MW-4	none	12.13
8-15-04	16:09	MW-5	none	11.45
8-15-04	16:12	MW-6	none	9.48
8-15-04	16:15	MW-2	none	9.68

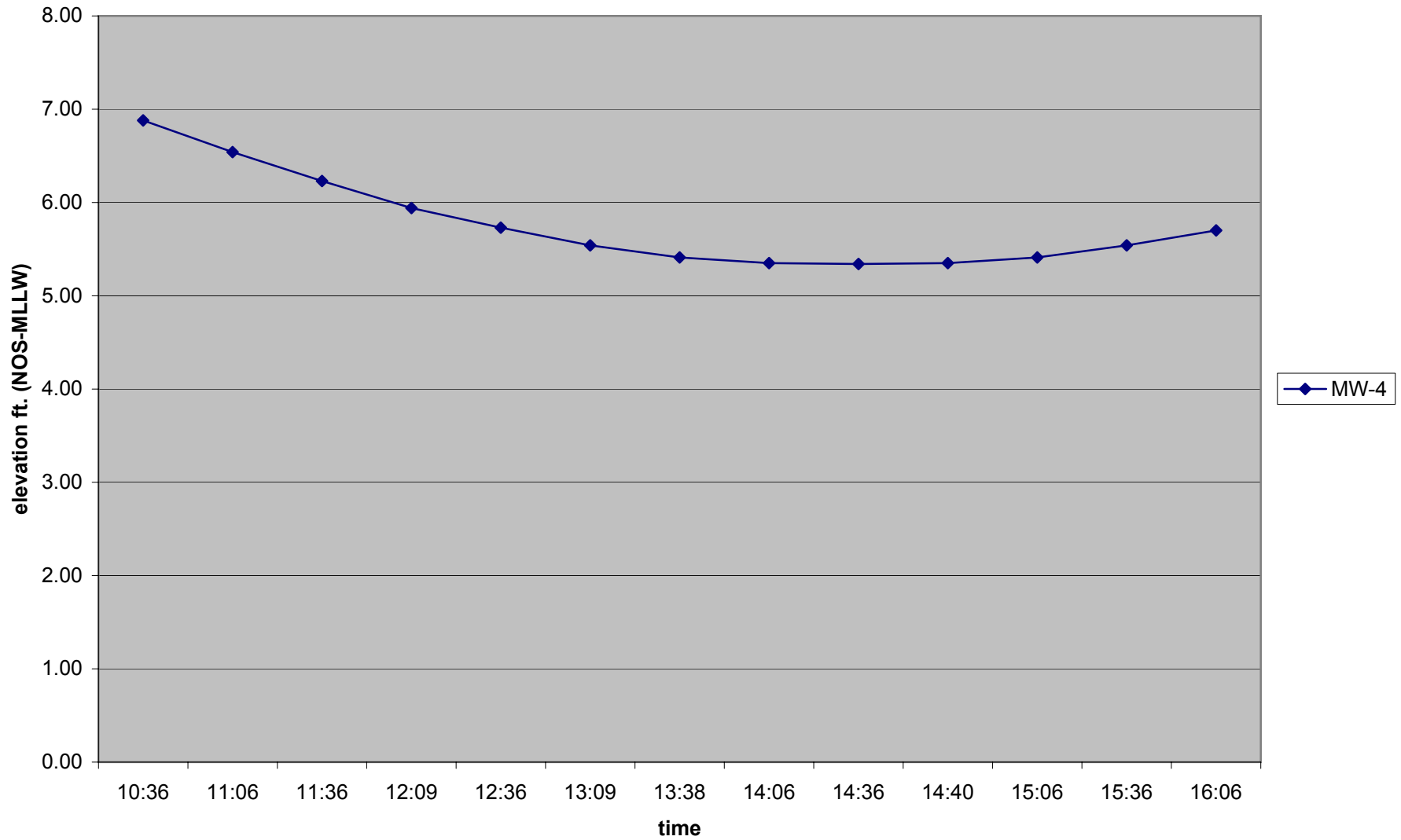
\* if none present, indicate "none."



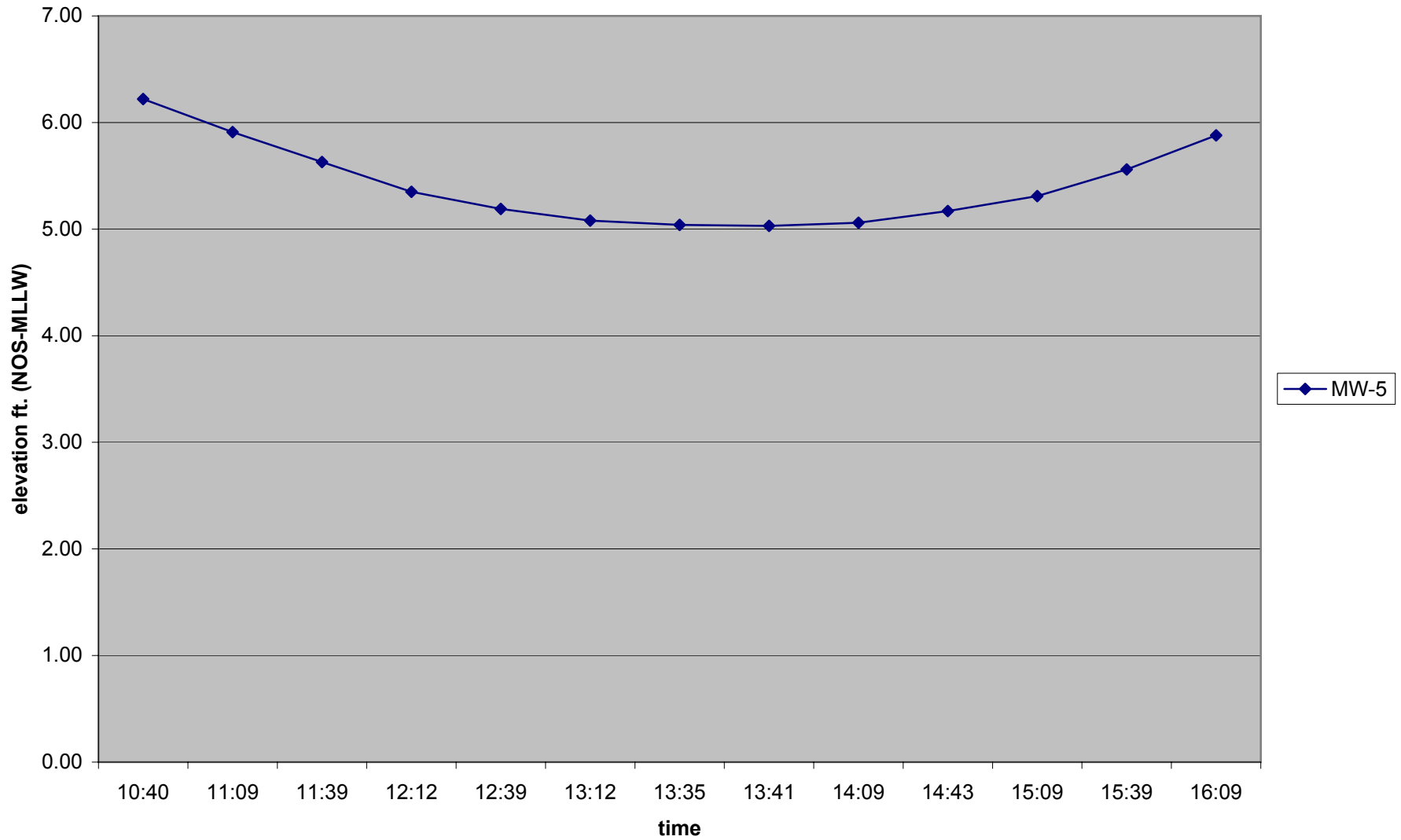
MW-02 Water Levels 8-15-04



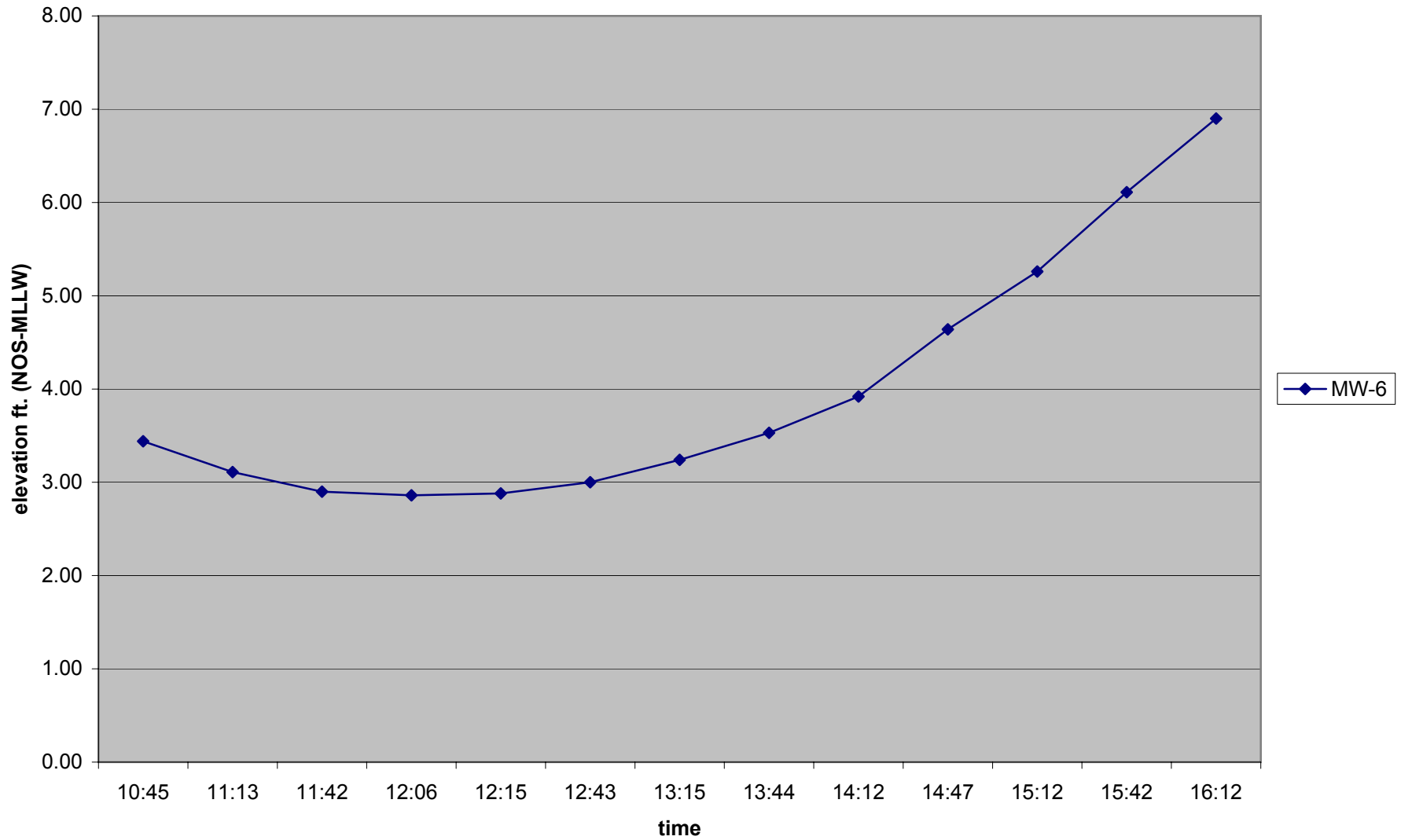
MW-4 Water Levels 8-15-04



MW-5 Water Levels 8-15-04



MW-6 Water Levels 8-15-04



<b>MW-2</b>			
Date	Time	Depth to Water (Ft below Top of Casing)	Water Elevation
8/15/2004	10:49	10.58	5.22
8/15/2004	11:16	11.03	4.77
8/15/2004	11:46	11.44	4.36
8/15/2004	12:18	11.78	4.02
8/15/2004	12:46	11.93	3.87
8/15/2004	13:06	11.97	3.83
8/15/2004	13:18	11.96	3.84
8/15/2004	13:47	11.85	3.95
8/15/2004	14:15	11.66	4.14
8/15/2004	14:50	11.23	4.57
8/15/2004	15:15	10.88	4.92
8/15/2004	15:45	10.33	5.47
8/15/2004	16:15	9.68	6.12

Top of Casing Elevation: 15.80

<b>MW-4</b>			
Date	Time	Depth to Water (Ft below Top of Casing)	Water Elevation
8/15/2004	10:36	10.95	6.88
8/15/2004	11:06	11.29	6.54
8/15/2004	11:36	11.60	6.23
8/15/2004	12:09	11.89	5.94
8/15/2004	12:36	12.10	5.73
8/15/2004	13:09	12.29	5.54
8/15/2004	13:38	12.42	5.41
8/15/2004	14:06	12.48	5.35
8/15/2004	14:36	12.49	5.34
8/15/2004	14:40	12.48	5.35
8/15/2004	15:06	12.42	5.41
8/15/2004	15:36	12.29	5.54
8/15/2004	16:06	12.13	5.70

Top of Casing Elevation: 17.83

<b>MW-5</b>			
Date	Time	Depth to Water (Ft below Top of Casing)	Water Elevation
8/15/2004	10:40	11.11	6.22
8/15/2004	11:09	11.42	5.91
8/15/2004	11:39	11.70	5.63
8/15/2004	12:12	11.98	5.35
8/15/2004	12:39	12.14	5.19
8/15/2004	13:12	12.25	5.08
8/15/2004	13:35	12.29	5.04
8/15/2004	13:41	12.30	5.03
8/15/2004	14:09	12.27	5.06
8/15/2004	14:43	12.16	5.17
8/15/2004	15:09	12.02	5.31
8/15/2004	15:39	11.77	5.56
8/15/2004	16:09	11.45	5.88

Top of Casing Elevation: 17.33

<b>MW-6</b>		Depth to Water	Water
Date	Time	(Ft below Top of Casing)	Elevation
8/15/2004	10:45	12.94	3.44
8/15/2004	11:13	13.27	3.11
8/15/2004	11:42	13.48	2.90
8/15/2004	12:06	13.52	2.86
8/15/2004	12:15	13.50	2.88
8/15/2004	12:43	13.38	3.00
8/15/2004	13:15	13.14	3.24
8/15/2004	13:44	12.85	3.53
8/15/2004	14:12	12.46	3.92
8/15/2004	14:47	11.74	4.64
8/15/2004	15:12	11.12	5.26
8/15/2004	15:42	10.27	6.11
8/15/2004	16:12	9.48	6.90

Top of Casing Elevation: 16.38