DOE–EM/GJTAC1890

Office of Environmental Management – Grand Junction

UMTRA Project

Moab UMTRA Project
Drilling Completion Report

June 2010

U.S. Department of Energy

Office of Environmental Management

Prepared by the Technical Assistance Contractor under contract number DE-AC30-07CC60012
for the U.S. Department of Energy Office of Environmental Management, Grand Junction, Colorado.

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Revision 0

Review and Approval

6/3/10

Elizabeth Glowiak
TAC Project Hydrogeologist
Date

6/3/10

Kenneth G. Pill
TAC Ground Water Manager
Date

6/3/10

Joseph D. Ritchey
TAC Senior Program Manager
Date

6-1-2010

Donald R. Metzler
Moab Federal Project Director
Date

Revision History

Revision No.	Date	Reason/Basis for Revision
0	June 2010	Initial issue.

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Acronyms and Abbreviations

CF	configuration
cfs	cubic feet per second
DOE	U.S. Department of Energy
ft bgs	feet below ground surface
gpm	gallons per minute
IA	interim action
IWP	Integrated Work Plan
mg/L	milligrams per liter
OBS	observation well
PVC	polyvinyl chloride
RAC	Remedial Action Contractor
TAC	Technical Assistance Contractor
TD	total depth
TDS	total dissolved solids
UMTRA	Uranium Mill Tailings Remedial Action

1.0 Introduction

The Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site is a former uranium ore-processing facility located approximately 3 miles northwest of Moab in Grand County, Utah. The plant was constructed in 1956 and operated under various corporations until the milling operations ceased in 1984, leaving behind 16 million tons of uranium mill tailings in an unlined impoundment. In October 2001, the title of the property and responsibility for remediation of the tailings pile and contaminated ground water beneath the site were transferred to the U.S. Department of Energy (DOE). Beginning April 20, 2009, the DOE began relocating the mill tailings by rail approximately 30 miles north to Crescent Junction, Utah for permanent cell disposal.

Previous investigations indicate that several contaminants have migrated from the tailings pile into the ground water. The contaminants of greatest concern are ammonia and dissolved uranium. Ground water from the plume has been demonstrated to discharge to the Colorado River. Backwater channels adjacent to the Moab UMTRA Project have been identified as potential habitat for several endangered fish species, so the DOE developed an interim action (IA) well field between the toe of the tailings pile and the Colorado River in 2001. As of 2009, the IA well field contained 41 remediation wells that are subdivided into Configurations (CFs) 1 through 4. CFs 2, 3, and 4 contain 10 remediation wells (CF1 has 11 extraction wells), upgradient and downgradient observation wells, well points, and surface water locations. The purpose of the well field is to extract contaminated ground water to a lined evaporation pond on top of the tailings pile before it discharges to the river. Occasionally, diverted river water is injected into the IA well field to assist in dilution of contaminants and to create a hydrologic boundary, inhibiting the contaminants from discharging into the river.

In 2010, the IA well field was expanded to include seven new extraction wells (CF5) and four new remediation wells (CF2). Three new monitoring wells were installed on the southwestern edge of the site to assist in delineating the contamination plume. In addition, a Geoprobe was used to install eight observation wells in CF5 and two monitoring wells just south of CF5. Figure 1 shows the location of the new extraction, remediation, monitoring, and observation wells. In addition, one monitoring well that was damaged during a 2006 storm event was abandoned according to state regulations. The purpose of this Drilling Completion Report is to summarize the well construction (Table 1 and Attachment 1), lithology (Attachment 1), and analytical data. The analytical data from these remediation and observation wells will be used to enhance mass removal, update contaminant plume maps, and assist in ground water modeling. Photos of the new wells are located in Attachment 2, and Attachment 3 contains the daily drilling log.

2.0 Drilling Operations

Zimmerman Well Services, LLC, from Magna, Utah, was the contractor selected for the well installation based on safety, past performance, and cost. The drillers mobilized the rig and associated equipment on December 4, 2009. The operations were completed with a DR-12 Air Rotary Drill Rig (Photo 1). Most of the drilling was completed with the use of a tri-cone bit. However, advancement was extremely slow (5 feet per hour) while drilling through gravels at CF2, so a hammer bit was used for well 0651. The hammer bit was able to drill through the gravels faster than the tri-cone bit, but the gravel was filling in around the bit, causing a build-up

of pressure, so the tri-cone bit was used on the remaining wells. E-Z Mud Polymer was used during drilling to assist in bringing the cuttings to the surface.

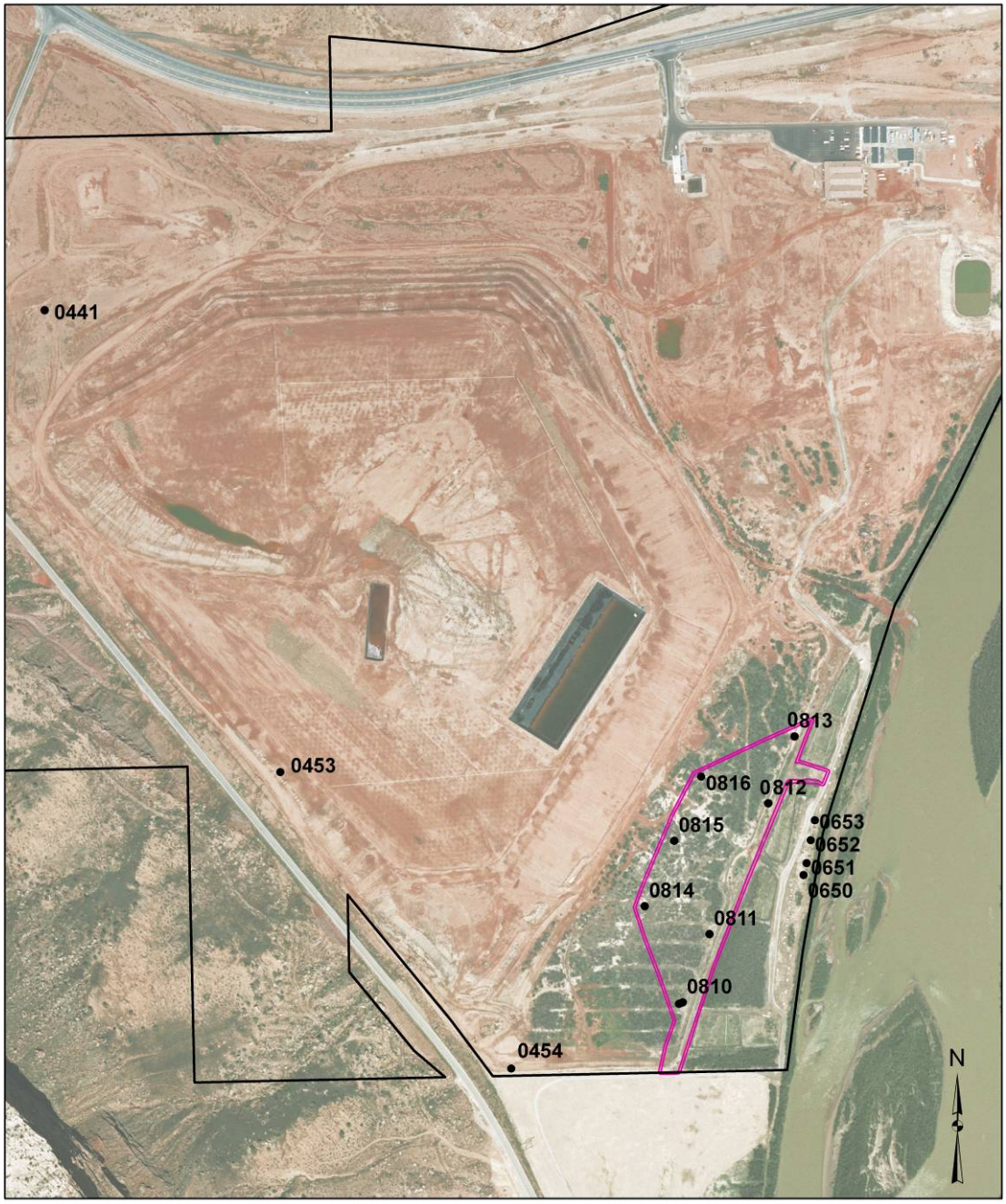

Figure 1. Wells Installed During 2010 at the Moab UMTRA Site

Drilling operations took place during daylight hours, 10 days on and 4 days off. The schedule was offset a bit during the holidays.

Rock cuttings were collected and logged at 5-foot intervals from the ground surface to the total depth of each well. Each interval sample was collected by Zimmerman from the discharge line with a metal strainer. Cuttings were not rinsed prior to identification. The lithology was

described by Technical Assistance Contractor (TAC) ground water personnel using the Unified Soil Classification System, and the color was identified using the Munsell Soil Color Chart. Sorting, gravel size, and angularity of clasts were also recorded. After identification, the drill cuttings were labeled and placed in plastic bags that are stored in the well field trailer. The lithology is included in the well logs located in Attachment 1.

The observation wells that were installed with a Geoprobe were completed by the TAC in April 2010. These 1.5-inch schedule 40 polyvinyl chloride (PVC) observation wells were installed using a direct push method with pre-packed schedule 40 PVC casing and 10 feet of 10-slotted screen.

Table 1. Completion Information for New Well Locations

Well No.	Site Location	Type	Well Dia. (in.)	TD (ft bgs)	Screen Interval (ft bgs)	Date Installed
0650	CF2	Remediation Well	6	44.5	14.5 to 44.5	Dec 18, 2009
0651	CF2	Remediation Well	6	43.2	13.2 to 43.2	Dec 17, 2009
0652	CF2	Remediation Well	6	43.1	13.1 to 43.1	Dec 15, 2009
0653	CF2	Remediation Well	6	43.1	13.1 to 43.1	Dec 8, 2009
0810	CF5	Extraction Well	8	40.4	10.4 to 40.4	Dec 23, 2009
0811	CF5	Extraction Well	8	38.6	8.6 to 38.6	Jan 5, 2010
0812	CF5	Extraction Well	8	44.2	14.2 to 44.2	Jan 6, 2010
0813	CF5	Extraction Well	8	44.4	14.4 to 44.4	Jan 7, 2010
0814	CF5	Extraction Well	8	42.4	12.4 to 42.4	Dec 22, 2009
0815	CF5	Extraction Well	8	51.7	21.7 to 51.7	Dec 20, 2009
0816	CF5	Extraction Well	8	50.9	20.9 to 50.9	Jan 8, 2010
0441	Support Area (SW corner)	Observation Well	2	54.2	44.2 to 54.2	Dec 6, 2009
0453	Contamination Area (SW side of pile)	Observation Well	2	80.5	70.5 to 80.5	Jan 12, 2010
0454	Off southern corner of pile	Observation Well	2	21.4	11.4 to 21.4	Jan 9, 2010
0810-OBS	Adjacent to 0810	Observation Well	1.5	14.2	4.2 to 14.2	Apr 14, 2010
0811-OBS	Adjacent to 0811	Observation Well	1.5	14.3	4.3 to 14.3	Apr 15, 2010
0812-OBS	Adjacent to 0812	Observation Well	1.5	13.4	3.4 to 13.4	Apr 19, 2010
0813-OBS	Adjacent to 0813	Observation Well	1.5	14.3	4.3 to 14.3	Apr 19, 2010
0814-OBS	Adjacent 0814	Observation Well	1.5	13.9	3.9 to 13.9	Apr 14, 2010
0815-OBS	Adjacent to 0815	Observation Well	1.5	13.4	3.4 to 13.4	Apr 21, 2010
0816-OBS	Adjacent to 0816	Observation Well	1.5	13.5	3.5 to 13.5	Apr 19, 2010
PW02-OBS	Adjacent to SMI-PW02	Observation Well	1.5	13.2	3.2 to 13.2	Apr 21, 2010
TP-22	Along Southern Boundary	Observation Well	1.5	17.6	7.64 to 17.6	Apr 12, 2010
TP-23	Along Southern Boundary	Observation Well	1.5	26.4	11.4 to 26.4	Apr 13, 2010

CF= Configuration; Dia.=diameter; ft bgs= feet below ground surface; in.=inches; obs = observation; TD= total depth

3.0 Installation of CF5 Extraction Wells

A series of seven extraction wells were installed at the southeastern toe of the tailings pile to assist in uranium and ammonia mass removal closer to the source of the contamination (the tailings pile). This proactive approach will assist in protecting the river by capturing the contaminants before they enter the downgradient IA well field and the river. This area was remediated by Envirocon in November/December 2009, and the wells were installed from December 22, 2009, to January 8, 2010. The seven extraction wells are numbered 0810 to 0816 and are located along a trapezoid-shaped road in the newly remediated area (Photos 1 and 2).

While Envirocon was remediating the new CF5 area, they came across pockets of perched water and fine-grained, water-logged silts and clays. The drill cuttings represent clayey gravel to a silty, gravelly clay lithology, which likely represents Colorado River floodplain deposits. An anomalous "flowing sand" interval was present at 45 feet below ground surface (ft bgs) at location 0814. Water was encountered between 5 and 8 ft bgs in CF5. The placement of the screen intervals and the total depth of each well were dependent on the lithology encountered during the drilling operations.

CF5 extraction wells were installed with a 12-inch air rotary drill rig. Each well consists of approximately 10 feet of 8-inch blank casing and 30 feet of an 8-inch 0.020 slotted stainless steel screen. The filter pack consists of 16/30 Colorado silica sand up to 3 feet above the top of the screen and approximately 3 feet of 10/20 Colorado silica sand. Bentonite chips extend from the top of the 10/20 sand to the ground surface. See Attachment 1 for a well construction diagrams. The ground water in the CF5 extraction wells was sampled in mid-February with the use of a portable peristaltic pump and weighted tubing. Three depths were sampled at each well: (1) 2 feet below the screen; (2) in the center of the screen; and (3) 2 feet above the bottom of the screen. Sample results are summarized in Table 2.

The analytical data indicates that uranium concentration increases slightly with depth and that well 0815 has the highest uranium concentration at 49 ft bgs (4.6 milligrams per liter[mg/L]). Ammonia concentration increases with depth at locations 0810, 0811, and 0813 and decreases with depth at locations 0812, 0814, 0815, and 0816. Two locations have anomalous ammonia readings at 49 ft bgs of 55 mg/L at well 0815 and 21 mg/L at well 0816. The highest ammonia concentration was 900 mg/L, which was recorded at 15 ft bgs at well 0814 and at 24 ft bgs at location 0815. Total dissolved solids (TDS) concentration increases with depth and is the highest (up to 36,000 mg/L) at location 0810. Manganese concentrations generally increase with depth, and the highest concentration was recorded at well 0813 at 42 ft bgs (5.4 mg/L).

Dedicated submersible pumps will be installed in each of the extraction wells in mid- 2010, and a protective concrete vault will enclose the well and the associated piping and flow meters.

Seven of the CF5 observation wells that were installed by the TAC are located upgradient and downgradient of the new extraction wells, and one of the new observation wells was installed upgradient of the pre-existing extraction well SMI-PW02. The wells are named after each corresponding extraction well. For example, the observation well adjacent to 0815 is numbered 0815-obs (obs for observation well). Each well contains protective steel over the riser casing and a concrete pad at the base. The new observation wells will be used exclusively to monitor drawdown associated with various CF5 extraction rates.

Photo 1. The DR-12 Air Rotary Drill Rig at Location 0453

4.0 Installation of CF2 Remediation Wells

Four new remediation wells were installed in CF2 to replace remediation wells 0570 to 0579 that were installed in 2004. These original CF2 wells are designed improperly and, and over time, the well efficiency decreased significantly. In addition, in 2005 a large volume of sediment was transported into these wells during the latter stages of the injection test, further reducing the efficiency. A habitat forms in the backwater channel of the river adjacent to CF2 when the river flow varies from 6,500 to 7,800 cubic feet per second (cfs), and the new CF2 remediation wells (0650 to 0653) were installed to assist in protecting this habitat area. These wells were installed between wells 0570 and 0579 from December 8 to 18, 2010.

The lithology was not logged during drilling since there is a high concentration of remediation and monitoring wells in CF2. The stratigraphy in this portion of the well field consists of silty sand from approximately 0 to 15 ft bgs and sand from approximately 15 to 20 ft bgs, with an increase in river cobble and gravel around 25 ft bgs.

CF2 remediation wells were installed with an 8-inch air rotary drill rig. Each well consists of approximately 10 feet of 6-inch blank schedule 80 PVC casing and 35 feet of 6-inch 0.020 slotted 6 Johnson PVC wire-wrapped screen. The filterpack consists of 10/20 Colorado silica sand to approximately 3 feet above the screen; 3 feet of 16/30 Colorado silica sand was installed on top of the 10/20. A bentonite seal was placed in the top 5 feet of each well.

Photo 2. Location of Newly Remediated Off-pile Area Where CF5 Wells Were Installed

Table 2. Analytical Results of CF5 Wells 0810 to 0816

Well No.	Type	Date	Sample Depth (feet)	U (mg/L)	Mn (mg/L)	NH_3-N (mg/L)	TDS (mg/L)
0810	CF5	2/16/10	12.5	2.9	4.4	310	22,000
			25.5	3.0	4.5	310	22,000
			38	4.5	4.8	440	36,000
0811	CF5	2/9/10	12.5	2.5	0.64	310	16,000
			23.5	2.6	0.73	320	16,000
			36.6	2.8	0.74	320	16,000
0812	CF5	2/16/10	16	2.9	2.8	460	14,000
			29	3.0	2.8	470	13,000
			42	3.1	2.8	430	14,000
0813	CF5	2/16/10	16	2.1	4.1	390	13,000
			29	2.2	5.3	430	14,000
			42	2.2	5.4	430	13,000
0814	CF5	2/8/10	15	2.6	2.0	900	18,000
			28	2.7	1.9	810	18,000
			41	2.6	1.9	690	17,000
0815	CF5	2/9/10	24	4.0	3.1	900	15,000
			36	4.3	3.1	250	15,000
			49	4.6	3.8	55	22,000
0816	CF5	2/9/10	23	2.2	3.7	130	13,000
			36	2.4	3.2	160	14,000
			49	4.1	3.8	21	26,000

Mn = manganese, NH_3-N = ammonia; U = uranium, TDS = total dissolved solids

These four remediation wells will be used to either inject diverted fresh river water into the ground water system or to extract the contaminated ground water out of the ground water system. Dedicated submersible pumps and protective concrete vaults will be installed at each well.

5.0 Installation of Monitoring Wells

Three new observation wells (0441, 0453, and 0454) were installed at the Moab UMTRA site to assist in delineation of the contamination plume on the southwestern side of the site boundary (Figure 1 and Photo 1).

5.1 Well 0441

Well 0441 has a total depth (TD) of 54.2 ft bgs and is located in the southwestern corner the Support Area. This well is considered an upgradient background well.

Drilling of well 0441 began on December 4, 2009, and was completed on December 7, 2009. The cuttings consist of gravelly clay with few clasts from 0 to 10 ft bgs transitioning to clayey silty sand from 10 to 65 ft bgs and increasing gravel from 65 to 80 ft bgs. It was anticipated that the water level would be approximately 70 to 90 ft bgs, however, after letting the ground water level adjust after drilling to 80 ft bgs, the water level was measured at 46 ft bgs.

Well 0441 was constructed with 2-inch schedule 40 PVC blank casing from 0 to 44.2 ft bgs with 10 feet of 0.020 slot machine slotted PVC screen from 44.2 to 54.2 ft bgs. Since the borehole was drilled to 80 ft bgs, it was backfilled with 16/30 Colorado silica sand up to 54.2 ft bgs. The primary filter pack of 16/30 Colorado silica sand extends to 40 ft bgs, and the secondary pack extends from 40 to 35 ft bgs. The rest of the annular space was filled in with a bentonite seal.

A dedicated bladder pump was installed at 53 ft bgs, and well 0441 was sampled on March 3, 2010. The analytical ground water data indicates that contaminant concentrations are near background levels and are similar to the surrounding upgradient well locations (Table 3). Observation well 0440, located directly south of well 0441, is sampled at a depth of 117 ft bgs and has similar ammonia, manganese, and uranium concentrations to well 0441; however, the TDS concentration is greater (approximately 6,500 mg/L) in well 0440 (Table 3). An increase in TDS with depth is expected because of the depth of the density-driven brine interface.

A dedicated bladder pump was installed at 53 ft bgs, and well 0441 was sampled on March 3, 2010. The analytical ground water data indicates that the ammonia concentration is near background levels and is similar to the surrounding upgradient well 0440 (Table 3). Observation well 0440, located directly south of well 0441, is sampled at a depth of 117 ft bgs and has lower TDS and uranium concentrations than well 0441. The TDS concentration is greater (approximately 6,500 mg/L) in well 0440 (Table 3), which is expected because of the depth of the density-driven brine interface. The increase in uranium is likely due to the proximity of well 0441 to the tailings pile.

Table 3. Analyte Concentration of New Observation Well 0441 and Nearby Observation Well 0440

Analyte	New Well 0441 (53 ft bgs)	Well 0440 (117 ft bgs)
Ammonia	0.1 mg/L	0.1 mg/L
Uranium	0.25 mg/L	0.033 mg/L
TDS	2,800 mg/L	6,300 mg/L

5.2 Well 0453

Well 0453 was installed on the southwestern side of the tailings pile to a TD of 80.5 ft bgs. This well was added to replace well 0442, which was damaged during a 2006 flood event. The drilling began January 10, 2010, and was completed January 12, 2010. The drill cuttings consist of silty sand to 70 ft bgs and then silty sand with an increase in gravel from 70 to 90 ft bgs. After allowing the water level to stabilize in the borehole, it was recorded at 72.1 ft bgs.

The borehole was backfilled with 16/30 Colorado silica sand up to 80.5 ft bgs, and the 0.020 slotted 2-inch PVC schedule 40 screen was set from 70.5 to 80.5 ft bgs. The blank schedule 80 PVC casing was placed from 0 to 70.5 ft bgs. Primary 16/30 Colorado silica sand was installed from TD to 60 ft bgs; the secondary filter pack extends from 60 to 55 ft bgs, and bentonite chips were installed from 55 to 50 ft bgs, 10/20 sand was installed from 50 to 30 ft bgs, and 30 ft bgs to the ground surface was filled with bentonite chips. A protective steel, weatherproof casing was installed over the riser, and a cement pad was placed at the base of the steel casing.

A dedicated bladder pump was installed at 77 ft bgs, and well 0453 was sampled March 4, 2010. The analytical ground water data indicates that contaminant concentration in well 0453 was lower than what was observed in well 0442; however, the TDS concentration is nearly the same (Table 4). This indicates that both wells are screened in approximately the same depth within the brine. Well 0442 was installed through mill tailings from 9.5 to 24 ft bgs, so it is possible that some of that material had leached further into the subsurface. It is also possible that the plume boundary was closer to abandoned well 0442.

Table 4. Analyte Concentration of New Observation Well 0453 and Nearby Abandoned Well 0442

Analyte	New Well 0453 (77 ft bgs)	Abandoned Well 0442 (65 ft bgs, 12/02)
Ammonia	490 mg/L	1374 mg/L
Uranium	2.3 mg/L	10.8 mg/L
Manganese	5.9 mg/L	1.92 mg/L
TDS	21,000 mg/L	22,000 mg/L

5.3 Well 0454

Well 0454 was installed on the southern edge of the Moab UMTRA property, at the fence line with private property, with a TD of 21.4 ft bgs. The purpose of this well is to help delineate the plume boundary on the southern portion of the site. Drilling began and was completed on January 9, 2010. The drill cuttings consist of sand to clayey sand transitioning to a silty sand (with the consistency of a thick liquid) to 30 ft bgs. After allowing the water level to stabilize in the borehole, the depth to water was tagged at 10.52 ft bgs.

Well 0454 was constructed with blank 2-inch schedule 40 PVC to 11.4 ft bgs, and the 0.020 slotted 2-inch PVC schedule 40 screen was set from 21.4 to 11.4 ft bgs. The borehole was backfilled with 16/30 Colorado silica sand to 21.4 ft bgs, the 10/20 Colorado silica sand was installed to 6 ft bgs, the secondary sand pack was installed to 4 ft bgs, and a bentonite seal was placed at 1 ft bgs. A protective, weatherproof steel casing was installed over the riser casing, and a cement pad was placed around the base of the steel casing.

Dedicated polyethylene tubing was installed at well 0454, and ground water was sampled from 13 ft bgs on February 17, 2010. The analytical ground water data (Table 5) indicates that the contaminant concentration in well 0454 is higher than well TP-07, which is located approximately 600 feet east, and well AMM-3, which is located approximately 300 feet north of well 0454.

Table 5. Analyte Concentration of New Observation Well 0454 vs. Nearby Wells TP-07 and AMM-3

Analyte	New Well 0454 (13 ft bgs)	TP-07 (29 ft bgs on 10/2009)	AMM-3 (48 ft bgs on 10/2009)
Ammonia	500 mg/L	140 mg/L	230 mg/L
Uranium	7.8 mg/L	3 mg/L	1.8 mg/L
Manganese	2.4 mg/L	3.7 mg/L	3 mg/L
TDS	36,000 mg/L	16,000 mg/L	17,000 mg/L

5.4 Wells TP-22 and TP-23

Observation wells TP-22 and TP-23 were installed with the Geoprobe using a direct push method. They were installed on the southeastern fence line adjacent to the fence that distinguishes the site from private property. The wells consist of 1.5-inch schedule 40 PVC with a 10-foot section of 10-slotted screen surrounded by a 10/20 sand filter pack. A protective outer steel casing was placed over the riser casing, and a cement pad was placed around the base of the steel casing.

Wells TP-22 and TP-23 will be used to monitor the contamination plume on the southeastern edge of the property and will be sampled in late spring 2010.

5.5 Abandonment of Well 0442

Well 0442 was located on the southwestern side of the tailings pile along the boundary fence with State Route 279. During a 2006 storm event, the well was damaged, and mud packed the inner casing. Utah state regulations mandate that wells with a TD of more than 30 feet must be properly abandoned. Since well 0442 had a TD of 120 ft bgs, Zimmerman abandoned it in accordance with the state regulations on January 13, 2010.

Since 2006, well 0442 had been buried and was not located in the field. In December 2009, Envirocon was able to locate the well with an excavator. Zimmerman Drilling evacuated the remaining water and cut the casing to 5 ft bgs. The well was then filled in with hydrated bentonite chips, and a concrete pad was placed over the top of the abandoned well.

6.0 Future Plans

The seven new extraction wells in CF5 will improve contaminant mass removal from the ground water before it discharges to the river. After the dedicated submersible pumps are installed in each of the wells, CF5 wells will be capable of pumping from 20 to 75 gallons per minute (gpm) per well. Observation wells are currently being installed both upgradient and downgradient of

each CF5 well using a direct-push Geoprobe, so it will be possible to monitor drawdown during extraction. The new extraction wells will be sampled when the system is running to determine contaminant mass removal during extraction.

The four new CF2 remediation wells will be used to protect the adjacent backwater channel habitat area. After the peak flow in the late spring, these new wells may used to inject diverted fresh river water into the ground water system. Injecting freshwater will help dilute the contaminant concentration, and the associated freshwater mounding will form a hydrologic boundary that will prohibit the flow of contaminants to the river. The wells will also have the capability to extract contaminated ground water. When the remediation wells are running on injection mode, upgradient and downgradient observation wells will likely be sampled, and water levels will be collected to determine the extent of the freshwater-induced mounding.

The new monitoring wells will be sampled periodically throughout the year to update contaminant plume boundaries. In addition, well 0454 will likely be sampled during various river stages to help determine the lateral extent of river bank storage during peak run-off versus river base-flow conditions.

Attachment 1.
Well Construction/Lithologic Logs

S & K Aerospace
200 Grand Ave., Ste. 500
Grand Junction, CO 81501
Telephone: 970-259-2100
Fax: 970-259-2174

BORING NUMBER MOA01-0441

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 12/4/09 **COMPLETED** 12/7/09
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 8"
LOGGED BY E. Glowiak, T. Meadows **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 4008.77 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 4008.77 ft MSL **HOLE SIZE** 8"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 46.06 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 2" PVC Schedule 40
5					0-5 ft, GRAVELLY CLAY (GP-GC), 50% poorly sorted gravel, rounded to subangular, moist, reddish brown (2.5YR 4/4)	4003.8	
10					5-10 ft, GRAVELLY CLAY (GP-GC), saturated from drill rig, angular to subrounded clasts up to 3cm, red (2.5YR 4/6)	3998.8	
15					10-20 ft, SILTY SAND (SM), few rounded pebbles, 2% subrounded clasts, fairly dry, dark reddish brown (2.5YR 3/4)		Bentonite Chips
20						3988.8	
25					20-25 ft, SILTY SAND (SM), 3% subangular to angular, fairly dry, dark red (2.5YR 3/6)	3983.8	
30					25-30 ft, CLAYEY SILTY SAND (SC-SM), 2% sub angular clasts up to 2 cm, fairly dry, reddish brown (2.5YR 4/4)	3978.8	
35					30-35 ft, CLAYEY SILTY SAND (SC-SM), slightly more cohesive than prior, 2% sub angular clasts, fairly dry, reddish brown (2.5YR 4/4)	3973.8	

(Continued Next Page)

S & K Aerospace
200 Grand Ave., Ste. 500
Grand Junction, CO 81501
Telephone: 970-259-2100
Fax: 970-259-2174

BORING NUMBER MOA01-0441

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					35-40 ft, CLAYEY SILTY SAND (SC-SM), slightly more clay than prior	16/30 Colorado Silica Sand
40				40.0	40-45 ft, CLAYEY SILTY SAND (SC-SM), less cohesive, 1% sub rounded clasts up to 2cm, fairly dry, dark red (10R 3/6) 3968.8	
45				45.0	45-50 ft, CLAYEY SILTY SAND (SC-SM), no clasts, red (2.5YR 4/6) 3963.8	10/20 Colorado Silica Sand
50				50.0	50-55 ft, CLAYEY SILTY SAND (SC-SM), more cohesive, slightly moist, red (2.5YR 4/6) 3958.8	0.020 Slotted PVC 2" Schedule 40; TD = 54.2 ft bgs
55				55.0	55-60 ft, CLAYEY SILTY SAND (SC-SM), moist, no clasts, red (2.5YR 4/4) 3953.8	
60				60.0	60-65 ft, CLAYEY SILT SAND (SC-SM), moist, 2% sub rounded clasts, GC/GM, increase in gravel, poorly sorted coarse sand, reddish brown (2.5YR4/4) 3948.8	
65				65.0	65-70 ft, CLAYEY SILTY SAND (GM/SM), increase in gravel, moist, slower drilling, reddish brown (2.5YR 4/4) 3943.8	16/30 Colorado Silica Sand
70				70.0	70-75 ft, CLAYEY SILTY SAND (GP/SM), increase in gravel ~40%, flat & sub rounded in a silty sand(SM) matrix, clasts up to 5 cm, (7.5YR 4/3) 3938.8	
75				75.0	3933.8	

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BORING NUMBER MOA01-0441

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
75						
80				80.0	75-80 ft, GRAVELLY SILTY SAND (GP-SM), H2O encountered @ 78 feet. Increase in gravel, ~80% silty sand(SM) matrix, sub rounded to sub angular clasts up to 4cm, GP, clasts are mafic, reddish brown (2.5YR 4/4) 3928.8	

Bottom of borehole at 80.0 feet.

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BORING NUMBER MOA01-0453

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 1/10/10 **COMPLETED** 1/12/10
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 8"
LOGGED BY T. Meadows, K. Pill **CHECKED BY** E. Glowiak
NOTES

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION **HOLE SIZE** 8"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 72.1 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						Casing Type: 2" PVC Schedule 40
					0-5 ft, SILTY SAND (SM), reddish brown, very fine grained, slightly moist, reddish brown (2.5YR 3/4)	
5					5.0	
					5-10 ft, SILTY SAND (SM), slightly moist, very red, very fine grained, red (2.5YR 4/8)	
10					10.0	
					10-15 ft, POORLY SORTED GRAVEL/ SILTY SAND (GP-SM), same as above except gravel, gravel @ 12', red (2.5YR 4/8)	
15					15.0	Bentonite Chips
					15-20 ft, SILTY SAND (SM), slightly moist, reddish orange, slightly moist, red (2.5YR 4/8)	
20					20.0	
					20-25 ft, SILTY SAND (SM), slightly moist, reddish orange, slightly moist, red (2.5YR 4/8)	
25					25.0	
					25-55 ft, no change	
30						
35						

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Moab TAC Team

BORING NUMBER MOA01-0453

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					25-55 ft, no change *(continued)*	
40						10/20 Colorado Silica Sand
45						
50						Bentonite Chips
55					55.0	
					55-60 ft, same lithology, increase in moist	
60					60.0	10/20 Colorado Silica Sand
					60-65 ft, SILTY SAND (SM), moist, very fine grained, red (2.5YR 4/6)	
65					65.0	
					65-70 ft, no change	
70					70.0	
					70-75 ft, SILTY SAND/GRAVEL (SM/GP), <5% gravel, moist, red (2.5YR 4/6)	16/30 Colorado Silica Sand
75					75.0	

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BORING NUMBER MOA01-0453

CLIENT Department of Energy
PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT NUMBER
PROJECT LOCATION Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
75					75-80 ft, no change	0.020 Slotted PVC 2" Schedule 40; TD = 80.5 ft bgs
80				80.0	80-85 ft, SILTY GRAVEL (GM), water, <20% gravel, reddish brown (2.5YR 5/4)	
85				85.0	85-90 ft, SILTY GRAVEL/SILTY SAND (GM/SM), <5% gravel, reddish brown (2.5YR 5/4)	10/20 Colorado Silica Sand
90				90.0		

Bottom of borehole at 90.0 feet.

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BORING NUMBER MOA01-0454

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 1/9/10 **COMPLETED** 1/9/10
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 8"
LOGGED BY E. Glowiak, J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3966.47 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3964.76 ft MSL **HOLE SIZE** 8"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 10.29 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 2" PVC Schedule 40
					0-5 ft, SAND (SP), approximately 10% rock fragments <2mm, subangular to subrounded, red (2.5 YR 4/6)		Bentonite Chips
5						3959.8	
					5-10 ft, SAND (SP), slightly damp, 5% subrounded rock fragments up to 5mm, increase in clay. red (2.5YR 4/6)		16/30 Colorado Silica Sand
10						3954.8	
					10-15 ft, CLAYEY SAND, hit water @ 15'bgs, cohesive, damp, no rock fragments. reddish brown (5YR 4/4)		10/20 Colorado Silica Sand
15						3949.8	0.020 Slotted PVC 2" Schedule 40; TD = 21.4 ft bgs
					15-20 ft, CLAYEY SAND (SC), slightly more cohesive, no rock fragments, moist. reddish brown (5YR 4/3)		
20						3944.8	
					20-25 ft, SILTY SAND (SM/ML), very wet, not cohesive, no rock fragments, nearly liquid, brown (7.5YR 5/3)		
25						3939.8	
					25-30 ft, SILTY SANDY CLAY (SM/CL), more cohesive, otherwise, same as above		
30						3934.8	

Bottom of borehole at 30.0 feet.

ENVIRONMENTAL BH - GINT STD US.GDT - 6/1/10 11:31 - M:\GROUND WATER\GINT\PROJECTS\WELL FIELD EXPANSION 2009.GPJ

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BORING NUMBER MOA01-0650

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 12/17/09 **COMPLETED** 12/18/09
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3967.40 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3967.32 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 13.83 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 6" PVC Schedule 80
					Lithology taken from Extraction Well MOA01-0575 0-5 ft, SILTY SAND (SM); approximately 80% very fine grained sand with 20% silt, dry, pale brown (10YR 6/3)		Bentonite Chips
5						3962.3	16/30 Colorado Silica Sand
				5.0	5.0-10.0 ft, SANDY SILT (ML-SP); slightly damp, mostly silt (80%) and ~20% very fine grained sand, brown (7.5YR 5/3), trace clay with mottles (white).		
10				10.0		3957.3	
					10.0-15.0 ft, SAND (SW); fine to medium grained, damp, brown (7.5YR 5/3).		
15				15.0		3952.3	
					15.0-20.0 ft, GRAVELLY SAND (SW-GW); moist, ~80% sand, very fine to medium grained, ~20% pebbles up to 2.0" in dianmenter, matrix sand is brown (7.5YR 4/3).		
20				20.0		3947.3	
					20.0-45.0 ft, SANDY GRAVEL (GW-SW); ~60% gravel and cobbles up to 3.0" in diameter, matrix sandy material is fine to medium grained and brown (7.5YR 4/3), wet.		
25				25.0		3942.3	10/20 Colorado Silica Sand
					25.0-30.0 ft, gravel increases to ~75%, matrix sand is brown (75YR 4/2).		0.020 Slotted 6" Stainless Steel Casing; TD = 44.5 ft bgs
30				30.0		3937.3	
					30.0-35.0 ft, gravel increased to ~80%, well rounded gravel and cobbles (up to 6.0" in diameter), ~20% fine grained sand matrix, brown (7.5YR 4/2), wet.		
35				35.0		3932.3	

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BORING NUMBER MOA01-0650

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					35.0-40.0ft, more sand (~25%), which is runny-water saturated.	
40				40.0	3927.3	
					40.0-45.0 ft, less sand (15-20%) and less runny.	
				45.0	3922.3	

Bottom of borehole at 44.5 feet.

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BORING NUMBER MOA01-0651

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 12/16/09 **COMPLETED** 12/17/09
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3967.77 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3967.44 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 13.88 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 6" PVC Schedule 80
					Lithology taken from Extraction Well MOA01-0575 0-5 ft, SILTY SAND (SM); approximately 80% very fine grained sand with 20% silt, dry, pale brown (10YR 6/3)		Bentonite Chips
5				5.0		3962.4	16/30 Colorado Silica Sand
					5.0-10.0 ft, SANDY SILT (ML-SP); slightly damp, mostly silt (80%) and ~20% very fine grained sand, brown (7.5YR 5/3), trace clay with mottles (white).		
10				10.0		3957.4	
					10.0-15.0 ft, SAND (SW); fine to medium grained, damp, brown (7.5YR 5/3).		
15				15.0		3952.4	
					15.0-20.0 ft, GRAVELLY SAND (SW-GW); moist, ~80% sand, very fine to medium grained, ~20% pebbles up to 2.0" in dianmenter, matrix sand is brown (7.5YR 4/3).		
20				20.0		3947.4	
					20.0-45.0 ft, SANDY GRAVEL (GW-SW); ~60% gravel and cobbles up to 3.0" in diameter, matrix sandy material is fine to medium grained and brown (7.5YR 4/3), wet.		
25				25.0		3942.4	10/20 Colorado Silica Sand
					25.0-30.0 ft, gravel increases to ~75%, matrix sand is brown (75YR 4/2).		0.020 Slotted 6" Stainless Steel Casing; TD = 43.2 ft bgs
30				30.0		3937.4	
					30.0-35.0 ft, gravel increased to ~80%, well rounded gravel and cobbles (up to 6.0" in diameter), ~20% fine grained sand matrix, brown (7.5YR 4/2), wet.		
35				35.0		3932.4	

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BORING NUMBER MOA01-0651

CLIENT Department of Energy
PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT NUMBER
PROJECT LOCATION Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					35.0-40.0ft, more sand (~25%), which is runny-water saturated.	
40				40.0	3927.4	
					40.0-45.0 ft, less sand (15-20%) and less runny.	
				45.0	3922.4	

Bottom of borehole at 43.2 feet.

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BORING NUMBER MOA01-0652

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 12/9/09 **COMPLETED** 12/16/09
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3967.95 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3967.64 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 13.75 ft bgs

DEPTH (ft)	MATERIAL DESCRIPTION		WELL DIAGRAM
0			Casing Type: 6" PVC Schedule 80
	Lithology taken from Extraction Well MOA01-0575 0-5 ft, SILTY SAND (SM); approximately 80% very fine grained sand with 20% silt, dry, pale brown (10YR 6/3)		Bentonite Chips
5		3962.6	16/30 Colorado Silica Sand
5.0	5.0-10.0 ft, SANDY SILT (ML-SP); slightly damp, mostly silt (80%) and ~20% very fine grained sand, brown (7.5YR 5/3), trace clay with mottles (white).		
10		3957.6	
10.0	10.0-15.0 ft, SAND (SW); fine to medium grained, damp, brown (7.5YR 5/3).		
15	▼	3952.6	
15.0	15.0-20.0 ft, GRAVELLY SAND (SW-GW); moist, ~80% sand, very fine to medium grained, ~20% pebbles up to 2.0" in dianmenter, matrix sand is brown (7.5YR 4/3).		
20		3947.6	
20.0	20.0-45.0 ft, SANDY GRAVEL (GW-SW); ~60% gravel and cobbles up to 3.0" in diameter, matrix sandy material is fine to medium grained and brown (7.5YR 4/3), wet.		
25		3942.6	10/20 Colorado Silica Sand
25.0	25.0-30.0 ft, gravel increases to ~75%, matrix sand is brown (75YR 4/2).		0.020 Slotted 6" Stainless Steel Casing; TD = 43.1 ft bgs
30		3937.6	
30.0	30.0-35.0 ft, gravel increased to ~80%, well rounded gravel and cobbles (up to 6.0" in diameter), ~20% fine grained sand matrix, brown (7.5YR 4/2), wet.		
35		3932.6	
35.0			

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BORING NUMBER MOA01-0652

CLIENT Department of Energy
PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT NUMBER
PROJECT LOCATION Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					35.0-40.0ft, more sand (~25%), which is runny-water saturated.	
40					40.0 3927.6 40.0-45.0 ft, less sand (15-20%) and less runny.	
					45.0 3922.6 Bottom of borehole at 43.1 feet.	

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BORING NUMBER MOA01-0653

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 12/7/09 **COMPLETED** 12/9/09
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3969.90 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3967.39 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 13.41 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 6" PVC Schedule 80
					Lithology taken from Extraction Well MOA01-0575 0-5 ft, SILTY SAND (SM); approximately 80% very fine grained sand with 20% silt, dry, pale brown (10YR 6/3)		Bentonite Chips
5						3962.4	16/30 Colorado Silica Sand
				5.0	5.0-10.0 ft, SANDY SILT (ML-SP); slightly damp, mostly silt (80%) and ~20% very fine grained sand, brown (7.5YR 5/3), trace clay with mottles (white).		
10				10.0		3957.4	
					10.0-15.0 ft, SAND (SW); fine to medium grained, damp, brown (7.5YR 5/3).		
15				15.0		3952.4	
					15.0-20.0 ft, GRAVELLY SAND (SW-GW); moist, ~80% sand, very fine to medium grained, ~20% pebbles up to 2.0" in dianmenter, matrix sand is brown (7.5YR 4/3).		
20				20.0		3947.4	
					20.0-45.0 ft, SANDY GRAVEL (GW-SW); ~60% gravel and cobbles up to 3.0" in diameter, matrix sandy material is fine to medium grained and brown (7.5YR 4/3), wet.		
25				25.0		3942.4	10/20 Colorado Silica Sand
					25.0-30.0 ft, gravel increases to ~75%, matrix sand is brown (75YR 4/2).		0.020 Slotted 6" Stainless Steel Casing; TD = 43.1 ft bgs
30				30.0		3937.4	
					30.0-35.0 ft, gravel increased to ~80%, well rounded gravel and cobbles (up to 6.0" in diameter), ~20% fine grained sand matrix, brown (7.5YR 4/2), wet.		
35				35.0		3932.4	

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BORING NUMBER MOA01-0653

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					35.0-40.0ft, more sand (~25%), which is runny-water saturated.	
40				40.0	3927.4	
					40.0-45.0 ft, less sand (15-20%) and less runny.	
				45.0	3922.4	

Bottom of borehole at 43.1 feet.

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BORING NUMBER MOA01-0810

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 12/22/09 **COMPLETED** 12/23/09
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY K. Pill **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3961.88 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3961.06 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 7.36 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						Casing Type: 8" PVC Schedule 80
					0-5 ft, SILTY CLAYEY SAND (ML/SC), moist, mostly silt(75%), fine sand(25%), trace of clay, yellowish brown (10YR 5/4)	Bentonite Chips
5					5.0 3956.1	
					5-10 ft, Hit H2O @ 8 ft. bgs.	
10					10.0 3951.1	
					10-15 ft CLAYEY SILTY SAND (CL, SM), moist, abundant clay w/minor fine sand(10%), not certain of thickness of clay unit, brown (7.5YR 4/4)	
15					15.0 3946.1	
					15-20 ft, SILTY GRAVEL (GM), wet, abundant gravel, subrounded to angular, up to 1"diam., minor coarse and fine sand (10% each), minor clay(10%), reddish brown (5YR 4/4)	
20					20.0 3941.1	
					20-25 ft, GRAVELLY SAND (SW/GW), becoming coarser grained, wet, abundant gravel(30%), very fine to coarse grained sand(25%), trace clay, yellowish red (5YR 4/6)	10/20 Colorado Silica Sand
25					25.0 3936.1	0.020 Slotted 8" Stainless Steel Casing; TD = 40.4 ft bgs
					25-30 ft, @ 30 feet a slight increase in fine sand with gravel, reddish brown (5YR 4/4)	
30					30.0 3931.1	
					30-40 ft, GRAVELLY SAND (SW/GW), wet, very fine to coarse grained sand, pebbles & cobbles up to 1" diameter (40%), reddish brown (5YR 3/2)	
35						

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BORING NUMBER MOA01-0810

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35						
40					30-40 ft, GRAVELLY SAND (SW/GW), wet, very fine to coarse grained sand, pebbles & cobbles up to 1" diameter (40%), reddish brown (5YR 3/2) *(continued)*	
					40.0 / 3921.1	
					40-40.4 ft, SAND (SP), wet, fine to medium grained, minor gravel, dark reddish clay (5YR 4/2)	
					40.4 / 3920.7	
					Bottom of borehole at 40.4 feet.	

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BORING NUMBER MOA01-0810-OBS

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3962.23 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3959.88 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 5.84 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 1.5" PVC Schedule 40
					Lithology taken from Extraction Well 0810 0-5 ft, SILTY CLAYEY SAND (ML/SC), moist, mostly silt(75%), fine sand(25%), trace of clay, yellowish brown (10YR 5/4)		Bentonite Chips
5				5.0		3954.9	
					▼ 5-10 ft, Hit H2O @ 8 ft. bgs.		
10				10.0		3949.9	0.010 Slotted PVC 1.5" Schedule 40; TD = 14.4 ft bgs
					10-15 ft CLAYEY SILTY SAND (CL, SM), moist, abundant clay w/minor fine sand(10%), not certain of thickness of clay unit, brown (7.5YR 4/4)		
				15.0		3944.9	

Bottom of borehole at 14.4 feet.

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BORING NUMBER MOA01-0811

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 1/4/10 **COMPLETED** 1/5/10
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY E. Glowiak/T. Meadows **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3962.82 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3961.27 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 7.06 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 8" PVC Schedule 80
					0-5 ft, GRAVEL (GP) (likely road base), angular gravel, poorly sorted, brown (7.5YR 5/4)		Bentonite Chips
5				5.0		3956.3	16/30 Colorado Silica Sand
					5-10 ft, CLAYEY GRAVEL (GC/CL), wet, clay with few (~10%) angular rock fragments up to 2" in diameter, ~20% sand, brown (7.5YR 5/4)		
10				10.0		3951.3	
					10-15 ft, CLAYEY GRAVEL (GC/CL), increase in clay content, same as above.		
15				15.0		3946.3	
					15-20 ft, CLAYEY GRAVEL (GC/CL), mostly clay, very cohesive, hit water at 17 ft bgs, few (~10%) gravel, red (2.5YR 4/6)		
20				20.0		3941.3	
					20-30 ft, SILTY GRAVEL (GM), poorly sorted, subangular to subrounded, clasts up to 5 mm in diameter, redish brown (2.5YR 5/4)		10/20 Colorado Silica Sand
25							0.020 Slotted 8" Stainless Steel Casing; TD = 38.6 ft bgs
30				30.0		3931.3	
					30-35 ft, SILTY GRAVEL (GM), increase in larger gravel fragments, up to 2 in. diameter		
35				35.0		3926.3	

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BORING NUMBER MOA01-0811

CLIENT Department of Energy
PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT NUMBER
PROJECT LOCATION Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35						
40					30-40 ft, Same as 30-35' but a slight increase in silt and sand, rock fragments up to 3" in diameter, reddish brown (2.5YR 5/3) 3921.3	
45					40-45 ft, GRAVELLY SAND (GM/SP), poorly sorted, angular to subangular, 30% fines 70% gravel, brown (7.5YR 4/3) 3916.3	

40.0

45.0

Bottom of borehole at 45.0 feet.

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BORING NUMBER MOA01-0811-OBS

CLIENT Department of Energy
PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT NUMBER
PROJECT LOCATION Moab UMTRA Mill Site
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
GROUND ELEVATION 3959.54 ft MSL **HOLE SIZE** 2.6"
DRILLING CONTRACTOR Moab TAC Field Services Group
GROUND WATER LEVELS:
DRILLING METHOD Direct Push Hydraulic Hammer
DURING DRILLING ---
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
AFTER DRILLING 6.93 ft bgs
NOTES Top of Casing Elevation: 3962.03 ft MSL

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						Casing Type: 1.5" PVC Schedule 40
					Lithology taken from Extraction Well 0811 0-5 ft, GRAVEL (GP) (likely road base), angular gravel, poorly sorted, brown (7.5YR 5/4)	Bentonite Chips
5				5.0	3954.5	
					5-10 ft, CLAYEY GRAVEL (GC/CL), wet, clay with few (~10%) angular rock fragments up to 2" in diameter, ~20% sand, brown (7.5YR 5/4)	
10				10.0	3949.5	0.010 Slotted PVC 1.5" Schedule 40; TD = 14.35 ft bgs
					10-15 ft, CLAYEY GRAVEL (GC/CL), increase in clay content, same as above.	
				15.0	3944.5	

Bottom of borehole at 14.4 feet.

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BORING NUMBER MOA01-0812

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 1/5/10 **COMPLETED** 1/6/10
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY T. Meadows **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3961.41 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3960.65 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 6.19 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						Casing Type: 8" PVC Schedule 80
5					0-5 ft, CLAYEY GRAVEL (GC), moist, road base, reddish brown (2.5YR 4/4)	Bentonite Chips
10					5-10 ft, GRAVEL (GP), 10% clay, reddish brown (2.5YR 4/4)	16/30 Colorado Silica Sand
15					10-15 ft, GRAVEL (GW), moist, water encountered @ approximately 15 ft bgs, reddish brown (2.5YR 4/4)	
20					15-20 ft, GRAVEL (GW), moist, ~10% silty clay, red (2.5YR 4/6)	
25					20-25 ft, GRAVELLY SAND (GW/SW), moist, poorly sorted, dark reddish brown (2.5YR 3/4)	
30					25-30 ft, GRAVELLY SAND (GW/SW), moist, mottled, color, poorly sorted	10/20 Colorado Silica Sand 0.020 Slotted 8" Stainless Steel Casing; TD = 44.4 ft bgs
35					30-35 ft, GRAVELLY SAND (GW/SW), mixed color, rock fragments less than and/or equal to 5cm, poorly sorted	

5.0 — 3955.7
10.0 — 3950.7
15.0 — 3945.7
20.0 — 3940.7
25.0 — 3935.7
30.0 — 3930.7
35.0 — 3925.7

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BORING NUMBER MOA01-0812

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					35-40 ft, SILTY GRAVELLY SAND (GM/SW), moist, rock fragments less than and/or equal to 5cm, weak red (2.5YR 5/2)	
40				40.0	3920.7	
					40-44.2 ft, SILTY SAND (GM), angular to sub angular, rock fragments<3cm, weak red (2.5YR 4/2)	
				44.2	3916.5	

Bottom of borehole at 44.2 feet.

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BORING NUMBER MOA01-0812-OBS

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3963.12 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3960.78 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 4.59 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Lithology taken from Extraction Well 0812 0-5 ft, CLAYEY GRAVEL (GC), moist, road base, reddish brown (2.5YR 4/4)	Casing Type: 1.5" PVC Schedule 40 Bentonite Chips
5				5.0	3955.8 5-10 ft, GRAVEL (GP), 10% clay, reddish brown (2.5YR 4/4)	
10				10.0	3950.8 10-15 ft, GRAVEL (GW), moist, water encountered @ approximately 15 ft bgs, reddish brown (2.5YR 4/4)	0.010 Slotted PVC 1.5" Schedule 40; TD = 13.5 ft bgs
				15.0	3945.8 Bottom of borehole at 13.5 feet.	

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BORING NUMBER MOA01-0813

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 1/6/10 **COMPLETED** 1/7/10
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY T. Meadows/J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3963.44 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3963.12 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 8.61 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 8" PVC Schedule 80
					0-5 ft, SANDY GRAVEL (GW/SP), moist, ~ <10% clay, red (2.5YR 4/6)		
5					5.0	3958.1	Bentonite Chips
					5-10 ft, CLAYEY GRAVELLY SAND (GC/SW), ~30% clay, moist, reddish brown (2.5YR 4/4)		
10					10.0	3953.1	16/30 Colorado Silica Sand
					10-15 ft, SILTY GRAVELLY SAND (GM/SP), moist, ~ <5% clay & silt, red (2.5YR 4/6)		
15					15.0	3948.1	
					15-20 ft, SILTY GRAVELLY SAND (GM/SP), moist, ~ <5% silty or clay, water encountered @ approximately 17 ft bgs. dark reddish brown (2.5YR 3/4)		
20					20.0	3943.1	
					20-25 ft, SILTY GRAVELLY SAND (GM/SP), moist, dark reddish brown (2.5YR 3/4)		
25					25.0	3938.1	
					25-35 ft, SILTY GRAVELLY SAND (GM/SP), moist, ~ <10% silt, reddish gray (2.5YR 5/1)		10/20 Colorado Silica Sand
30							0.020 Slotted 8" Stainless Steel Casing; TD=44.4 ft bgs
35					35.0	3928.1	

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BORING NUMBER MOA01-0813

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35						
					35-40 ft, SILTY GRAVELLY SAND (GM/SP), moist, rock fragments less than or equal to 5cm, ~10-20% silt, reddish gray (2.5YR 5/1)	
40				40.0	3923.1	
					40-44.4 ft, SILTY GRAVELLY SAND (GM/SP), moist, rock fragments less than or equal to 5cm, ~10-20% silt, reddish gray (2.5YR 5/1)	
				44.4	3918.7	

Bottom of borehole at 44.4 feet.

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BORING NUMBER MOA01-0813-OBS

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3964.45 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3962.13 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 6.63 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Lithology taken from Extraction Well 0813	Casing Type: 1.5" PVC Schedule 40
					0-5 ft, SANDY GRAVEL (GW/SP), moist, ~ <10% clay, red (2.5YR 4/6)	Bentonite Chips
5				5.0	3957.1	
					5-10 ft, CLAYEY GRAVELLY SAND (GC/SW), ~30% clay, moist, reddish brown (2.5YR 4/4)	
10				10.0	3952.1	0.010 Slotted PVC 1.5" Schedule 40; TD = 14.35 ft bgs
					10-15 ft, SILTY GRAVELLY SAND (GM/SP), moist, ~ <5% clay & silt, red (2.5YR 4/6)	
				15.0	3947.1	

Bottom of borehole at 14.4 feet.

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BORING NUMBER MOA01-0814

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 12/22/10 **COMPLETED** 12/22/09
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3960.98 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3960.54 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 5.78 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						Casing Type: 8" PVC Schedule 80
					0-5 ft, CLAY (CL), with poorly sorted gravel (road base), saturated, dark reddish brown (2.5YR 3/4)	Bentonite Chips
5				5.0	3955.5	
					5-10 ft, CLAYEY SAND (SC/CL), well sorted, subangular, saturated, dark reddish brown (2.5YR 3/4)	16/30 Colorado Silica Sand
10				10.0	3950.5	
					10-25 ft, SILTY SANDY CLAY (SM/CL), poorly sorted, subangular, 10% gravel <0.5cm, brown (7.5YR 4/3)	
15						
20						
25				25.0	3935.5	
					25-30 ft, SILTY GRAVEL (GP/GM), poorly sorted, angular to subangular, brown (7.5YR 4/3)	10/20 Colorado Silica Sand 0.020 Slotted 8" Stainless Steel Casing; TD = 42.4 ft bgs
30				30.0	3930.5	
					30-35 ft, SILTY GRAVELLY SAND (GM/SP), poorly sorted, angular to subangular, rounded gravel, 50% sand, brown (7.5YR 4/3)	
35				35.0	3925.5	

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BORING NUMBER MOA01-0814

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					35-40 ft, SILTY GRAVELLY SAND (GM/SP), poorly sorted, angular to subangular, 60%< 5cm, 40% sandy silt(SM), brown (7.5YR 4/3)	
40				40.0	3920.5	
					40-45 ft, SILTY GRAVELLY SAND (GM/SP), poorly sorted, angular to subangular, 30% fines 70% gravel, brown (7.5YR 4/3)	
45				45.0	3915.5	
					45-50 ft, SILTY SAND (SM), fairly sorted, <5% gravel, angular to subangular, brown (7.5YR 4/3)	Flowing sand encoutered at 45 ft.
50				50.0	3910.5	

Bottom of borehole at 50.0 feet.

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BORING NUMBER MOA01-0814-OBS

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3962.94 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3960.41 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 5.55 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Lithology taken from Extraction Well 0814 0-5 ft, CLAY (CL), with poorly sorted gravel (road base), saturated, dark reddish brown (2.5YR 3/4)	Casing Type: 1.5" PVC Schedule 40 Bentonite Chips
5				5.0	3955.4	
					5-10 ft, CLAYEY SAND (SC/CL), well sorted, subangular, saturated, dark reddish brown (2.5YR 3/4)	
10				10.0	3950.4	0.010 Slotted PVC 1.5" Schedule 40; TD = 13.4 ft bgs
					10-25 ft, SILTY SANDY CLAY (SM/CL), poorly sorted, subangular, 10% gravel <0.5cm, brown (7.5YR 4/3)	
				25.0	3935.4	

Bottom of borehole at 13.4 feet.

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BORING NUMBER MOA01-0815

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 12/19/09 **COMPLETED** 12/20/09
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY T. Meadows/J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3963.14 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3961.45 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 6.56 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						Casing Type: 8" PVC Schedule 80
					0-20 ft, SILTY CLAY (ML/CL), very moist, poorly sorted, ~<10% sand, sub angular, red (2.5YR 4/6)	Bentonite Chips
5						
10						10/20 Colorado Silica Sand
15						16/30 Colorado Silica Sand
20					20.0 3941.5	
					20-20 ft, CLAYEY GRAVEL (GC), sub angular to angular, highly saturated, red (2.5 YR4/6)	
25					25.0 3936.5	
					25-35 ft, CLAYEY GRAVEL (GC), more gravel, angular to sub angular, poorly sorted, rock fragments<5cm, saturated, red (2.5YR 4/6)	
30						
35					35.0 3926.5	10/20 Colorado

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BORING NUMBER MOA01-0815

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
35					35-40 ft, SILTY GRAVEL (GM/GP), angular to sub angular, poorly sorted, rock fragments <4cm, reddish brown (2.5 YR4/3)		Silica Sand 0.020 Slotted 8" Stainless Steel Casing; TD = 51.7 ft bgs
					40.0	3921.5	
40					40-45 ft, GRAVEL (GP), angular to sub angular, poorly sorted, rock fragments <3cm, a little silt		
					45.0	3916.5	
45					45-50 ft, GRAVEL (GP), angular to sub angular, poorly sorted, rock fragments <3cm, a little silt, gray (5YR 5/1)		
					50.0	3911.5	
50					Increase in silt		
55					57.0	3904.5	

Bottom of borehole at 57.0 feet.

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BORING NUMBER MOA01-0815-OBS

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3964.48 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3961.96 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 5.09 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Lithology taken from Extraction Well 0815 0-20 ft, SILTY CLAY (ML/CL), very moist, poorly sorted, ~<10% sand, sub angular, red (2.5YR 4/6)	Casing Type: 1.5" PVC Schedule 40 Bentonite Chips
5					▽	
10						0.010 Slotted PVC 1.5" Schedule 40; TD = 13.4 ft bgs
					20.0 3942.0 Bottom of borehole at 13.4 feet.	

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BORING NUMBER MOA01-0816

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 1/7/10 **COMPLETED** 1/8/10
DRILLING CONTRACTOR Mike Zimmerman Well Service, LLC
DRILLING METHOD Air Rotary 12"
LOGGED BY T. Meadows/J. Ritchey **CHECKED BY** E. Glowiak
NOTES Top of Casing Elevation: 3961.87 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3960.42 ft MSL **HOLE SIZE** 12"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 5.5 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 8" PVC Schedule 80
					0-5 ft, CLAYEY SANDY GRAVEL (GC/SC), moist, red (2.5YR 5/8)		
5				5.0		3955.4	
					5-10 ft, CLAYEY SANDY GRAVEL (GC/SC), moist, rock fragments less than or equal to 3cm		Bentonite Chips
10				10.0		3950.4	
					10-15 ft, GRAVELLY SILTY SAND (GP/SM), moist, poorly sorted, ~60% gravel & 40% sand, reeddish brown (5YR 5/4)		
15				15.0		3945.4	
					15-20 ft, GRAVELLY SILTY SAND (GP/SM), moist, approximately 75% sand, 25% gravel less than or equal to 7cm. Water encountered @ approximately 15'bgs. weak red (2.5YR 4/2)		16/30 Colorado Silica Sand
20				20.0		3940.4	
					20-25 ft, GRAVELY SILTY SAND (GP/SM), ~75% sand & 25% gravel, angular gravel less than or equal to 7cm. weak red (2.5YR 4/2)		
25				25.0		3935.4	
					25-35 ft, GRAVELY SILTY SAND (GP/SM), ~60% sand & 40% gravel, angular to sub angular, coarse sand, gravel less than or equal to 5cm., weak red (2.5 YR 4/2)		
30							
35				35.0		3925.4	10/20 Colorado

(Continued Next Page)

S & K Aerospace
200 Grand Ave., Ste. 500
Grand Junction, CO 81501
Telephone: 970-259-2100
Fax: 970-259-2174

BORING NUMBER MOA01-0816

CLIENT Department of Energy **PROJECT NAME** Moab UMTRA Wellfield Expansion

PROJECT NUMBER **PROJECT LOCATION** Moab UMTRA Mill Site

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					35-40 ft, GRAVELLY SILTY SAND (GP/SM), moist, no fines, mixed color, no soil	Silica Sand 0.020 Slotted 8" Stainless Steel Casing; TD = 50.9 ft bgs
40				40.0	3920.4	
					40-50 ft, SILTY GRAVELLY SAND (GM/SM), moist, ~40-50% silt, dark reddish gray (2.5YR 4/1)	
45						
50				50.0	3910.4	

Bottom of borehole at 50.9 feet.

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200 Grand Ave., Ste. 500
Grand Junction, CO 81501
Telephone: 970-259-2100
Fax: 970-259-2174

BORING NUMBER MOA01-0816-OBS

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3962.37 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3960.04 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 4.44 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Lithology taken from Extraction Well 0816	Casing Type: 1.5" PVC Schedule 40
					0-5 ft, CLAYEY SANDY GRAVEL (GC/SC), moist, red (2.5YR 5/8)	Bentonite Chips
5				5.0	3955.0	
					5-10 ft, CLAYEY SANDY GRAVEL (GC/SC), moist, rock fragments less than or equal to 3cm	
10				10.0	3950.0	0.010 Slotted PVC 1.5" Schedule 40; TD = 13.25 ft bgs
					10-15 ft, GRAVELLY SILTY SAND (GP/SM), moist, poorly sorted, ~60% gravel & 40% sand, reddish brown (5YR 5/4)	
				15.0	3945.0	
					Bottom of borehole at 13.3 feet.	

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Telephone: 970-259-2100
Fax: 970-259-2174

BORING NUMBER MOA01-SMI-PZ2S

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3966.48 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3964.3 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 8.06 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						Casing Type: 1.5" PVC Schedule 40
					Lithology taken from Obeservation Well SMI-PZ2D. 0-7 ft, CLAYEY SAND (SC-SM); 50% sand and 50% silt or clay. Very fine to fine grained sand, subrounded to rounded, 90% quartz, 10% lithic fragments, dry, reddish brown (5YR 4/4) roots and wood chips abundant. Interval slightly cohesive.	Bentonite Chips
5						
				7.0	3957.3	
					7.0-17.0 ft, CLAY (CL); 70% clay and 30% sand, very fine grained sand, subrounded to rounded, 90% quartz, 10% lithic fragments. Interval slightly cohesive, moist to 10 ft and wet from 10-12 ft. Reddish brown (5YR 4/4).	0.010 Slotted PVC 1.5" Schedule 40; TD = 13.35 ft bgs
10						
				17.0	3947.3	

Bottom of borehole at 13.4 feet.

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Grand Junction, CO 81501
Telephone: 970-259-2100
Fax: 970-259-2174

BORING NUMBER MOA01-TP-22

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3966.48 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3964.58 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 10.47 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Type: 1.5" PVC Schedule 40
					Lithology taken from Observation Well 0454 0-5 ft, SAND (SP), approximately 10% rock fragments <2mm, subangular to subrounded, red (2.5 YR 4/6)		Bentonite Chips
5					5.0	3959.6	
					5-10 ft, SAND (SP), slightly damp, 5% subrounded rock fragments up to 5mm, increase in clay, red (2.5YR 4/6)		
10					10.0	3954.6	
					▼ 10-15 ft, CLAYEY SAND (SC), hit water @ 15'bgs, cohesive, damp, no rock fragments, reddish brown (5YR 4/4)		0.010 Slotted PVC 1.5" Schedule 40; TD = 18.1 ft bgs
15					15.0	3949.6	
					15-20 ft, CLAYEY SAND (SC), slightly more cohesive, no rock fragments, moist, reddish brown (5YR 4/3)		
					20.0	3944.6	

Bottom of borehole at 18.1 feet.

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Grand Junction, CO 81501
Telephone: 970-259-2100
Fax: 970-259-2174

BORING NUMBER MOA01-TP-23

CLIENT Department of Energy
PROJECT NUMBER
DATE STARTED 4/12/10 **COMPLETED** 4/22/10
DRILLING CONTRACTOR Moab TAC Field Services Group
DRILLING METHOD Direct Push Hydraulic Hammer
LOGGED BY T. Meadows **CHECKED BY** James Ritchey
NOTES Top of Casing Elevation: 3962.54 ft MSL

PROJECT NAME Moab UMTRA Wellfield Expansion
PROJECT LOCATION Moab UMTRA Mill Site
GROUND ELEVATION 3960.35 ft MSL **HOLE SIZE** 2.6"
GROUND WATER LEVELS:
DURING DRILLING ---
AFTER DRILLING 5.38 ft bgs

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Lithology taken from Observation Well TP-07 0-26 ft, CLAYEY SILTY SAND (ML-SP); brownish gray.	Casing Type: 1.5" PVC Schedule 40 Bentonite Chips
5						
10						
15						
20						0.010 Slotted PVC 1.5" Schedule 40; TD = 26 ft bgs
25				26.0	3934.4	

Bottom of borehole at 26.0 feet.

Attachment 2.
Well Location Photos

CF5 Extraction Well 0810

CF5 Extraction Well 0811

CF5 Extraction Well 0812

CF5 Extraction Well 0813

CF5 Extraction Well 0814

CF5 Extraction Well 0815

CF5 Extraction Well 0816

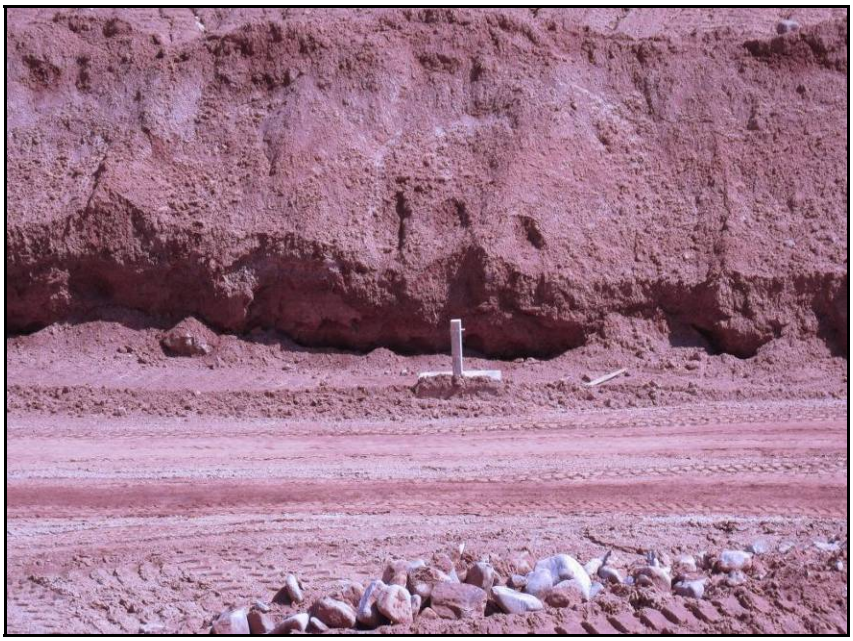
CF2 Remediation Well 0650

CF2 Remediation Well 0651

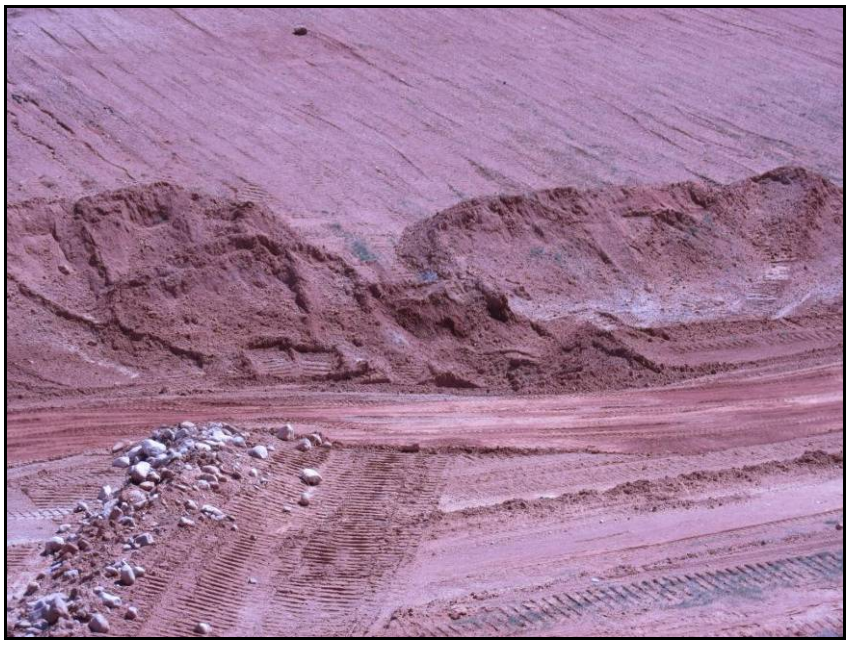
CF2 Remediation Well 0652

CF2 Remediation Well 0653

Upgradient Background Observation Well 0441



Observation Well 0453



Location of Observation Well 0442 after Abandonment

Observation Well 0454

Attachment 3.
Summary of Well Field Expansion Drilling Activities

Summary of Well Field Expansion Drilling Activities

Friday, December 4, 2009
The safety meeting was held at 0630, and the topic of discussion was rig safety and potential radiological concerns. After the safety meeting, Remedial Action Contractor (RAC) Health and Safety personnel completed a rig inspection and radiologic scan, and the drillers prepped the equipment. By the time the rig was mobilized and ready to start drilling at location 0441, it was 1500. It was decided that the drilling would begin tomorrow. T. Meadows, L. Glowiak, and K. Pill covered drilling activities.

Saturday, December 5, 2009
Additional rig inspection provided by the RAC further delayed drilling. The drilling began at 1041 at well 0441 (in the Support Area), and the lithology transitioned from gravelly sand to silty sandy clay to 65 ft bgs. At approximately 1150, complications occurred when the drill bit got stuck on a welded joint in the outer casing. M. Zimmerman left to get a new drill bit, and the drillers removed the outer casing from the hole. As the driller tripped back into the hole, he had to weld temporary handles onto the casing so that it wouldn't fall through. M. Zimmerman returned with the bit around 1400 and realized that he needed one more piece of equipment. The shift ended at 1600 and will resume tomorrow morning at 0630. The plan for tomorrow is to complete the drilling and to construct the well. The total depth should be around 7 to 8 feet below depth to water. L. Glowiak, T. Meadows, J. Ritchey, and K. Pill covered drilling activities.

Sunday, December 6, 2009
The safety meeting was held at 0630, and the topic of discussion was the cold weather and the operations for the day. Drilling began at 0830, and the drillers had to re-drill about 20 feet of slough from the previous day. By 0930, the drilling slowed as we hit a gravel layer, and water was present in abundance at 76 ft bgs. At 0945 the drill pipe was tripped out to determine water level. It was tagged with four different water level indicators at approximately 47.4 ft bgs. At 1030, the water level was still around 47 feet. The drillers filled in the bottom of the hole with 16/30 silica sand and then placed the screen. The screen was set at 44.5 to 54.5 ft bgs, and the primary filter pack extends to 40 ft bgs. The secondary pack was added and is placed from 40 ft bgs to 35 ft bgs. The operations ended at approximately 1715. Spoke with K. Pill at 1500 regarding potential issues with screen placement. L. Glowiak, T. Meadows, and J. Ritchey covered drilling activities.

Monday, December 7, 2009
The safety meeting was held at 0645, and the topic of discussion was ice and mobilizing through the Support Area. At 0755 the water level was measured at 47 ft bgs at well 0441, which is the same that it was yesterday. At 0810 Zimmerman began to add bentonite chips up to 31.5 ft bgs. The grouting began at 0900 and was complete by 1000, soon after that, Zimmerman began demobilization from the Support Area. The rig arrived in the well field by 1120, and the drill rig derrick was set up on location 0653 by 1430 (the power to the electrical lines was double verified as off prior to set-up). Drilling began at 0654 on 1512, and the drill rig reached 15 ft bgs before the operation was shut down at approximately 1730. L. Glowiak, T. Meadows, and J. Ritchey covered drilling activities.

Tuesday, December 8, 2009
The safety meeting was held at 0700, and the topic of discussion was the overnight snow event; the workers were all briefed on the drilling foam material data safety sheets. After clearing the

snow off the equipment, drilling commenced on 0653 at 1030, and TD was measured at 44.5 ft bgs at 1400. The drillers had to drill slowly in order to prevent the bit from getting buried by the gravel cuttings. The well casing was installed at 1500 and was complete by 1545. At 1547, Zimmerman began to tremie in the primary filter pack. The site operations were complete at 1710. M. Zimmerman and K. Pill discussed the option of using a hammer bit to speed up the drilling. M. Zimmerman noted that he would pick up a hammer bit in Salt Lake City this weekend, and we will likely use that to complete the rest of the wells. L. Glowiak, T. Meadows, and K. Pill covered drilling activities.

Wednesday, December 9, 2009
The safety meeting was held at 0700, and the topic of discussion was working in the cold and rig safety. Very cold temperatures (near 0^{o}F in morning); took some time to get equipment thawed out and ready to go. Continued installing sand pack on 0653, finished at 1320, top of sand set at 5 ft bgs. Rig moved to 0652 location, had to move location about 1 foot closer to road, still within safe zone regarding utility lines. T. Cox updated the Integrated Work Plan (IWP) to include work under lights. Drilled down to about 20 ft bgs at 0652 and stopped for the night. Spent about 20 minutes developing 0653; sand pack did not drop during development. It was difficult working under the extreme cold conditions today, which caused a number of delays. T. Meadows and K. Pill covered drilling activities.

Thursday, December 10, 2009
Drillers on site at 0730, and safety meeting topic of discussion was working in the cold and rig safety. Very cold temperatures again (below 0^{o}F in morning); took some time to get equipment thawed out and ready to go. Well 0441 was checked to determine how quickly it recharges; water level at 49.05 below top of casing. Bailed out water and monitored recovery (could not dewater well using bailer). It appears that water is coming from screened interval (47 to 57 ft bgs) and not from deeper sandy gravel unit. Added cement and installed surface casing to well. Continued drilling 0652 from 20 ft bgs and hit 40 ft bgs by 1120. They reached the point where they would have to finish the well today or stop and complete drilling and installation when they return next week. Driller decided to stop work for the day; they returned to Salt Lake City for the weekend (will return Monday, December 14). It was difficult working under the extreme cold conditions today, which caused a number of delays. J. Ritchey and K. Pill covered drilling activities.

Monday, December 14, 2009
Drillers were on site at approximately 1300. After the daily inspections and filling the water truck, the drillers added a length of drill pipe to the rig. Around 1520, the threads on the drill pipe were shredded, and the drillers identified the need for a man-lift to safely remove the piece. RAC does not have a man-lift readily available, so the operation will commence tomorrow, assuming that a man-lift can be found in town. J. Ritchey and T. Meadows covered the drilling activities.

Tuesday, December 15, 2009
The IWP was updated to include a man-lift, and T. Cox briefed the TAC and Zimmerman crew on the Field Change Notice. A man-lift (rented from Grand Rentals) arrived on site at 0900 and was inspected by T. Cox. By 1000, the casing was repaired, and the man-lift operator left the site. Drilling commenced on 0652 at 1115 and was complete by 1200. The casing was set at 1300 with a TD of 39.5 ft bgs. By 1400, the tremie pipe was installed, and Zimmerman began pouring the sand pack. L. Glowiak and T. Meadows covered the drilling activities.

Wednesday, December 16, 2009
The crew was on site at 0645 for the safety meeting. The safety topic was counterfeit clamps and equipment inspections. T. Cox and D. Allen performed a safety check of the smaller well-development rig. During the inspection, they identified a hook that they wanted replaced on the actual drill rig. M. Zimmerman replaced the hook, and the rig mobilized to CF2 well 0651 by 1000. Drilling began at approximately 1300, and Zimmerman drilled to TD (45 ft bgs) at 1700. The last few feet were still hard to drill through with the new hammer bit, but it seemed to go a bit faster than the tri-cone bit. M. Zimmerman said that he might switch back to the tri-cone bit because with the hammer bit, the gravel fills in over the bit and creates a lot of pressure build up. L. Glowiak, T. Meadows, and R. Moran covered the drilling activities.

Thursday, December 17, 2009
The crew was on site at 0700 for the safety meeting. The drillers tagged the TD of well 0651 at 43.5 ft bgs. After the casing/screen was set, the primary filter pack was completed up to 5 ft bgs. A blow-out occurred at 8-10 ft bgs, so more sand had to be added than expected. The well will be surged tomorrow, and the secondary pack and bentonite chips will be added at that time. At 1330, the drill rig mobilized to CF2 well 0560 and began drilling at 1434. By 1600, the drillers had reached approximately 35 ft bgs. L. Glowiak and J. Ritchey covered the drilling activities.

Friday, December 18, 2009
The crew was on site at 0700 for the safety meeting. The drillers finished the last 5 feet of drilling on 0650 and tagged bottom at approximately 45 feet bgs. Screen was then set to 35 ft bgs. Blank casing was set from 35 ft bgs to the ground surface. Primary sand pack was then completed to 5 ft bgs. More sand was needed than expected due to another blow-out. The secondary pack was not installed because surging was to take place later to ensure proper settling of primary pack. The drill rig and water truck were then mobilized to location 0815 where the derrick was lifted and secured. Area was secured, and drillers departed through the well field with ground water staff escorting at 1550 hours. T. Meadows and J. Ritchey covered the drilling activities.

Saturday, December 19, 2009
The crew was on site at 0700 for the safety meeting. The drillers then started drilling on extraction well 0815 and drilled uninhibited to 47 feet. At that point, the last piece of casing was too big, so they had to run to Moab to find another piece. They returned and welded it together, saving the remainder of the drilling for the morning. Water was encountered at 15 to 17 ft bgs. The drillers also surged 0652 with primary sand pack at 6 ft bgs, secondary at 3 ft bgs, and bentonite to ground surface. T. Meadows and J. Ritchey covered the drilling activities.

Sunday, December 20, 2009
The crew was on site at 0700 for the safety meeting. The drilling crew finished drilling extraction well 0815 and tagged bottom at 50 ft bgs. Well was screened with stainless steel screen to 20 ft bgs. The primary sand pack was tremied to 17 ft bgs. The secondary was tremied to 14 ft bgs, and more primary was added to 6 ft bgs. On well 0560, primary sand pack was added to 5.5 ft bgs, secondary sand pack to 3 ft bgs, and bentonite to ground surface.
T. Meadows and J. Ritchey covered the drilling activities.

Monday, December 21, 2009
The drilling crew arrived at 0700 and held their own safety meeting. The drillers mobilized the rig to well 0814. After mobilizing, the drillers loaded some equipment onto the water truck in the

well field staging area and then left the site to fill the water tank on the water truck. No further drilling operations could be performed until Zimmerman returned with a particular piece of casing. The drillers left site at approximately 1000 and did not return to the site. No further drilling operations were performed. T. Meadows and J. Ritchey covered the drilling activities.

Tuesday, December 22, 2009
The drilling crew arrived at 0700 and held their own safety meeting. Completed drilling well 0814 down to 50 ft bgs; had to complete well with a TD of 42 ft bgs due to flowing sand unit encountered at about 45 ft bgs. Screen set 12 to 24 feet (42 feet**)**, sand pack up to 10 ft bgs. Mobilized to well 0810, drilled down to 35 ft bgs and ran out of daylight. Snowed for most of the day, about 4 inches accumulation. T. Meadows and J. Ritchey covered the drilling activities.

Wednesday, December 23, 2009
The drilling crew arrived at 0700 and held a safety meeting, discussing gloves and traffic. Completed drilling well 0810 down to 45 ft bgs; had to complete well with a TD of 40 ft bgs due to flowing sand unit encountered at about 45 ft bgs. Screen set 10 to 40 feet, sand pack up to 7 ft bgs. Wells 0815, 0814, and 0810 developed. Completed short-term aquifer test on 0814 and 0815; each had about 4 feet of drawdown after pumping 50-60 gpm for 15 minutes. Rig left 0811 location; development rig left in well field. Crew to return Monday, January 4 in the afternoon; will start drilling again on Tuesday January 5. K. Pill and J. Ritchey covered the drilling activities.

Monday, January 4, 2010
The drilling crew arrived at 1000 and performed safety checks and started up the equipment. By 1200 they were set up on new extraction well 0811. Drilling commenced at 1400, and the drillers reached TD by 1600. The lithology consisted of gravelly clays grading into silty gravel. The drillers left the site by 1630 and plan to construct well 0811 tomorrow. T. Meadows and L. Glowiak covered the drilling activities.

Tuesday, January 5, 2010
The drilling crew arrived at 0700 with the water truck and finished 0811 and tagged bottom at 45 ft bgs and commenced completion. After primary sand pack was installed, the drillers set up and started drilling on 0812. Water was encountered at approximately 15-17ft bgs. TD was reached at 45 ft bgs. T. Meadows and J. Ritchey covered the drilling activities.

Wednesday, January 6, 2010
The drillers arrived at 0700 and finished completion to primary sand pack on 0812. The drill rig then mobilized to 0813 and commenced drilling. Zimmerman then arrived and finished 0812 (surging, secondary sand pack, and bentonite). Water was encountered at approximately 17 ft bgs. Drilling continued uninterrupted to 45 ft bgs. T. Meadows and J. Ritchey covered the drilling activities.

Thursday, January 7, 2010
The drillers arrived at 0700 and finished the primary sand pack on 0813. Then they mobilized to 0816 and started drilling. Ground water was encountered at approximately 15 ft bgs. Zimmerman pump tested 0812. Total depth on 0816 was tagged at 50 ft bgs. T. Meadows and J. Ritchey covered the drilling activities.

Friday, January 8, 2010
The drillers arrived at 0700 and were briefed, along with L. Glowiak,T. Meadows, and J. Ritchey on the intrusive radiological work permit by T. Unrein. Then they completed primary sand pack on 0816 to 3 feet above screen. Then they mobilized the drill rig to 0454 and raised the derrick. The correct distance from the power lines was verified by TAC Safety, T. Cox. T. Meadows and J. Ritchey covered the drilling activities for the day.

Saturday, January 9, 2010
Zimmerman crew was on site for the 0700 meeting. We discussed the activities for the day and talked about minimizing tools in the Contamination Area on Sunday. From 0700 to 0900 the crew worked on equipment inspections, getting water, warming up the rig, and getting the 6-inch casing on the water truck. The drilling began on 0454 at 1015. Zimmerman noted that we hit water around 15 ft bgs. The sediments consisted of sandy silt and silty clay. At around 17 feet the cuttings were completely saturated (pudding consistency). By 1100, Zimmerman had drilled to 30 ft bgs, and we decided to let the water level adjust for about an hour. By 1300, the water level had raised to 12 ft bgs. We decided to set the screen from 10-20 ft bgs since it would cover the water level and the extremely saturated sediments that we had drilled through. The well construction was complete by 1530 with the primary sand pack at 6 ft 10-inches bgs, the secondary sand pack at 4 ft bgs, and bentonite chips at 1 ft bgs. Zimmerman pumped on some of the CF5 wells during the day. M. Zimmerman noted that well 0810 was dewatering at 30 feet and 100 gpm. At the end of the day he mentioned that at 60 gpm, the well had a couple feet of drawdown. L. Glowiak and J. Ritchey covered the drilling activities for the day.

Sunday, January 10, 2010
Zimmerman crew was on site for the 0700 meeting with T. Meadows. K. Pill arrived at 0820. Zimmerman working inside Contamination Area with T. Meadows. Zimmerman continued with well development. Rig moved into Contamination Area and started drilling well 0453 at about 1200. Hit water between 75 and 80 ft bgs, drilled down to 90 feet by 1335. Primarily silty sand; did not encounter significant gravel unit or bedrock block during the drilling. Could not measure water level (tape too short), decided to wait and complete well the next day. Talked with Zimmerman regarding their crew coming down the next morning to bring down pump for abandonment, and he will pick up a 10-foot length of 10 slot, will use to complete 0453 with the 16/30 as opposed to the 20 slot with 20/10 based on the lithology. Development of 0454 was difficult due to the screen slot size, did not significantly clean up. T. Meadows and K. Pill covered the drilling activities for the day.

Monday, January 11, 2010
Zimmerman on site for the 0700 meeting with T. Meadows, J. Ritchey, and K. Pill. Zimmerman had to wait on crew member to get back with 10-slot screen. Zimmerman working inside Contamination Area with K. Pill starting at about 1330; started completion of 0453. Depth to water was 72 ft bgs, hole open to 92 feet. Had them backfill with 10/20 sand to 80 feet, then set well with screen from 70 to 80 ft bgs using 16/30 sand. Installed sand pack over screen interval, then shut down for the day (daylight). Zimmerman continued with well development. T. Meadows, J. Ritchey, and K. Pill covered the drilling activities for the day.

Tuesday, January 12, 2010
Zimmerman on site at 0700 and entered the Contamination Area with T. Meadows to finish the completion of 0453. Completion resumed at 0930 after heating the water truck. The sand pack was installed as follows: 90-80 feet with 10/20, 80-60 feet with 16/30, 60-55 feet with 10/20,

55-50 feet with bentonite chips, 50-30 with 10/20, 30-ground surface with bentonite chips. Bentonite chips were then hydrated.

Zimmerman continued developing well 0652 at 0745. The pump intake was measured at 32 feet. At 1030, the turbidity was recorded at 28.3 nephelometric turbidity units (NTUs), and the depth to water was recorded at 32 feet below top of casing while pumping at approximately 70 gpm. The pump was then mobilized to well 0653. The initial depth to water was at 16.4 feet below top of casing. The pump was started at 1110 at a depth of 29 feet. At 1159, the well was pumping dry at 38 gpm. The pump was reset to a depth of 34 feet. At 1228, the well was again pumping dry at 25 gpm. The pump continued to run until an acceptable turbidity reading of 30.6 NTUs was recorded at 1304. Zimmerman also installed the concrete pad at observation well 0454. T. Meadows, J. Ritchey, and L. Glowiak covered the drilling activities for the day.

Wednesday, January 13, 2010
Zimmerman was on site at 0700. They entered the Contamination Area with T. Meadows and completed the concrete pad, steel upright, and well cap for the 0453. Then they finished abandonment of well 0442 by evacuating remaining water, cutting the top to 5 ft bgs, filling with bentonite chips, and pouring a concrete pad on the top. Drillers then mobilized drill rig and water truck to decontamination pad where it is currently awaiting decontamination. Zimmerman arrived on site at TP-08 at 0900 to abandon the well. The well was filled with bentonite chip to 5 ft bgs. Zimmerman then removed the top piece of PVC casing. Depth to water was recorded at 13.00 feet below top of casing prior to abandonment. T. Meadows and J. Ritchey covered the drilling activities for the day.

Thursday, January 14, 2010
Initially had problems determining if drillers can use RAC radiological work permit and IWP and who was allowed to work in decontamination area. Also had issues with available equipment for decontamination (sprayers moved to Support Area for cleaning off containers) and other Envirocon equipment waiting to be decontaminated (two scrapers were waiting for decontamination) ahead of rig and water truck. Drillers arrived and completed briefing on IWP and radiological work permit for decontamination. TAC arranged for sprayer to be used for decontamination purposes; rental had to come from Grand Junction. Arrived on site later in the day; no time to start work.

Friday, January 15, 2010
Could not get sprayer to start; not able to start decontamination of equipment. Drillers left site for the weekend.

Saturday, January 16, 2010
Another sprayer from Grand Junction delivered to site for decontamination.

Tuesday, January 19, 2010
Drillers arrived at 1300 hours and dressed in Access Control for decontamination preparation. Decontamination of their water truck started. Nothing was cleared by the end of the day**.**

Wednesday, January 20, 2010
Drillers arrived at 0700 hours and received clearance for their water truck. Decontamination of the drilling rig began, and received clearance at approximately 1200. Drillers mobilized their remaining supplies and water truck for Salt Lake City; due to return for their drill rig tomorrow.