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Memorandum

To: Brian Renaghan, CIV AFCEE/EXA Mike Dobbs, DES-DDC-EE

- From: Kevin Sedlak Tom Holmes
- Date: 6 February 2008

Re: Monitoring Well Replacement Dunn Field Property Transfer Defense Depot Memphis, Tennessee FA8903-04-D-8722, TO 0031

engineering-environmental Management, Inc (e²M) has prepared this report to document replacement of monitoring wells in support of the public sale of the eastern section of Dunn Field at Defense Depot Memphis, Tennessee (DDMT). This work was performed for the Defense Logistics Agency (DLA) under Contract FA8903-04-D-8722, Task Order 0031 to the Air Force Center for Engineering and the Environment.

The eastern section of Dunn Field, containing approximately 41.2 acres, was identified in the Dunn Field Record of Decision as available for unrestricted reuse. The area was included in Finding of Suitability to Transfer (FOST) 4, which was signed by the Department of the Army (DA) on 4 March 2005. DA transferred 1.57 acres to the City of Memphis for the Hayes Road expansion project. The remainder of the FOST 4 property was offered for public sale following the City of Memphis decision to decline the property. In order to facilitate transfer of the property, DLA decided to abandon the monitoring wells on the property and to install replacement wells on public right-of-way or remaining DA property, where necessary for continued groundwater monitoring.

There were four existing monitoring wells on the property to be transferred: MW-36 and MW-84 in the southeast corner, MW-49 along the eastern fence line and MW-09 in the northwest corner. The locations are shown on Figure 1. MW-36 was a deep well screened in the intermediate aquifer, while the other wells were screened in the fluvial aquifer. MW-09 and MW-36 were included in water level sweeps for the IRA monitoring program although samples were not collected. MW-36 and MW-84 were included in the Main Installation (MI) Long-term monitoring (LTM) program; MW-36 was a sentinel well and MW-84 was a background well. Both were sampled annually.

The BRAC Cleanup Team (BCT) agreed at their June 2007 meeting that MW-49 and MW-84 could be abandoned without replacement. However, prior to abandoning MW-49 a groundwater sample was to be collected with analysis for volatile organic compounds (VOCs). The BCT agreed that MW-09 and MW-36 would be abandoned with

replacement wells installed at the locations selected during the June meeting. MW-36 was to be replaced because of its usefulness as a sentinel well in the MI LTM program and MW-9 was needed for hydraulic control for the off-depot plume.

A groundwater sample was collected from MW-49 on 9 July 2007. No analytes were detected above reporting limits (RLs). The analytical results are included with those from the new wells on Table 4. Tetrachloroethene was detected below the RL, as it was in the most recent previous sample collected in 1998. The analytical results for MW-49 were provided to the BCT by email on 27 July and abandonment of MW-49 was approved.

The field activities described in this report consist of abandonment of four wells (MW-09, MW-36, MW-49 and MW-84), installation and development of two replacement wells (MW-230 for MW-09 and MW-229 for MW-36) and groundwater sampling of the replacement wells. The well locations are shown on Figure 1. The field activities, including the previous sampling of MW-49, were performed in accordance with the *Remedial Action Sampling and Analysis Plan* (RA SAP) (MACTEC, 2005).

FIELD ACTIVITIES

Well Abandonment

Four monitoring wells (MW-09, MW-36, MW-49 and MW-84) were abandoned on 2 August 2007 in accordance with the Memphis Shelby County Health Department regulations. Well abandonment was performed by Prosonic and observed by an e²M geologist. The total depth of each well was measured to confirm that no obstructions were present.

Well	Total Depth (ft)
MW-09	82
MW-36	209
MW-49	90
MW-84	89

One-half gallon of bleach was poured into each well and then the wells were filled with cement/bentonite grout from the bottom up until undiluted grout was visible at the surface. The grout was tremied into the casing, keeping the side-discharge tremie pipe approximately 1 foot below the grout surface. The water displaced by the grout was contained and transported to the fractionation tank located near the decontamination pad and stored with other investigation-derived wastewater for testing and disposal. After allowing at least two days for grout settlement, the grout was topped off with concrete. Surface completions were removed, and the area was brought to grade with soil and seeded to match the surrounding area.

Well Installation and Development

Monitoring wells MW-229 and MW-230 were installed 30 July through 1 August 2007 at the locations shown on Figure 1. Well installation data are provided on Table 1.

The wells were installed in borings drilled by Prosonic using rotasonic drilling methods with a 6-inch outer core and a 4-inch inner core barrels. Continuous soil cores were collected from ground surface to the termination depth of each boring. An e²M field geologist was present during drilling to record field observations and to log the soil core.

At MW-230, the boring was drilled 10 feet into the uppermost clay of the Jackson Formation/Upper Claiborne Group. The boring was back-filled with bentonite to near the top of the clay/base of the fluvial aquifer prior to well installation. MW-229 was drilled into the intermediate aquifer at a total depth of 210 feet bas. Soil boring logs are provided in Appendix A.

Monitoring wells were constructed of new, 2-inch inside diameter PVC with internal flush joined threaded joints and factory-slotted 0.010-inch well screen; a screen length of 15 feet was installed in MW-230 and 20 feet in MW-229. Centralizers were attached to the well casing 1 foot from the bottom of the well and 1 foot above the top of the screen. A filter pack of clean 10/20 gradation filter sand was placed around the screen in both wells from the bottom of the well to at least 5 feet above the top of the well screen. A bentonite seal at least 5 feet thick was placed above the sand and the annular space was filled with a cement-bentonite grout (approximately 94 pounds Portland type II cement, 4 pounds of bentonite and 8 gallons of water with a density measured between 12 to 15 pounds per gallon). The grout was placed to approximately 6 inches below the ground surface. Both wells had flush mount 3-foot by 3-foot by 0.5-foot thick concrete pads with an 8-inch manhole. Well construction was performed by Prosonic under the supervision of an e²M field geologist. Well completion diagrams are provided in Appendix B.

The new wells were surveyed were surveyed by Allen & Hoshall, Inc. of Memphis, Tennessee, a Tennessee Registered Land Surveyor. Horizontal and vertical coordinates are based on the North American Datum, 1927 used for all survey data at DDMT. Horizontal coordinates were provided in the Tennessee State Plane coordinate system.

Both wells were developed using a Grundfos Redi-Flo2 submersible pump, Field measurements were made to evaluate well development in accordance with the RA SAP criteria: stabilized turbidity less than 10 NTU, pH within 0.1 standard units, and temperature and specific conductance within 10 percent within three consecutive readings. Development criteria were met in MW-230 but not in MW-229. Development of MW-229 began with a Grundfos pump but was halted due to silt clogging the pump; the screened interval in MW-229 includes very fine-grained sand with clay. The well was bailed by hand to remove the silt; development with a Grundfos pump and with an air-lift pump was attempted but neither method was successful. The hand bailing was resumed and development was halted after several days and purging of 4.7 well volumes. dedicated bladder pump was installed in MW-229 for sampling during MI LTM events. A well development summary, including volume purged and final stabilization parameters, is shown on Table 2.

Groundwater Sampling

e²M collected groundwater samples from MW-229 on 5 October and from MW-230 on 18 October 2007 with stainless steel pumps using low-flow purging methods. A portable pump with new Teflon® bladders and Teflon®-lined polyethylene tubing was used at MW-230. The same procedure was used at MW-49 prior to abandonment. After sampling the bladder and tubing was labeled, sealed in a plastic bag and stored for future use. MW-229 was sampled using a dedicated bladder pump. The pumping rate at each well was set such that the water levels would not decline more than 1.2 inches (0.1 foot).

Water quality parameters were measured at approximately 5 to 10 minute intervals during purging using a flow-through cell with a Horiba U-22XD. The units were

calibrated each morning prior to sampling, and if abnormal readings were observed during the day, the instruments were recalibrated in the field. All measurements were recorded on the field sampling forms.

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Purging continued at each well for up to two hours in order to meet the stabilization criteria: three successive readings within 0.1 for pH, 10 milliVolts for oxygen reduction potential (ORP), 3 percent for specific conductance, 10 percent for dissolved oxygen (DO) and <20 nephelometric turbidity units (NTU) for turbidity. Temperature was also measured and recorded but was not used as a stabilization parameter. Stabilization criteria were met in all wells. The final stabilization measurements, including those from the sample at MW-49, are shown on Table 3.

Samples were sent to Kemron Laboratories in Marietta, OH, for laboratory analysis. The samples were analyzed for volatile organic compounds (VOCs) by method 8260B.

IDW Management

The purge water and wastewater generated during sampling were transported to a 500gallon tank on the Main Installation. The water was analyzed and discharged to the sewer with purge water from other sampling events following approval from the City of Memphis.

The soil cuttings were stored in a roll-off container on Dunn Field with soil cuttings from installation of other wells at Dunn Field. The soil was disposed as special waste at the BFI Landfill on 31 July 2007.

SUMMARY OF FINDINGS

Analytical Results

The complete analytical results for the samples from MW-49, MW-229, and MW-230 are presented in Table 4.

Several chlorinated VOCs were detected in MW-230. The analytes with the highest concentrations were: Tetrachloroethene at 87.2 micrograms per liter (μ g/L); Trichloroethene at 83.3 μ g/L; and 1,1-Dichloroethene at 27.1 μ g/L. These results are consistent with concentrations in the off depot plume.

Only one VOC was detected above RLs in MW-229, toluene at 2.37 μ g/L. Toluene was not detected in the previous two samples from MW-36 in May 2004 and October 2006. In accordance with the MI LTM plan, MW-229 will be sampled semi-annually until four samples have been collected and the sample frequency is re-evaluated.

TABLES

- 1 Well Installation Summary
- 2 Well Development Summary
- 3 Well Stabilization Summary
- 4 Analytical Results, MW-49, MW-229, and MW-230

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TABLE 1 WELL INSTALLATION SUMMARY MONITORING WELL REPLACMENT - PROPERTY TRANSFER Dunn Field - Defense Depot Memphis, Tennessee

		Total Well	Depth	(ft. toc)	208.7	74.5
			Screen	Length	20	15
	Depth to	Top of	Screen	(ft. toc)	188.4	59.3
undwater			Date	Measured	9/27/2007	8/2/2007
Gro			Depth	(ft. toc)	160.83	57.46
	Total	Boring	Depth	(ft. bgs)	210.0	90.0
		Ground	Elevation	(ft. msl)	311.99	286.92
	Top of	Casing	Elevation	(ft msl)	311.77	286.57
				Easting	802836.28	802800.22
				Northing	279293.98	281842.54
			Date	Completed	8/1/2007	7/30/2007
				Well ID	MW-229	MW-230

TABLE 2 WELL DEVELOPMENT SUMMARY MONITORING WELL REPLACEMENT - PROPERTY TRANSFER Dunn Field Defense Depot Memphis, Tennessee

	Total Depth ft, btoc	208.3	74.5
ters	Temperature C	25.9	19.6
ion Parame	Turbidity NTUs	925	4.7
Final Stabilizat Specific	Conductivity mS/M	0.354	0.346
	Hđ	6.6	5.6
Volume	Purged gallons	43.0	602.7
	Finish Time	16:36	16:29
Start	Time	8:50	11:24
	Date Developed	8/3/07-8/8/07	8/2/2007
	Weil ID	MW-229	MW-230

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TABLE 3 WELL STABILIZATION SUMMARY MONITORING WELL REPLACEMENT - PROPERTY TRANSFER Dunn Field Defense Depot Memphis, Tennessee

Turbidity NTUs	11.4 18.6 19.0
MC ORP	138 -116 271
DO DO	7.3 1.9 7.6
Specific Conductivity mS/cm	0.201 0.999 0.282
Temp C	19.3 20.2 18.8
Ha	5.6 6.8 5.9
Volume Purged Liters	11.6 20.0 25.0
Purge Rate m⊥/min	260 180 280
Water Depth ft, btoc	79.65 160.65 57.5
Sample Pump Depth ft, btoc	87.0 200.0 66.5
Time	10:35 9:23 14:10
Method	low flow Iow flow Iow flow
Sample Date	7/9/2007 10/5/2007 10/18/2007
Well ID	MW-49 MW-229 MW-230

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TABLE 4 ANALYTICAL RESULTS MONITORING WELL REPLACEMENT - PROPERTY TRANSFER Dunn Field - Defense Depot Memphis, Tennessee

	WELL ID	MW-229	MW-230	MW-49	MW-49 DUP
	LABID	L0710208-01	L0710695-01	L0707151-01	L0707157-017
	DATE SAMPLED	10/5/2007	10/18/2007	7/9/2007	7/9/2007
1 1 2-Tetrachloroethage	units	<0.5	<0 F	-0 F	-0.5
1.1.1-Trichloroethane	ug/L	<1	1 82	<0.5	<0.5
1,1,2,2-Tetrachloroethane	ua/L	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	ug/L	<1	<1	<1	<1
1,1-Dichloroethane	ug/L	<1	1.77	<1	<1
1,1-Dichloroethene	ug/L	<1	27.1	<1	<1
1,1-Dichloropropene	ug/L	<1	<1	<1	<1
1,2,3-Trichlorobenzene	ug/L	<1	<1	<1	<1
1,2,3-Inchioropropane	ug/L	<1	<1	<1	<1
1,2,4-Tranki ki ka katali	ug/L	<1	<1	<1	<1
1 2-Dibromo-3-chloroprocene	ug/L	<1	4	~1	<1
1.2-Dibromoethane	ug/L	<1	~2	~2	<2
1,2-Dichlorobenzene	ug/L	<1	<1	<1	<1
1,2-Dichloroethane	ug/L	<0.5	0.603	<0.5	<0.5
1,2-Dichloropropane	ug/L	<1	<1	<1	<1
1,3,5-Trimethylbenzene	ug/L	<1	<1	<1	<1
1,3-Dichlorobenzene	ug/L	<1	<1	<1	<1
1,3-Dichloropropane	ug/L	<0.4	<0.4	<0,4	<0.4
1,4-Dichlorobenzene	ug/L	0.162 F	<0.5	<0.5	<0.5
2 2-Dichlomoronane	ug/L	<1	<1	<1	<1
2-Chlorotoluene	ugrt.	<1	<1	<1	<1
2-Hexanone	ացու	<10	<10	<1	<1
4-Chlorotoluene	ug/L	<1	<1	_ <1	<1
Acetone	ug/L	3.26 F	<10	<10	<10
Benzene	ug/L	<0.4	<0.4	<0.4	<0.4
Bromobenzene	ug/L	<1	<1	<1	<1
Bromochloromethane	ug/L	<1	<1	<1	<1
Bromodichloromethane	ug/L	<0.5	<0.5	<0.5	<0.5
Bromomethane	ug/L	<1	<1	<1	<1
Carbon disulfide	ugyL	<1 0.575 E	<1	3	3
Carbon tetrachtoride	ug/t	0.575 F	<1	-	-
Chlorobenzene	ug/L	<0.5	⊲05	<0.5	<0.5
Chloroethane	ug/L	<1	<1	<1	<1
Chloroform	ug/L	<0.3	0.199 F	<0.3	<0.3
Chloromethane	ug/L	<1	0.312 F	<1	<1
cis-1,2-Dichloroethene	ug/L	<1	1.29	<1	<1
CIS-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0,5	<0.5
Dibromocnoromethane	ug/L	<0.5	<0.5	<0.5	<0.5
Dichlomdifluoromethane	ugn	<1	<1	<1	<1
Ethylbenzene	ugat. Loni	<1	<1 <1	<1	<1
Hexachlorobutadiene	ug/L	<06	<0.6	<0.6	<0.6
Isopropylbenzene	ug/L	<1	<1	<1	<1
m-,p-Xytene	ug/L	~2	<2	4	<2
MEK (2-Butanone)	ug/L	<10	<10	<10	<10
Methyl t-butyl ether (MTBE)	ug/L	<5	<5	<5	<5
Methylene chloride	ug/L	<1	<1	<1	<1
MIBK (memyi isobutyi ketone)	ug/L	<10	<10	<10	<10
naphulaene n-Rutybenzene	ug/L	<1	<1	<1	<1
n-Propylbenzene	ug/L	<1	<1	<1	<1
o-Xviene	ug/t.	<1	<1	<1	<1
p-Isopropyitoluene	ug/L	<1	<1	<1	<1
sec-Butylbenzene	ug/L	<1	<1	<1	<1
Styrene	ug/L	<1	<1	<1	<1
tert-Butylbenzene	ug/L	<1	<1	<1	<1
l etrachioroethene	ug/L	<1	87.2	0.285 F	0.373 F
TUIUERE	ug/L	2.37	<1	<1	<1
trans-1.3 Dichlorogross	ug/L	<1	<1	<1	<1
Trichloroethene	ացրե ազ/1	<1 21	<1 83.2	<1	<1
Trichlorofluoromethane	ug/L	<1	65.3 <1	<1	~1
Vinyl acetate	ug/L	<5	<5	-	-,
Vinyl chloride	ug/L	<1	<1	<1	<1

<: Not detected above Reporting Limit (RL) F: Concentration reporteds below RL

--: Not analyized

FIGURES

1 Well Location Map



APPENDICES

- A Soil Boring Logs
- B Well Completion Diagrams

APPENDIX A

Soil Boring Logs

	925 15
	FIELD BOREHOLE LOG
evi	BOREHOLE NO.: MW-229
and the strength for the strength for the strength of the stre	TOTAL DEPTH: 210
PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: FOST-4	DRILLING CO.: Boart Longvear
PROJECT NO.: 3202-031	DRILLER: K. Smith
SITE LOCATION: DF	DRILLING METHOD/RIG: Sonic
PROJECT MANAGER: T. Holmes	BOREHOLE DIAMETER: 6"
FIELD STAFF: E. Van Schaik	GROUND SURFACE ELEVATION: 311.99
BOREHOLE STARTED: 7/31/07 09:55	WATER DEPTH/ DATE: 160.83 ft. bgs 9/27/2007
BOREHOLE FINISHED: 8/1/2007 13:30	BOREHOLE USE: Monitoring Well

NOTES

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
1		CL Silty clay - brown 7.5YR (4/4), crumbly, some gravel, low plasticity, dry.		
		CH Clay - reddish brown 5YR (4/4), medium to high plasticity, soft, dry.		
10-				Grouted Annulus
		CL Clay - yellowish red 5YR (4/6), medium plasticity, soft, dry.		
20-				
		CL Sandy Clay - yellowish red 5YR (5/6), medium plasticity, soft, dry.		
30				
Created	By: WTR	a		

925 16 FIELD BOREHOLE LOG



BOREHOLE NO .: MW-229

TOTAL DEPTH: 210

Symbol	Soil Description	Well Completion	Well Description
-	CL Sandy Clay - red 2.5YR (4/8), low plasticity, soft, dry.		
	SC Clayey sand - red 2.5YR (4/6), dry.		
	SC Clayey sand - red 2.5YR (4/8), dry.		
	SP Sand - yellowish red 5YR (5/8), very fine grained, clayey, dry.		
	SP Sand - red 2.5YR (5/8), fine grained, dry.		
	SP Sand - red 2.5YR (4/8), very fine to fine grained, trace clay, dry.		
50- 10-10-10-10-10-10-10-10-10-10-10-10-10-1			
	SC Clayey sand - dark red 2.5YR (3/6), very fine grained, dry.		
Labar and and the	SW Gravelly sand - reddish yellow 5YR (6/8), fine		



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BOREHOLE NO.: MW-229

TOTAL DEPTH: 210

Depth Som	Soil Soil Description		Well Completion	Well Description
70-	SW Gravelly grained, subroun gravel, s	sand - yellowish red 5YR (5/8), fine medium to coarse subangular to ded gravel, some extremely coarse silty, dry.		
	ML Clayey s very fine SW Gravelly grained,	ilt - dark reddish brown 5YR (3/4), to fine grained sand, moist. sand - yellowish red 5YR (5/8), fine medium to coarse gravel, moist.		
80	No Reco	overy		
90 Created By: W	TR			





FIELD BOREHOLE LOG

BOREHOLE NO.: MW-229 TOTAL DEPTH: 210

Depth Soil Symbol	Soil Description	Well Completion	Well Description
	SW Sand - yellow 10YR (7/6), fine grained, medium to very coarse gravel, subrounded, moist.		
	CL Clay - grey 10YR (5/1), low plasticity, moist.		
	CL Clay - grey 10YR (5/1), low plasticity, hard, moist.		
-			
100-			
-			
-			
-			
-	CL Clay - grey 10YR (5/1), low plasticity, hard, moist.		
120-			
reated By: WTR		Nillia Villia	



BOREHOLE NO.: MW-229

TOTAL DEPTH: 210

epth	Soil Symbol	Soil Description	Well Completion	Well Description	
-					
-					
130		<u></u>			
		Clay - grey 10YR (5/1), low plasticity, hard, trace lignite,moist.			
-					
		CL			
		Clay - grey 10YR (5/1), low plasticity, hard, trace lignite,moist.			
40-					
-					
-					
		CL Clay - grey 10YR (5/1) low plasticity, bard			
		trace lignite, moist.			
50-					





Checked By:

FIELD BOREHOLE LOG

BOREHOLE NO.: MW-229 TOTAL DEPTH: 210

epth	Soil Symbol	Soil Description	Cor	Well	Well Description
160	Soli	Soil Description CL Clay - grey 10YR (5/1), low plasticity, hard, trace very fine grained sand in lower 10 feet, moist. CL Sandy Clay - grey 10YR (5/1), low plasticity, hard, trace very fine grained sand, moist. CL Sandy Clay - grey 10YR (5/1), low plasticity, hard, trace very fine grained sand, moist. CL Sandy Clay - grey 10YR (5/1), low to medium plasticity, moderatley hard, very fine grained sand, moist.	Cor	160.83 -ft bgs.	Well Description
70-			60554		
80		4	高速	影	Bentonite Plug



FIELD BOREHOLE LOG

BOREHOLE NO .: MW-229

TOTAL DEPTH: 210

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epth Soil Symbol	Soil Description	Well Completion	Well Description
-	CL Sandy Clay - grey 10YR (5/1), medium plasticity, very fine grained sand, moist.		Bentonite Plug
	SP Sand - grey 10YR (5/1), very fine grained, clayey, moist.		
	SP Sand - grey 10YR (5/1), poorly sorted, some clay, moist.		Sand Pack
90			
	SP Sand - grey 10YR (5/1), very fine grained, little to no clay, moist.		Screened Interval
· FREE			

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eM	FIELD BOREHOLE LOG BOREHOLE NO.: MW-230 TOTAL DEPTH: 90	22
PROJECT INFORMATION	DRILLING INFORMATION	22
PROJECT: FOST-4	DRILLING CO.: Prosonic	0
PROJECT NO.: 3202-031	DRILLER: K. Smith	
SITE LOCATION: DF	DRILLING METHOD/RIG: Sonic	
PROJECT MANAGER: T. Holmes	BOREHOLE DIAMETER: 6	
FIELD STAFF: E. Van Schaik	GROUND SURFACE ELEVATION: 286.92	
BOREHOLE STARTED: 7/30/2007 09:50	WATER DEPTH/ DATE: 57.81 ft. bgs 9/27/2007	
BOREHOLE FINISHED: 7/30/2007 14:00	BOREHOLE USE: Monitoring Well	

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
-		CL Clay - strong brown 7YR (4/6), low plasticity, dry.		
		CL Clay - strong brown 7YR (4/6), medium plasticity, soft, dry.		Grouted Appulus
-		CI		Glotted Annua
		Clay - strong brown 7YR (4/6), medium plasticity, sandy,soft, dry. Becomes silty at 20 feet, mottled.		
		SC Clayey sand - red 2.5YR (4/8), moist.		
ALC: NO		SP Sand - red 2.5YR (4/6, fine grained, dry		
30-				

Checked By:

PAGE: 1 of 3



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BOREHOLE NO.: MW-230 TOTAL DEPTH: 90

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epth	Soil Symbol	Soil Description	Well Completion	Well Description
	00000000000000000000000000000000000000	SC Clayey sand - red 2.5YR (4/6), fine grained, moist.		
		SP Sand - yellowish red 5YR (5/8), trace subrounded gravel, dry.		
Constant of the		SC Clayey sand - reddish brown 5YR (4/4), very fine grained, moist.		
40		SP Sand - yellowish red 5YR (5/6), very fine grained, some clay, dry.		
		SW Sand - reddish yellowish 5YR (6/8), fine grained, medium to coarse gravel, subrounded to subangular, dry.		
50-		SC Sandy clay - reddish brown 5YR (4/4), dry. SM Silt - gray 5YR(6/6), sandy, very fine grained		Bentonite Plug
		dry. SW Gravelly sand - yellowish red 5YR (5/8), dry.	pgs	
		SC Clayey sand - yellowish red 5YR (5/8), dry.	5 7.81 -f	
60-0	00000000000000000000000000000000000000			

Checked By:



FIELD BOREHOLE LOG

BOREHOLE NO .: MW-230

TOTAL DEPTH: 90

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
100	arao tao tao			Sand Pack
		SW Sand - yellowish red 5YR (5/8), moist.		
		SW Sand - yellowish red 10YR (7/8),fine to medium gravel, moist.		Screened Interva
70		SP Sand - yellowish red 10YR (7/8) very fine to fine grained, moist.		
		CL Sandy clay - yellow 10YR (7/8), fine to medium grained sand, moist. CL Sandy clay - yellow 10YR (7/8), very sandy, moist.		
80		CL Clay - grey 7.5 YR (5/1), moist.		
90 Created	By:			

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APPENDIX B

Well Completion Diagrams

	WELL INSTALLATION DIAGRAM	
ervi	WELL NO.: MW-229	
PROJECT: FOST-4	NORTHING: 279293.98	-
PROJECT NUMBER: 3202-031	EASTING: 802836.28	10
SITE LOCATION: DF	GROUND SURFACE ELEVATION (ft, msl): 311.99	22
e2M PROJECT MANAGER: T. Holmes	TOP OF CASING ELEVATION (ft, msl): 311.77	
e2M FIELD STAFF: E. Van Schaik	TOP OF SCREEN ELEVATION (ft, msl): 123.34	
DATE COMPLETED: 8/1/2007		
WELL LOCATION:		
DRILLING CO .: Boart Longvear	TYPE OF FILTER PACK: Sand	
DRILLING METHOD: Sonic	GRADATION OF FILTER PACK: 10-20	
BOREHOLE DIAMETER (in): 6	QUANTITY OF FILTER PACK: 9 Bags	
SURFACE COMPLETION: Flush Mount	TYPE OF BENTONITE IN SEAL: Shur Plug 3/8"	
BOLLARDS: No	QUANTITY OF BENTONITE IN SEAL: 1 Bag	
WELL DIAMETER (in): 2	TYPE OF GROUT: Portland Type 1	
TYPE OF SCREEN/RISER MATERIAL: Sch. 40 PVC	QUANTITY OF GROUT: 16 Bags	
SLOT SIZE OF SCREEN: 0.010 inch	DEVELOPMENT METHOD: Grunfos Pump	
	DATE DEVELOPED: 8/3/2007 - 8/8/2007	
	DEPTH TO WATER (ft.btoc): 160.61	
NOTES:		
Well	Well	1
Completion (Not to Scale)	Details	
RISER	DIMENSIONS OF CONCRETE PAD: <u>3' x 3'</u>	
	LENGTH OF PISED (6): 188.43	
	LENGTH OF RISER (II). 100.42	
BENTONITE	DEPTH TO TOP OF BENTONITE (ft, bgs): <u>178.6</u>	
	DEPTH TO TOP OF SAND PACK (ft, bgs): <u>184,1</u>	
SAND PACK		
	x	
SCREEN	LENGTH OF SCREEN (ft): 20	
	LENGTH OF END CAP 0.22	
	TOTAL DEPTH OF WELL (A beau 200 (C	
END CAP	DEPTH TO TOP OF BACKFILL (ft, bgs): <u>NA</u> TOTAL DEPTH OF BORING (ft, bgs): <u>210</u>	

e M	WELL INSTALLATION DIAGRAM WELL NO.: MW-230	22
PROJECT: FOST-4	NORTHING: <u>281842.54</u>	10
PROJECT NUMBER:	EASTING: <u>802800.22</u>	32
SITE LOCATION:	GROUND SURFACE ELEVATION (ft, msl): 286.92	~.
e2M PROJECT MANAGER: T. Holmes	TOP OF CASING ELEVATION (ft, msl): 286.57	
e2M FIELD STAFF: E. Van Schaik	TOP OF SCREEN ELEVATION (II, msi): 227.32	
DATE COMPLETED: 7/30/2007		
WELL LOCATION:		
DRILLING CO - Boart Longvear	TYPE OF FILTER PACK: Sand	
DRILLING METHOD: Sonic	GRADATION OF FILTER PACK: 10-20	
BOREHOLE DIAMETER (in): 6	OUANTITY OF FILTER PACK: 7 Bays	
SURFACE COMPLETION: Flush Mount	TYPE OF BENTONITE IN SEAL: Shur Plug 3/8"	
BOLLARDS: No	OUANTITY OF BENTONITE IN SEAL: 1 Bag	
WELL DIAMETER (in): 2	TYPE OF GROUT: Portland Type 1	
TVPE OF SCREEN/RISER MATERIAL Sch. 40 PVC	OUANTITY OF GROUT: 7 Bags	
SLOT SIZE OF SCREEN 0.010 - inch	DEVELOPMENT METHOD: Grunfos Pump	
SECT SIZE OF SCREEN. GOTO - IRM	DATE DEVELOPED: 8/2/2007	
	DEPTH TO WATER (ft.btoc): 57.46	
NOTES:		
Well Completion (Not to Scale)	Well Details	
RISER	DIMENSIONS OF CONCRETE PAD: <u>3' x 3'</u>	
	LENGTH OF RISER (ft): 59.25	
	DEPTH TO TOP OF BENTONITE (ft, bgs): 49.3	
BENTONITE		
2.50	DEPTH TO TOP OF SAND PACK (ft, bgs): 54.6	
SAND PACK	-	
SCREEN		
	LENGTH OF SCREEN (ft): 15	
	LENGTH OF END CAP: 0.22 ft.	
	TOTAL DEPTH OF WELL (ft, btoc): 74.49	
BENTONITE		
DENTOINTE	DEPTH TO TOP OF BACKFILL (ft, bgs): 75	

Prepared by: Date: Checked by:

Date:

