

Document Tracking Number: 14C-2-29

RECORD OF UFPQAPP-SAP MODIFICATION

INSTRUCTIONS: This form is required anytime a modification is being made to any worksheets or sections for any portion of the Phase 1A SAP, including attachments, tables, figures, and/or SOPs.

Requestor: Kevin Lundmark
Title: ERM RI Task Lead
Name of Site / Field Event: US Magnesium / Site-wide Hydrologic Investigation
Date of Proposed Modification: 22 May 2017
Modified SAP Section(s): September 2013 OU-1 Phase 1A SAP Worksheet #14, Table 14-1, Figure 14-14, and other sections as required for total sample counts (Table 18-1 and Table 20-1)

Describe the Modification:

ERM will collect groundwater samples from five deeper zone monitoring wells to evaluate whether the deeper zone of shallow aquifer is impacted by groundwater COPCs or surface water COPCs/COPECs. Two of the monitoring wells are existing (installed in 2004) and the other three wells will be installed by US Magnesium in 2017 during a field program to resolve key data gaps for a Groundwater Discharge Permit (GWDP) Application (Stantec, 2017). ERM will also collect groundwater samples from one existing and one new shallow zone monitoring wells to provide baseline groundwater quality data for use in GWDP Application and as additional data points for evaluating nature and extent (N&E) of groundwater contaminants for the RI.

Groundwater samples will be collected by ERM following the requirements and procedures of the Final Phase 1A RI SAP (USEPA, 2013). Prior to sampling, the new monitoring wells will be developed and the existing monitoring wells will be re-developed. Well development/re-development will be performed as part of the GWDP data gaps field program following procedures that are equivalent to the well development procedures described in Standard Operating Procedure (SOP) USM-10, Monitoring Well Installation and Development.

The five deeper zone groundwater sampling locations are shown in Figure 14-C-2-29 and are listed in the following table consistent with Table 14-1 of the Phase 1A SAP:

| Sample Location ID | Sample Media | PRI Area ¹ | Figure Number | X ² | Y ² | Rationale |
|--------------------|--------------|-----------------------|---------------|----------------|----------------|---|
| MW-9 | Groundwater | 7 | 14C-2-29 | 1303820 | 7512001 | To collect samples of groundwater from existing wells screened in the deeper zone aquifer hydraulically downgradient of the Old Waste Pond for Site Characterization and to confirm that the deeper zone aquifer is not impacted by COPCs/COPECs. |
| MW-10 | Groundwater | 7 | 14C-2-29 | 1307700 | 7512137 | |

| Sample Location ID | Sample Media | PRI Area ¹ | Figure Number | X ² | Y ² | Rationale |
|--------------------|--------------|-----------------------|---------------|----------------|----------------|---|
| MW-21 | Groundwater | 6 | 14C-2-29 | 1302027 | 7508985 | To collect samples of groundwater from new wells screened in the deeper zone aquifer hydraulically downgradient of the Current Wastewater Pond for Site Characterization and to confirm that the deeper zone aquifer is not impacted by COPCs/COPECs. |
| MW-22B | Groundwater | 5 | 14C-2-29 | 1303120 | 7507925 | |
| MW-23 | Groundwater | 5 | 14C-2-29 | 1305111 | 7506550 | |
| PZ-13 | Groundwater | 5 | 14C-2-29 | 1305136 | 7506525 | To collect a sample of groundwater in the upper shallow zone for GWDP Application baseline water quality and for groundwater N&E for the RI. |
| MW-22A | Groundwater | 5 | 14C-2-29 | 1303100 | 7507945 | |

¹ - The PRI Area listed is where the monitoring well is located; all groundwater samples are part of PRI Area 17, Site-Wide Water.

² - X and Y Coordinates are U.S. State Plane, NAD 83, Utah North Zone (U.S. Survey Feet). Locations of new monitoring wells (MW-21, MW-22A/B, MW-23) are approximate; the final locations will be surveyed after the wells are installed. MW-21, MW-22A/B, and MW-23 will be installed by US Magnesium for the GWDP Application and will be located adjacent to existing monitoring wells PZ-8, PZ-10, and PZ-13, respectively. The locations of the new wells will be determined in the field in order to locate a safe drilling location and avoid installing wells in areas of potential future hydraulic barrier wall construction to avoid replacement installations (Stantec, 2017).

All data generated under this SAP modification will be uploaded to the RI/FS project database (EQuIS) in accordance with the September 2013 Final Data Management Plan. The results of groundwater sampling and analysis activities completed pursuant to this SAP Modification will be reported to USEPA in a standalone technical memorandum that will:

- Summarize samples collected;
- Include tables presenting analytical results for the subject samples;
- Include laboratory analytical reports and data validation reports;
- Include copies of field notes, sampling forms, and other relevant sample collection and tracking information;
- Identify any discrepancies between the actual procedures followed and the Phase 1A SAP; and
- Summarize and include as an attachment all EPA-approved field modification and additional SAP modification forms associated with collection and analysis of the subject samples.

The *Final Phase 1A Data Report for PRI Areas 2 and 8 through 17 and Surface Water Addendum* and associated data adequacy evaluations will not be revised to include these sample results, and the collection of this additional data will not necessitate an update to the OU-1 Screening Level Risk Assessment for COPC selection.

Justification or Reason for the Modification:

Deeper Zone Well Sampling

During the first site-wide hydrologic RI scoping meeting on 12 and 13 April 2017, ERM and USEPA agreed that the RI will initially consider a 3-layer conceptual model for the shallow groundwater system at the site: an upper shallow zone, a semi-confining deeper silty clay layer, and a deeper shallow zone. This is consistent with the conceptual site model and the proposed groundwater flow model being developed for a GWDP Application for a proposed hydraulic barrier wall engineering design (engineered hydraulic barrier wall) for the Current Wastewater Pond at the site. Under this current conceptual model, the deeper silty clay layer creates a confined condition in the deeper shallow zone and an upward vertical gradient between the

deeper and upper shallow zone. The continuity of the deeper silty clay and the magnitude of the vertical gradient in the vicinity of the current wastewater ponds are data gaps being addressed for the GWDP Application.

Groundwater samples from the deeper zone aquifer were not collected during the 2014 – 2015 Phase 1A RI groundwater sampling program. As agreed to during the scoping meeting, RI characterization requirements for the deeper zone (below the deeper silty clay) will be contingent on sampling and analysis results from the deeper zone groundwater for COPCs/COPECs as follows:

- If the deeper shallow zone is shown to not be impacted through the data collection and analysis of deeper zone groundwater samples from existing wells MW-9 and MW-10 and new monitoring wells MW-21, MW-22B, and MW-23, then only limited characterization of the deeper shallow zone will be required for the RI.
- If the deeper shallow zone is shown to be impacted, then further evaluation may be required to evaluate whether there is a potential exposure pathway for contaminants in groundwater in the deeper shallow zone.

The screen intervals for the existing deeper zone wells and the proposed screen intervals for the new deeper zone monitoring wells will be adequate to evaluate for impacts to the deeper zone via downward migration of COPCs/COPECs from the shallow zone aquifer beneath the Current Wastewater Pond and Old Waste Pond for the following reasons:

- Well MW-9 is screened from 59 to 69 feet below ground surface (bgs) in silty sand/fine-grained sand that is oolitic in part. The deeper silty clay was encountered from about 38 to 54 feet bgs at this location and is underlain by a 5-foot layer of silt/sandy silt/clayey silt. Well MW-9 is therefore screened within the first water-bearing zone beneath the silty clay.
- Well MW-10 is screened from 68 to 78 feet bgs in fine-grained sand interbedded with silt and clay. The deeper silty clay was encountered from 48 to 68 feet bgs at this location. Well MW-10 is screened immediately below the bottom of the silty clay.
- Wells MW-21, MW-22B, MW-23 will be screened across the first water-bearing zone encountered below the confining silty clay unit. To allow for the sand pack, the ten-foot screens are expected to begin approximately two feet below the silty clay unit; however, the actual screened interval for each well will be based on observed lithologies as determined in the field by the US Magnesium GWDP contractor (Stantec) with field consultation from USEPA and UDEQ.

Boring and well completion logs for wells MW-9 and MW-10 and a typical construction detail for new wells MW-21, MW-22B, MW-23 are included as an attachment to this SAP Modification Request.

Upper Shallow Zone Well Sampling

One round of groundwater samples with complete analysis (including the full list of organic and inorganic constituents identified in Phase 1A SAP Worksheet 15) is required for existing well PZ-13 and new well MW-22A to evaluate baseline groundwater conditions for the GWDP Application. These analytical results will also be used for evaluating nature and extent of groundwater contaminants for the RI.

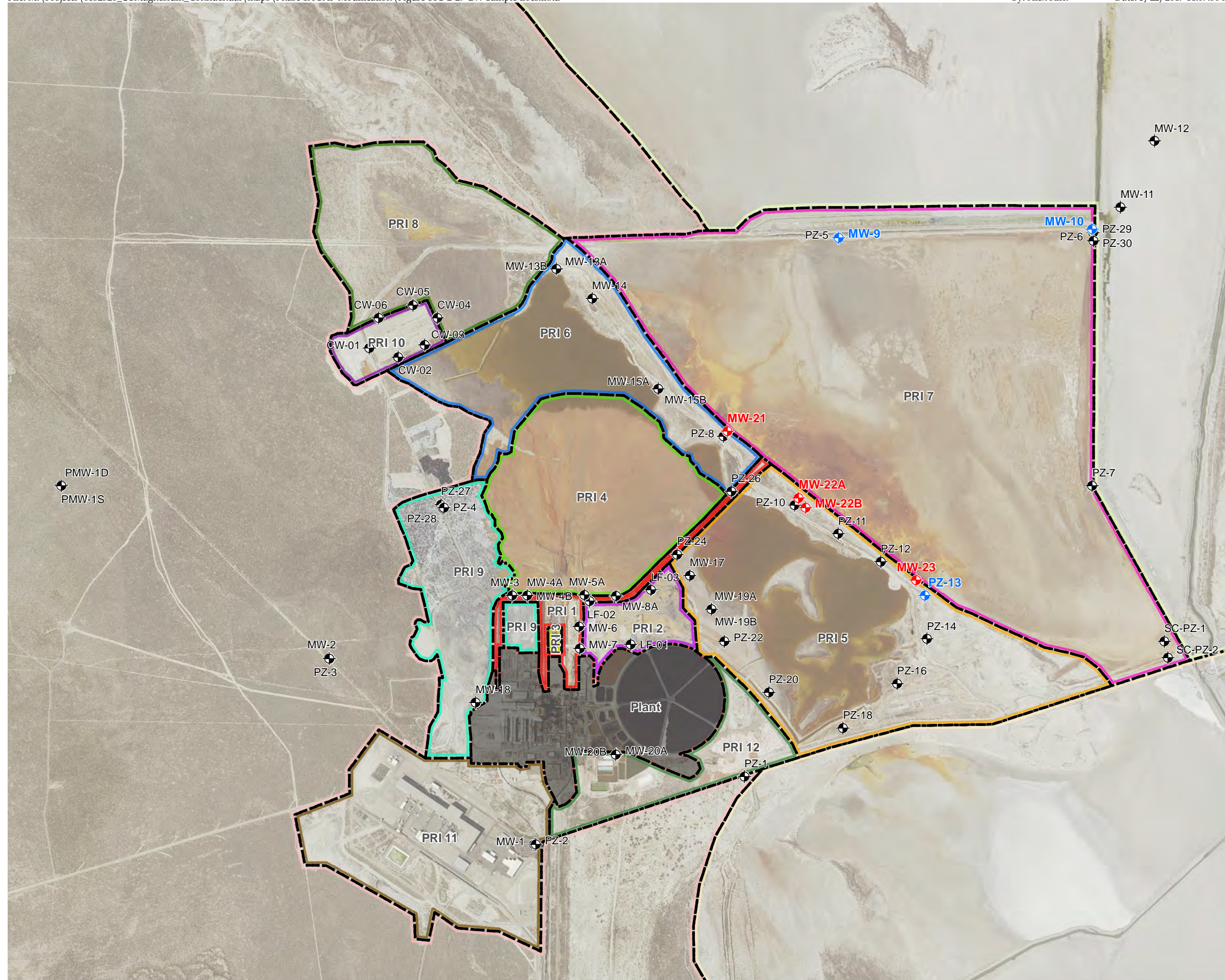
A set of ten wells will be used to establish baseline conditions for the GWDP Application, including six existing shallow-zone wells (MW-13B, MW-15B, PZ-8, PZ-10, PZ-12, and PZ-13) and four new wells to be installed to address GWDP Application data gaps (MW-21, MW-22B, and MW-23 in the deeper zone and MW-22A in the shallow zone). One round of complete groundwater analysis is required for each well for the GWDP Application. For these ten wells, one round of complete groundwater analyses is available for existing wells MW-13B, MW-15B, PZ-8, PZ-10, and PZ-12 from the 2014 Phase 1A RI. New deeper zone wells MW-21, MW-22A, and MW-23 will be sampled and analyzed by ERM as described above. The single round

of sampling and complete analysis for shallow zone wells PZ-13 and MW-22A will be performed by ERM at the same time that deeper zone groundwater samples are collected.

Additional rounds of baseline sampling for the GWDP Application at all ten wells will include inorganic analyses only and will be performed by Stantec.

EPA Review/Approval: _____ **Date:** _____
(RPM or designee)

Each approved UFPQAPP-SAP Modification Form will become part of Attachment 17B in the Phase 1A Final SAP and also incorporated into the appropriate RI Results Report. A copy is to be provided to all recipients identified on SAP Worksheet #3.



Legend

- ◆ New GWDP Well To Be Sampled Under This SAP Mod
- ◆ Existing Well To Be Sampled Under This SAP Mod
- ◆ Other Existing Well/Piezometer
- Preliminary Remedial Investigation Areas
- PRI 1: Ditches
- PRI 2: Landfill
- PRI 3: Sanitary Lagoon
- PRI 4: Gypsum Pile
- PRI 5: Southeast Poned Waste Lagoon
- PRI 6: Northwest Poned Waste Lagoon
- PRI 7: Northeast Poned Waste Lagoon
- PRI 8: Northwest Poned Waste Lagoon Overflow
- PRI 9: Smut Area
- PRI 10: Barium Sulfate Area
- PRI 11: ATI Titanium and USM Parking Lots
- PRI 12: Ancillary Worker Exposure Areas
- PRI 13: Buffer Area North & East
- PRI 14: Buffer Area South
- PRI 15: Buffer Area West
- Operating Facility

Notes:
 GWDP = Groundwater Discharge Permit
 All boundaries approximate, originally provided by EPA
 Revised Buffer Areas - April 2012.
 Aerial Photo: NAIP (USDA) 2014

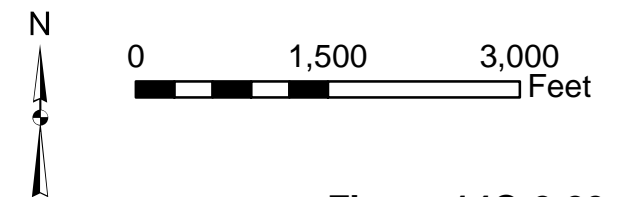


Figure 14C-2-29
 Groundwater Sampling Locations
 Phase 1A SAP Modification 14C-2-29
 US Magnesium LLC
 Tooele County, Utah



Phase 1A SAP Modification 14C-2-29

Attachment 1

*Boring and Well Completion Logs for Monitoring Wells MW-9 and
MW-10*

MONITORING WELL LOG FORM

4270163.010103

| | | |
|---|--|---|
| <p>BORING LOCATION</p> <p style="text-align: center;">Old Waste Pond</p> | Project: <u>ASVM</u> Project No: _____ | Boring ID: <u>MW-9</u> |
| | Date Drilled: <u>4/12/04</u> Date Completed: <u>4/12/05</u> | Northing: <u>14872254.57</u> Easting: <u>11686691</u> |
| | Logged By: <u>B. Braden</u> | Ground Surface Elevation (ft.): <u>4211.29</u> |
| | Water Elevation (ft.): <u>4207.96</u> | Measuring Point (MP) Elevation (ft.): <u>Ground</u> MP is Top of PVC Casing Datum: NGVD (1929) |
| Date Measured: <u>5/6/04</u> | Total Depth (ft.): <u>90'</u> | Drilling Contractor: <u>Layne</u> |
| Diameter (in.): <u>4"</u> | Diameter (in.): <u>4"</u> | Drilling Method: <u>Recessed Hammer</u> |
| Screen: Diameter <u>4"</u> Depth <u>59-69</u> Slot Size <u>0.010</u> | Casing: Diameter <u>4"</u> Length <u>42-59</u> Type <u>Pvc</u> | Sand <u>53-75</u> Bentonite Seal <u>1-55</u> Cement Grout Seal _____ |

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICATION | GRAPHIC LOG | LITHOLOGIC DESCRIPTION (USCS name; color, size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|--------------|-----------------|--------------------------|-------------|---|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | | |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | c/s | | Fill material of mixtures of silty clay and fine to medium sand. moderate yellowish brown 10VR S/4, slightly moist. | |
| 3 | | | | | | | | SM/SL | | silty fine sand and clayey fine to medium sand, sand is subangular light olive gray 5Y 6/1, slightly plastic to low plasticity locally. stiff, slightly moist | |
| 4 | | | | | | | | | | | |

M366297

PROJECT NO. 4270163.010101.ai 03/04/03 SLG

- * C California Split Spoon Sampler (2.5" I.D.)
- S Standard penetration test sampler
- c Cuttings
- ▼ Elevation of ground water

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|-------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | 60 | 40 | 0 | | | | | GP | | fine to coarse sandy fine & coarse gravel, very light gray N8 to white N9 subangular to angular, dense, wet weak sulfur odor | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 11 | | | | | | | | | | | |
| 12 | 10 | 90 | 0 | | | | | SP | | fine to medium sand w/ fine gravel light gray N7, subangular to sub rounded, wet dense | |
| 13 | 60 | 40 | 0 | | | | | SP/SP | | AS Above w/ increase in fine gravel to SP/GP | |
| 13 | 0 | 0 | 100 | | | | | CL | | silty clay, olive gray 5Y4.5, medium plasticity wet, stiff, sulfur odor | |
| 13 | 0 | 90 | 10 | | | | | SP | | fine sand w/ some medium sand, medium dark gray N4, wet, dense, weak sulfur odor | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |

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M366298

PROJECT NO. 4270106.010101.ai.03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|-------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | | |
| 5 | 0 | 0 | 100 | | | | | SM | | Increase in silt to sm | |
| 6 | | | | | | | | | | medium light gray NO 8 and light olive gray 5Y 6/1 interbedded, non plastic, dense, wet, strong sulfur odor | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |
| 21 | | | | | | | | | | | |
| 22 | | | | | | | | | | | |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |

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--- cl
 --- cl w/ few greenish gray 5Y 6/1 partings
 --- cl cl - silty clay, medium plasticity
 --- cl

M366299

PROJECT NO. 4270106.010101.ai 02/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID | READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ Boring ID.: <u>MW-9</u> | ELEVATION (FEET) |
|--------------|------------|--------|---------|----------|---------------|---------------|-------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | | | |
| 25 | | | | | | | | | SM | | | |
| 26 | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | |

— c w/ clay partings, greenish gray 56Y6/1

— cc w/ few clay partings, greenish gray medium plasticity, silty, sulfur odor greenish gray 56Y6/1

— cc w/ few clay partings, greenish gray 56Y6/1
— cc

grades to slightly moist to moist

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M366300

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|-------------|-----------------|------------------------|-------------|---|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | Boring ID.: <u>MW-9</u> | |
| 35 | | | | | | | | SM | | LITHOLOGIC DESCRIPTION (USCS name; color, size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 36 | 0 | 0 | 100 | | | | | | | SM AS ABOVE | |
| 37 | 0 | 70 | 30 | | | | | CL | | silty clay, greenish gray 5644/1 slow to medium plasticity, stiff moist, sulfur odor w/ moderate yellowish brown 104R5/4 molding, sulfur odor | |
| 38 | | | | | | | | | | | |
| 39 | | | | | | | | CL | | silty clay, greenish gray 5644/1 medium plasticity, stiff to very stiff, moist, sulfur odor. | |
| 40 | 0 | 60 | 40 | | | | | SM | | SM silty fine sands, as below @ 41.7' | |
| 41 | | | | | | | | CL | | | |
| 42 | 0 | 60 | 40 | | | | | SM | | SM silty fine sand greenish gray 5644/1 wet, dense, sulfur odor clay as above @ 38' | |
| 43 | | | | | | | | CL | | | |
| 44 | | | | | | | | | | | |
| 45 | | | | | | | | | | | |

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M366301

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIF. CAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|--|------------------------|---------------|-------------|-----------------|-------------------------|-------------|---------------------------------------|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | | Boring ID.: <u>MW-9</u> | |
| 45 | | | | | | | | | | | | |
| 46 | | | | | | | | | | | | |
| 47 | | | | | | | | | | | | |
| 48 | | | | | | | | | | | | |
| 49 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| 51 | | | | | | | | | | | | |
| 52 | | | | | | | | | | | | |
| 53 | | | | | | | | | | | | |
| 54 | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | |

U
 silty clay, greenish gray 5G4/1
 medium plasticity, stiff to very stiff
 moist, sulfur odor
 w/ Moderate yellowish brown 10YR5/4
 mottling
 sm (1/4") silty fine sand, olive gray 5Y4/1
 ✓
 ✓
 M/pe
 clayey silt, greenish gray 5G6/1 and
 olive gray 5Y4/1 layers, low to medium
 plasticity, stiff to very stiff, moist
 sulfur odor
 ✓

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M366302

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|--------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | Boring ID: <u>MW9</u> | |
| 55 | | | | | | | | ML | | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| | | | | | | | | | | ML as above | |
| 56 | | | | | | | | | | | |
| | | | | | | | | | | Increase in clay to CL/ML medium plasticity | |
| 57 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 59 | 10 | 70 | 20 | | | | | SM | | silty fine sand with fine gravel, dark greenish gray 564 #11, angular, NP dense, wet, subplastic | |
| | | | | | | | | CL | | CL AS ABOVE | |
| | | | | | | | | SM | | SM AS ABOVE, no gravel | |
| 60 | | | | | | | | | | SM & CL AS ABOVE | |
| 61 | | | | | | | | CL | | silty clay | |
| | | | | | | | | SM | | silty fine sand | |
| 62 | | | | | | | | CL | | silty clay | |
| | | | | | | | | | | silty fine sand | |
| 63 | | | | | | | | SM | | collected TOC & neutralization potential 60-65' @ 1745 4/12/04 | |
| | | | | | | | | CL | | silty clay | |
| 64 | | | | | | | | SM | | silty fine sand w/ a few fine angular gravel | |
| | | | | | | | | CL | | silty clay | |
| 65 | | | | | | | | SM | | silty fine sand | |

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M366303

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|-------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 65 | | | | | | | | | | | 413 ↓ |
| 66 | 0 | 0 | 100 | | | | | ML/CL | | Silty clay / clayey silt interbedds greenish gray 56Y 6/1, low to medium plasticity stiff to very stiff, strong sulfur odor | |
| 67 | 0 | 70 | 30 | | | | | SM | | grades to med. dark gray M, moist silty fine sand, olive gray 5Y 4/1, non plastic dense, wet, sulfur odor | |
| | | | | | | | | ML/CL | | ML/CL AS Above | |
| | 10 | 70 | 20 | | | | | SM | | AS Above with few angular ^{fine} gravel | |
| 68 | | | | | | | | ML | | clayey silt, greenish gray 56Y 6/1 low to medium plasticity, stiff moist, sulfur odor | |
| 69 | | | | | | | | | | | |
| 70 | | | | | | | | ML/CL | | | |
| 71 | 0 | 70 | 30 | | | | | SM | | SM silty fine sand, greenish gray 56Y 6/1 non plastic dense, wet, sulfur odor | |
| | 0 | 0 | 100 | | | | | ML/CL | | | |
| 72 | | | | | | | | | | | |
| 73 | | | | | | | | | | | |
| 74 | | | | | | | | | | grades to greenish black 56Y 2/1 and dark greenish gray 56Y 4/1 low to medium plasticity, moist sulfur odor | |
| 75 | | | | | | | | | | | |

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M366304

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|--------------|-----------------|------------------------|------------------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 75 | | | | | | | | ML/A | | | |
| 76 | | | | | | | | | | sm silty fine sand, olive gray 54 & 11 wet, dense, non plastic | |
| 77 | | | | | | | | ML | | silt and clayey silt interbedded olive gray 54 & 11, low plasticity wet stiff to very stiff sulfur odor | |
| 78 | | | | | | | | | Δ Δ Δ Δ Δ Δ Δ | w/ gypsum xtals or Halite | |
| 79 | | | | | | | | sm ML Δ Δ | | silt and silty fine sand medium gray NS, non plastic, dry dense, wet, sulfur odor | |
| 80 | | | | | | | | | | w/ few gypsum xtals. | |
| 81 | | | | | | | | CL | | Silty clay, greenish gray 56 611 moist, medium plasticity sulfur odor, dry stiff to very stiff | |
| 82 | | | | | | | | | Δ | | |
| 83 | | | | | | | | | | w/ few ^{gypsum} xtals as above | |
| 84 | | | | | | | | | Δ Δ | | |
| 85 | | | | | | | | | Δ | | |

CONFIDENTIAL SETTLEMENT COMMUNICATIONS SUBJECT TO FED R. EVID. 408

M366305

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|-------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 88 | 0 | 0 | 100 | | | | | CL | | | |
| | | | | | | | | | | | |
| 86 | | | | | | | | | | | |
| | | | | | | | | | | | |
| 87 | | | | | | | | | | | |
| | | | | | | | | | | | |
| 88 | 0 | 10 | 40 | | | | | | SM | | |
| | | | | | | | | | | | |
| 89 | | | | | | | | CL | | | |
| | | | | | | | | | | | |
| 90 | | | | | | | | | | | |
| | | | | | | | | | | | |
| 91 | | | | | | | | | | | |
| | | | | | | | | | | | |
| 92 | | | | | | | | | | | |
| | | | | | | | | | | | |
| 93 | 0 | 70 | 30 | | | | | CL | | | |
| | | | | | | | | SM | | | |
| 94 | | | | | | | | CL | | | |
| | | | | | | | | | | | |
| 95 | | | | | | | | | | | |

CONFIDENTIAL SETTLEMENT COMMUNICATIONS SUBJECT TO FED R. EVID. 408

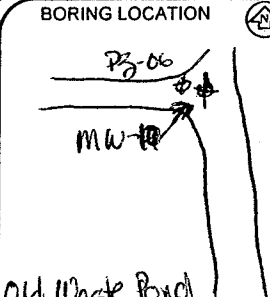
grades to olive gray 5Y 4/1
 silty fine to medium sand, olive gray 5Y 4/1, wet, dense, NP; sulfur odor
 silty clay, olive gray 5Y 4/1 medium plasticity, stiff to very stiff, moist, strong sulfur odor

TD 95'

M366306

MONITORING WELL LOG FORM

4270163.010103

| | | |
|--|--|--|
| BORING LOCATION  | Project: <u>USM</u> Project No: _____ | Boring ID: <u>MW-10</u> |
| | Date Drilled: <u>4/14/04</u> Date Completed: <u>4/15/04</u> | Northing: <u>4872367.41</u> Easting: <u>1167747.38</u> |
| | Logged By: <u>B. Bragdon</u> | Ground Surface Elevation (ft.): <u>4210.61</u> |
| | Water Elevation (ft.): <u>4203.7</u> | Measuring Point (MP) Elevation (ft.): <u>Ground</u> |
| | Date Measured: <u>5/6/04</u> | MP is Top of PVC Casing Datum: <u>NGVD (1929)</u> |
| | Total Depth (ft.): <u>80</u> | Drilling Contractor: <u>Layne</u> |
| Diameter (in.): <u>2"</u> | Drilling Method: <u>Percussion Hammer</u> | |
| Screen: Diameter <u>4"</u> Depth <u>68-78</u> Slot Size <u>0.010</u> | Casing: Diameter <u>4"</u> Length <u>42-68</u> Type <u>PVC</u> | Sand <u>63-80</u> Bentonite Seal <u>1-63</u> Cement Grout Seal _____ |

| DEPTH (FEET) | GRAIN SIZE | | | | MAX. PID READING (ppm) | BLOWS (8 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICATION | GRAPHIC LOG | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|--------------|------------|--------|---------|--|------------------------|---------------|--------------|-----------------|--------------------------|---|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | | | |
| 1 | | | | | | | | | | Fill material 0-5' mixture of: 1) silty clay (CL) light olive gray 5Y 6/1, medium plasticity, stiff, moist 2) fine sand (SP) light olive gray 5Y 6/1 to moderate reddish brown 10R 4/6, NP, dense, moist 3) fine to coarse sandy fine gravel w/ gypsum xtals, moderate reddish brown 10R 4/6, dense moist. | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |

CONFIDENTIAL SETTLEMENT COMMUNICATIONS SUBJECT TO FED R. EVID. 408

M366308

PROJECT NO. 4270106.010101.ai 03/04/03_SLC

- * C California Split Spoon Sampler (2.5" I.D.)
- S Standard penetration test sampler
- c Cuttings
- ▼ Elevation of ground water

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>NSM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|---|------------------------|---------------|-------------|-----------------|------------------------|-------------|--|--|
| | % GRAVEL | % SAND | % FINES | | | | | | | | Boring ID: <u>MW-10</u> | |
| 5 | 0 | 90 | 10 | 0 | | | | SP | | | <p>LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)</p> | |
| 6 | | | | | | | | | | | | <p>fine sand w/ trace silt light olive gray 5Y 6/1, non plastic dense, wet, weak sulfur odor</p> |
| 7 | | | | | | | | | | | <p>grades to dark greenish gray 5Y 4/1 with strong sulfur odor</p> | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | <p>grades to very light gray 10E</p> | |
| 10 | | | | | | | | | | | | |
| 11 | 0 | 100 | 0 | 0 | | | | CL | | | <p>salty clay green, dark greenish gray 5Y 4/1, medium plasticity stiff to very stiff, slightly moist to moist, sulfur odor</p> | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | |
| 14 | 0 | 15 | 100 | 0 | | | | ML | | | <p>silt/clayey silt, light ^{olive} gray gray 5Y 6/1, wet, slightly to low plasticity, stiff, sulfur odor</p> | |
| 15 | | | | | | | | | | | <p>few partings of brownish gray 5YR 4/1 organic odor and grayish black 5YR 2/1</p> | |

CONFIDENTIAL SETTLEMENT
COMMUNICATIONS SUBJECT
TO FED R. EVID. 408

M366309

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>WSM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|--------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color, size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 15 | | | | | | | | | | | |
| 16 | | | | | | | | ML | | | |
| 17 | | | | | | | | | | | |
| 18 | AD | W | LS | | | | | SP/LS | | | |
| 19 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |
| 21 | | | | | | | | | | | |
| 22 | U | W | LS | | | | | SP | | | |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |

? contact for ML SP/GP estimated.

fine to coarse sand and fine and coarse gravel, light olive gray 54 5/2 to yellowish gray 54 7/3, angular non plastic, dense, wet, sulfur odor.

"oolitic sand"

grades to fine to medium sand light gray N7, wet, dense to very dense, some grains are white N9 to very light gray N8

w/ few coarse gravel, angular

CONFIDENTIAL SETTLEMENT COMMUNICATIONS SUBJECT TO FED R. EVID. 408

M366310

PROJECT NO. 4270106.010101.ai 03/04/03 SLC


| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|--------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 25 | | | | | | | | | | | |
| 26 | | | | | | | | | | oolitic sand as above very dense. | |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | w/ few angular coarse gravel | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | oolitic sand | |
| 34 | | | | | | | | | | grades to silty fine sand, olive gray 54 4/11, dense, wet, sulfur odor | |
| 35 | | | | | | | | | | | |

CONFIDENTIAL SETTLEMENT COMMUNICATIONS SUBJECT TO FED R. EVID. 408

F

M366311

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>CSM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|--------------|-----------------|------------------------|---|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color, size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 35 | | | | | | | | SM | | silty fine sand, dark greenish gray 50 4/1 dense, wet, sulfur odor | |
| 36 | | | | | | | | GP |  | w/ some fine and coarse gravel | |
| 37 | | | | | | | | SM | | cu silty clay, low to medium plasticity dark greenish gray 50 4/1, wet, sulfur odor | |
| 38 | 0 | 60 | 40 | | | | | | | silty fine sand greenish gray 50 6/1 wet, dense, sulfur odor | |
| 39 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |
| 41 | | | | | | | | SM | | SM as above | |
| 42 | | | | | | | | | | | |
| 43 | | | | | | | | | | cu w/ thin interbeds of silty clay cu (≈ 1/8 - 1/4" thick) | |
| 44 | 0 | 15 | 10 | | | | | cu | | silty clay, greenish gray 50 6/1 medium plasticity, stiff to very stiff, moist, sulfur odor | |
| 45 | | | | | | | | | | | |

CONFIDENTIAL SETTLEMENT COMMUNICATIONS SUBJECT TO FED R. EVID. 408

M366312

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|--------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 45 | 0 | 60 | 40 | | | | | SM | | silty fine sand, greenish gray 5 & 6/11 wet, dense, sulfur odor, nonplastic | |
| 46 | | | | | | | | | | | |
| 47 | | | | | | | | | | cl with 1/16" clay partings cl | |
| 48 | 0 | 15 | 100 | | | | | CL | | Silty clay, greenish gray 5 & 6/11 medium plasticity, stiff to very stiff moist, sulfur odor | |
| 49 | | | | | | | | | | | |
| 50 | 0 | 0 | 100 | | | | | CL | | wi few gypsum x'tals | 4114.8 4115.0 |
| 51 | 0 | 0 | 100 | | | | | CL | | silty clay, greenish gray 5 & 6/11 medium plasticity, stiff, moist sulfur odor | |
| 52 | 0 | 0 | 100 | | | | | ML | | silt slightly plastic, greenish gray 5 & 6/11 wet, sulfur odor, stiff | |
| 53 | 0 | 0 | 100 | | | | | CL | | silty clay CL AS Above | |
| 54 | 0 | 0 | 100 | | | | | ML | | silt ML AS Above | |
| 55 | 0 | 0 | 100 | | | | | CL | | silty clay CL AS Above | |

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M366313

PROJECT NO. 4270106.010101.ai 03/04/03 SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|-----------------|------------|--------|---------|---------------------------|---------------|--------------|--------------------|---------------------------|-------------|---|---------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | |
| 55 | 0 | 0 | 100 | 0 | | | | CL | | | |
| 56 | | | | | | | | | | Silty clay greenish gray 56-61 medium plasticity, vugy locally with water in vugs, moist, stiff weak sulfur odor. | |
| 57 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 59 | | | | | | | | | | | |
| 60 | | | | | | | | CL | | CL As Above | |
| 61 | | | 0 | | | | | | | | |
| 62 | | | | | | | | | | | |
| 63 | | | | | | | | | | | |
| 64 | | | | | | | | | | | |
| 65 | | | | | | | | | | | |

CONFIDENTIAL SETTLEMENT
COMMUNICATIONS SUBJECT
TO FED R. EVID. 408

M366314

PROJECT NO. 4270106.010101.ai_03/04/03_SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE* | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | Project: <u>USM</u> Project No: _____ | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|--------------|-----------------|------------------------|-------------|---------------------------------------|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | Boring ID.: <u>VNW-10</u> | |
| 65 | 0 | 0 | 100 | | | | | | | | |
| 66 | | | | | | | | | | | |
| 67 | | | | | | | | | | | |
| 68 | | | | | | | | | | | |
| 69 | | | | | | | | | | | |
| 70 | | | | | | | | | | | |
| 71 | | | | | | | | | | | |
| 72 | | | | | | | | | | | |
| 73 | | | | | | | | | | | |
| 74 | 0 | 60 | 40 | | | | | | | | |
| 75 | | | | | | | | | | | |

CL
 silty clay, greenish gray 5661
 medium plasticity, stiff to very
 stiff, moist with wet lugs

sm grades to CL as above with
 sm partings silty fine sand partings
 and up to 1/2", light olive
 gray 5461 to Brownish
 gray 54R 4/1, wet
 at partings, weak
 sulfur odor

CL A
 A
 few gypsum x'tals

sm partings
 sm silty fine sand as below @ 73'

sm
 silty fine sand, greenish gray
 56461, wet, dense, sulfur odor
 non plastic.

CONFIDENTIAL SETTLEMENT
 COMMUNICATIONS SUBJECT
 TO FED R. EVID. 408

M366315

PROJECT NO. 4270106.010101.ai_03/04/03_SLC

| DEPTH (FEET) | GRAIN SIZE | | | MAX. PID READING (ppm) | BLOWS (6 IN.) | SAMPLE TYPE | SAMPLE RECOVERY | USCS/ASTM CLASSIFICAT. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts) | ELEVATION (FEET) |
|--------------|------------|--------|---------|------------------------|---------------|-------------|-----------------|------------------------|-------------|--|------------------|
| | % GRAVEL | % SAND | % FINES | | | | | | | | |
| 75 | | | | | | | | SM | | SM AS ABOVE | |
| 76 | 0 | 100 | 0 | | | | | CL | | silty clay, greenish gray 56/61 medium plasticity, stiff to very stiff, moist to wet locally | |
| 77 | 0 | 15 | 85 | | | | | ML/CL | | grades to clayey silt, moist low plasticity, sulfur odor | |
| 78 | 0 | 60 | 40 | | | | | SM | | SM silty fine sand, greenish gray 56/61, wet, sulfur odor dense | |
| 78 | 0 | 0 | 100 | | | | | CL | | CL AS ABOVE | |
| 79 | | | | | | | | | | | |
| 80 | | | | | | | | | | collected TOC & Neutralization Potential 73-75 SM and 76-78 CL @ 1015 @ 949 TD 80' both 4/15/04 | |
| 11 | | | | | | | | | | | |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |

CONFIDENTIAL SETTLEMENT COMMUNICATIONS SUBJECT TO FED R. EVID. 408

M366316

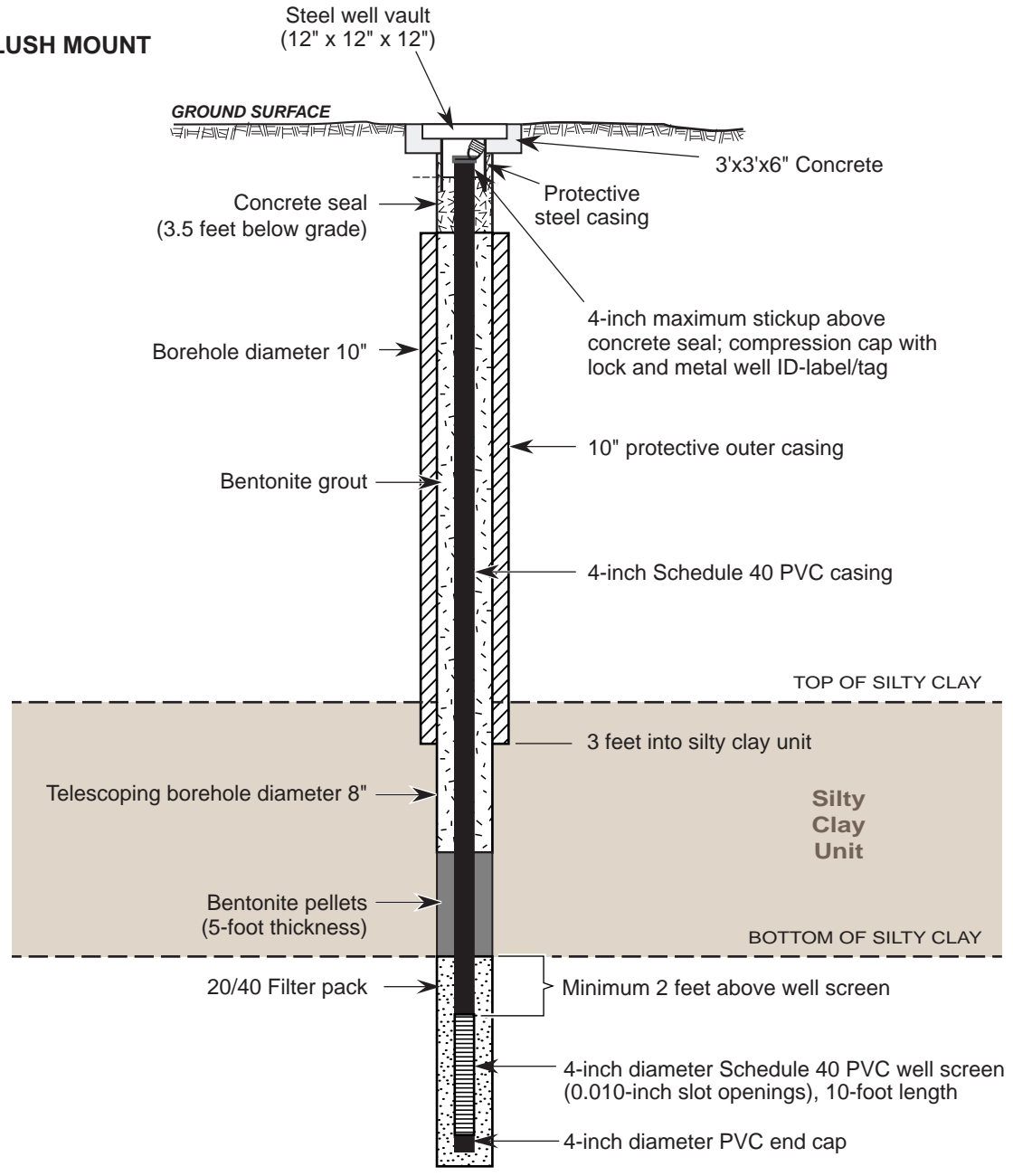
Phase 1A SAP Modification 14C-2-29

Attachment 2

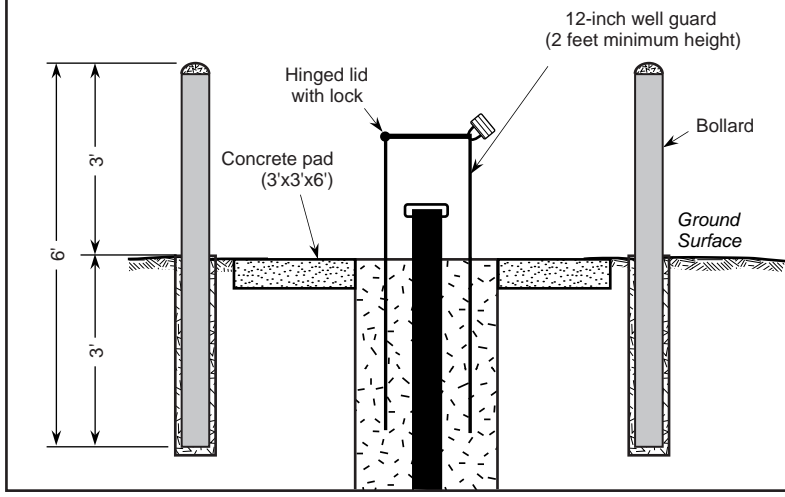
Typical Construction Detail for New Wells MW-21, MW-22B, and MW-23

Source: 2 May 2017 US Magnesium Groundwater Discharge Permit Application Preparation - Field Data Collection Work Plan. Prepared by Stantec for US Magnesium LLC.

FLUSH MOUNT



STICK-UP MOUNT (OPTION)



NOT TO SCALE



CONSTRUCTION DETAILS FOR
FOUR-INCH DIAMETER
MONITORING WELLS

Figure 2-2

Document Tracking Number: 14C-2-29

RECORD OF UFPQAPP-SAP MODIFICATION

INSTRUCTIONS: This form is required anytime a modification is being made to any worksheets or sections for any portion of the Phase 1A SAP, including attachments, tables, figures, and/or SOPs.

Requestor: Kevin Lundmark
Title: ERM RI Task Lead
Name of Site / Field Event: US Magnesium / Site-wide Hydrologic Investigation
Date of Proposed Modification: 22 May 2017
Modified SAP Section(s): September 2013 OU-1 Phase 1A SAP Worksheet #14, Table 14-1, Figure 14-14, and other sections as required for total sample counts (Table 18-1 and Table 20-1)

Describe the Modification:

ERM will collect groundwater samples from five deeper zone monitoring wells to evaluate whether the deeper zone of shallow aquifer is impacted by groundwater COPCs or surface water COPCs/COPECs. Two of the monitoring wells are existing (installed in 2004) and the other three wells will be installed by US Magnesium in 2017 during a field program to resolve key data gaps for a Groundwater Discharge Permit (GWDP) Application (Stantec, 2017). ERM will also collect groundwater samples from one existing and one new shallow zone monitoring wells to provide baseline groundwater quality data for use in GWDP Application and as additional data points for evaluating nature and extent (N&E) of groundwater contaminants for the RI.

Groundwater samples will be collected by ERM following the requirements and procedures of the Final Phase 1A RI SAP (USEPA, 2013). Prior to sampling, the new monitoring wells will be developed and the existing monitoring wells will be re-developed. Well development/re-development will be performed as part of the GWDP data gaps field program following procedures that are equivalent to the well development procedures described in Standard Operating Procedure (SOP) USM-10, Monitoring Well Installation and Development.

The five deeper zone groundwater sampling locations are shown in Figure 14-C-2-29 and are listed in the following table consistent with Table 14-1 of the Phase 1A SAP:

| Sample Location ID | Sample Media | PRI Area ¹ | Figure Number | X ² | Y ² | Rationale |
|--------------------|--------------|-----------------------|---------------|----------------|----------------|---|
| MW-9 | Groundwater | 7 | 14C-2-29 | 1303820 | 7512001 | To collect samples of groundwater from existing wells screened in the deeper zone aquifer hydraulically downgradient of the Old Waste Pond for Site Characterization and to confirm that the deeper zone aquifer is not impacted by COPCs/COPECs. |
| MW-10 | Groundwater | 7 | 14C-2-29 | 1307700 | 7512137 | |

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p. 1 of 27

| Sample Location ID | Sample Media | PRI Area ¹ | Figure Number | X ² | Y ² | Rationale |
|--------------------|--------------|-----------------------|---------------|----------------|----------------|---|
| MW-21 | Groundwater | 6 | 14C-2-29 | 1302027 | 7508985 | To collect samples of groundwater from new wells screened in the deeper zone aquifer hydraulically downgradient of the Current Wastewater Pond for Site Characterization and to confirm that the deeper zone aquifer is not impacted by COPCs/COPECs. |
| MW-22B | Groundwater | 5 | 14C-2-29 | 1303120 | 7507925 | |
| MW-23 | Groundwater | 5 | 14C-2-29 | 1305111 | 7506550 | |
| PZ-13 | Groundwater | 5 | 14C-2-29 | 1305136 | 7506525 | To collect a sample of groundwater in the upper shallow zone for GWDP Application baseline water quality and for groundwater N&E for the RI. |
| MW-22A | Groundwater | 5 | 14C-2-29 | 1303100 | 7507945 | |

¹ - The PRI Area listed is where the monitoring well is located; all groundwater samples are part of PRI Area 17, Site-Wide Water.

² - X and Y Coordinates are U.S. State Plane, NAD 83, Utah North Zone (U.S. Survey Feet). Locations of new monitoring wells (MW-21, MW-22A/B, MW-23) are approximate; the final locations will be surveyed after the wells are installed. MW-21, MW-22A/B, and MW-23 will be installed by US Magnesium for the GWDP Application and will be located adjacent to existing monitoring wells PZ-8, PZ-10, and PZ-13, respectively. The locations of the new wells will be determined in the field in order to locate a safe drilling location and avoid installing wells in areas of potential future hydraulic barrier wall construction to avoid replacement installations (Stantec, 2017).

All data generated under this SAP modification will be uploaded to the RI/FS project database (EQuIS) in accordance with the September 2013 Final Data Management Plan. The results of groundwater sampling and analysis activities completed pursuant to this SAP Modification will be reported to USEPA in a standalone technical memorandum that will:

- Summarize samples collected;
- Include tables presenting analytical results for the subject samples;
- Include laboratory analytical reports and data validation reports;
- Include copies of field notes, sampling forms, and other relevant sample collection and tracking information;
- Identify any discrepancies between the actual procedures followed and the Phase 1A SAP; and
- Summarize and include as an attachment all EPA-approved field modification and additional SAP modification forms associated with collection and analysis of the subject samples.

The *Final Phase 1A Data Report for PRI Areas 2 and 8 through 17 and Surface Water Addendum* and associated data adequacy evaluations will not be revised to include these sample results, and the collection of this additional data will not necessitate an update to the OU-1 Screening Level Risk Assessment for COPC selection.

Justification or Reason for the Modification:

Deeper Zone Well Sampling

During the first site-wide hydrologic RI scoping meeting on 12 and 13 April 2017, ERM and USEPA agreed that the RI will initially consider a 3-layer conceptual model for the shallow groundwater system at the site: an upper shallow zone, a semi-confining deeper silty clay layer, and a deeper shallow zone. This is consistent with the conceptual site model and the proposed groundwater flow model being developed for a GWDP Application for a proposed hydraulic barrier wall engineering design (engineered hydraulic barrier wall) for the Current Wastewater Pond at the site. Under this current conceptual model, the deeper silty clay layer creates a confined condition in the deeper shallow zone and an upward vertical gradient between the

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6/12/17

deeper and upper shallow zone. The continuity of the deeper silty clay and the magnitude of the vertical gradient in the vicinity of the current wastewater ponds are data gaps being addressed for the GWDP Application.

Groundwater samples from the deeper zone aquifer were not collected during the 2014 - 2015 Phase 1A RI groundwater sampling program. As agreed to during the scoping meeting, RI characterization requirements for the deeper zone (below the deeper silty clay) will be contingent on sampling and analysis results from the deeper zone groundwater for COPCs/COPECs as follows:

- If the deeper shallow zone is shown to not be impacted through the data collection and analysis of deeper zone groundwater samples from existing wells MW-9 and MW-10 and new monitoring wells MW-21, MW-22B, and MW-23, then only limited characterization of the deeper shallow zone will be required for the RI.
- If the deeper shallow zone is shown to be impacted, then further evaluation may be required to evaluate whether there is a potential exposure pathway for contaminants in groundwater in the deeper shallow zone.

The screen intervals for the existing deeper zone wells and the proposed screen intervals for the new deeper zone monitoring wells will be adequate to evaluate for impacts to the deeper zone via downward migration of COPCs/COPECs from the shallow zone aquifer beneath the Current Wastewater Pond and Old Waste Pond for the following reasons:

- Well MW-9 is screened from 59 to 69 feet below ground surface (bgs) in silty sand/fine-grained sand that is oolitic in part. The deeper silty clay was encountered from about 38 to 54 feet bgs at this location and is underlain by a 5-foot layer of silt/sandy silt/clayey silt. Well MW-9 is therefore screened within the first water-bearing zone beneath the silty clay.
- Well MW-10 is screened from 68 to 78 feet bgs in fine-grained sand interbedded with silt and clay. The deeper silty clay was encountered from 48 to 68 feet bgs at this location. Well MW-10 is screened immediately below the bottom of the silty clay.
- Wells MW-21, MW-22B, MW-23 will be screened across the first water-bearing zone encountered below the confining silty clay unit. To allow for the sand pack, the ten-foot screens are expected to begin approximately two feet below the silty clay unit; however, the actual screened interval for each well will be based on observed lithologies as determined in the field by the US Magnesium GWDP contractor (Stantec) with field consultation from USEPA and UDEQ.

Boring and well completion logs for wells MW-9 and MW-10 and a typical construction detail for new wells MW-21, MW-22B, MW-23 are included as an attachment to this SAP Modification Request.

Upper Shallow Zone Well Sampling

One round of groundwater samples with complete analysis (including the full list of organic and inorganic constituents identified in Phase 1A SAP Worksheet 15) is required for existing well PZ-13 and new well MW-22A to evaluate baseline groundwater conditions for the GWDP Application. These analytical results will also be used for evaluating nature and extent of groundwater contaminants for the RI.

A set of ten wells will be used to establish baseline conditions for the GWDP Application, including six existing shallow-zone wells (MW-13B, MW-15B, PZ-8, PZ-10, PZ-12, and PZ-13) and four new wells to be installed to address GWDP Application data gaps (MW-21, MW-22B, and MW-23 in the deeper zone and MW-22A in the shallow zone). One round of complete groundwater analysis is required for each well for the GWDP Application. For these ten wells, one round of complete groundwater analyses is available for existing wells MW-13B, MW-15B, PZ-8, PZ-10, and PZ-12 from the 2014 Phase 1A RI. New deeper zone wells MW-21, MW-22A, and MW-23 will be sampled and analyzed by ERM as described above. The single round

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US Magnesium NPL Site

of sampling and complete analysis for shallow zone wells PZ-13 and MW-22A will be performed by ERM at the same time that deeper zone groundwater samples are collected.

Additional rounds of baseline sampling for the GWDP Application at all ten wells will include inorganic analyses only and will be performed by Stantec.

EPA Review/Approval:  Date: 6/12/17
(RPM or designee)
(27 pages)

Each approved UFPQAPP-SAP Modification Form will become part of Attachment 17B in the Phase 1A Final SAP and also incorporated into the appropriate RI Results Report. A copy is to be provided to all recipients identified on SAP Worksheet #3.