APPENDIX D2 - Construction Permit Specifications and Plans

CONSTRUCTION PERMIT ISSUED BY
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Utah Division of Water Quality
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Review Engineer: WC
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Stantec

Retrofitted Waste Pond Phase 1 Basis of Design Report - US Magnesium Facility
Revision C

March 3, 2020

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DWQ-2020-006548

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
bgs	below ground surface
BOD	basis of design
BSA	borrow source area
CWP	Current Waste Pond
CY	cubic yards
cm/s	centimeters per second
DWQ	Division of Water Quality
EPA	U.S. Environmental Protection Agency
Facility	US Magnesium Rowley Facility
ft	foot/feet
GDWP	Groundwater Discharge Permit
GLEI	Great Lakes Environmental and Infrastructure
GSL	Great Salt Lake
H:V	Horizontal to vertical
HBW	hydraulic barrier wall
NAD	North American Datum
NAVD	North America Vertical Datum
MDD	maximum dry density
OMC	optimum moisture content
OWP	Old Waste Pond
PI	plasticity index
Project	Retrofitted Waste Pond Project
RWP	Retrofitted Waste Pond
SB	soil boring
SPT	Standard Penetration Test
Stantec	Stantec Consulting Services Inc.
UAC	Utah Administrative Code
UDEQ	Utah Department of Environmental Quality
USEPA	United States Environmental Protection Agency
US Magnesium	US Magnesium LLC

4.0 EMBANKMENT DESIGN

This section presents the design of the embankment to be constructed as part of Phase 1. Engineering drawings, technical specifications for earthwork, and the Construction Quality Assurance Plan for the Phase 1 portion of work are provided in **Appendix E**, **Appendix F**, and **Appendix G**, respectively.

4.1 GENERAL EMBANKMENT CONFIGURATION

The embankment will be constructed of homogenous earthen fill with 4H:1V (horizontal to vertical ratio) inboard and a 3H:1V outboard slopes. For Phase 1, the embankment will be constructed to the maximum predicted RWP operating water level of 4218 ft amsl and will have a minimum crest width of 30 ft to provide a sufficient working platform for the HBW to be installed during Phase 2. Following construction of the HBW the embankment will be raised to the final design elevation, to be determined during Phase 2 design activities, to accommodate for necessary pond freeboard.

4.2 EMBANKMENT FOUNDATION

Improvements to the soil underlying the embankment will be required to provide a suitable foundation of sufficient strength to limit the potential for settlement. In some areas along the alignment, the embankment will be constructed over previously constructed dikes. In these areas, the dikes will be scarified and re-compacted to the required specifications. In areas along the alignment where the embankments will be constructed within the existing RWP footprint, foundation improvement will consist of over-excavating soils within the footprint of the embankment to a minimum depth of 3-ft and backfilling and compacting with soils from the BSA.

4.3 CONSTRUCTION MATERIAL

Soils used for the construction of the embankment will be generated from the BSA. Embankment soils will be placed and compacted to 95% of the maximum dry density (MDD) and within 0 to +2% of the optimum moisture content (OMC), as determined by Standard Proctor testing.

4.4 HYDRAULIC BARRIER WALL

Seepage though the embankment will be restricted by the installation of the HBW during Phase 2 of the Project. Provisions for future construction have been incorporated into the Phase 1 design to provide adequate bench width for the HBW installation. Given the low pH of the wastewater and its potential impact on the performance of the proposed HBW, a compatibility test was conducted to evaluate the use of various slurry mixes in the HBW backfill. Although this BOD is not intended to present the final design of the HBW, a letter report documenting the test's procedures and results was submitted to DWQ in December 2018.

4.5 SLOPE STABILITY ASSESSMENT

A slope stability assessment was performed to evaluate the long-term stability of the RWP embankment and is provided in **Appendix H**. Based on the stability assessment conducted, the embankment meets the required minimum factors-of-safety for long-term static conditions of 1.5.

5.0 REFERENCES

Bureau of Reclamation, 2012. Design Standards No.13 Embankment Dams Chapter 6: Freeboard, Us Department of Interior Bureau of Reclamation. September 2012.

ERM, 2016. Draft Old Waste Pond/Current Waste Pond Area Hydrologic Conceptual Site Model, US Magnesium LLC. June 2016.

Great Lakes Environmental & Infrastructure, 2018. Soil-clay Backfill Compatibility Test, US Magnesium. Letter report dated November 28, 2018.

MWH, 2015. Draft Preliminary Design Basis and Feasibility Evaluation Report, for Proposed New Evaporation Pond. September 2015.

Stantec, 2017a. Groundwater Discharge Control Plan, Groundwater Discharge Permit Application, US Magnesium Facility, Rowley, Utah. December 2017.

Stantec, 2017b. Hydrogeologic Report, Groundwater Discharge Permit Application, US Magnesium Facility, Rowley, Utah. December 15, 2017

Stantec, 2019. Addendum to the CPT/HPT Investigation Work Plan, US Magnesium Facility, Rowley, Utah. January 9, 2019.

TABLES

Table 3.1
March 2019 Borehole Generalized Lithology and Details
Retrofitted Waste Pond
US Magnesium, Rowley, Utah

eralized Lithology	Depth Range of Generalized Lithology (feet bgs)	Top of Deeper Silty Clay Unit Elevation (feet amsl)	Ground Surface Elevation[1] (feet amsl)	Blow Counts at Specified Depth (ft bgs)		
				2.5	7.5	12.5
ers of clay and silty sand	0-30	4190.71	4220.71	1,4,3	2,1,3	1,4,2
/s (Deeper Silty Clay Unit)	30-40					
ers of clay and silty sand	0-30	4191.29	4221.29	8,8,8	2,1,1	1,3,2
/s (Deeper Silty Clay Unit)	30-40					
ers of clay and silty sand	0-30	4175.55	4212.05	2,4,2	1,2,1	1,1,1
y with clayey silt	30-36.5					
/s (Deeper Silty Clay Unit)	36.5-40					
ers of clay and silty sand	0-40	4170.15	4210.15	3,3,2	3,4,1	3,18,17
/s (Deeper Silty Clay Unit)	40-50					
ers of clay and silty sand	0-15	4163.53	4210.03	6,6,4	1,2,3	1,1,1
silty sand	15-30					
silty clay	30-46.5					
sum crystals (Deeper Silty Clay Unit)	46.5-50					
ers of clay and silty sand	0-12.5	4164.79	4209.79	1,3,3	1,3,3	2,1,1
o core recovery	12.5-17					
silty sand	17-32					
silty clay	32-40					
o core recovery	40-42					
silty clay	42-45					
sum crystals (Deeper Silty Clay Unit)	45-50					
ers of clay and silty sand	0-11	4162.71	4209.21	1,2,2	1,2,1	4,1,1
avel with sand and silty sand	11-15					
silty sand	15-37					
silty clay	37-46.5					
sum crystals (Deeper Silty Clay Unit)	46.5-50					
of silty sand, silt, and sand	0-30	4183.57	4219.57	No Collected		
clayey silt	30-36					
sum crystals (Deeper Silty Clay Unit)	36-45					
sand	0-14	4174.63	4219.63	Not Collected		
clay	14-18					
silty sand	18-40					
clayey silt	40-45					
sum crystals (Deeper Silty Clay Unit)	45-50					

TABLE 3.2

GEOTECHNICAL TEST RESULTS FOR UNDISTURBED SAMPLES COLLECTED IN THE PROPOSED BORROW SOURCE AREA IN 2015

US MAGNESIUM, ROWLEY, UTAH

Boring ID	Depth Interval (ft bgs)		Unified Soil Classification	Water Content, w (%)	Dry Unit Weight (pcf)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Gravel (%)	Sand (%)	Fines (%)	Hydraulic Conductivity (cm/sec)
SB-3	6.5	8.5	CL	34.6	80.4	47	22	25	0.0	4.1	95.9	3.0E-04
SB-4	9.0	11.0	CL	40.8	78.0	49	26	23	0.0	0.9	99.1	1.1E-06
SB-5	7.0	9.0	CL	33.7	86.9	47	23	24	0.0	1.5	98.5	1.5E-07
SB-6	8.0	10.0	CH	50.3	72.2	58	24	34	0.0	1.4	98.6	--
SB-7	8.0	9.0	CL	46.7	75.7	48	23	25	0.0	2.4	97.6	1.9E-07
SB-8	5.0	7.0	CL	40.5	84.5	42	20	22	2.6	8.3	89.2	--
SB-9	3.0	5.0	CL	37.2	84.7	48	22	26	0.0	3.0	97.0	1.1E-07

--	not analyzed
CL	lean clay
CH	fat clay
bgs	below ground surface
cm/sec	centimeters per second
ID	identification
pcf	pounds per cubic foot

Laboratory methods used:

ASTM D2487	Classification of Soils for Engineering Purposes
ASTM D422	Particle Size Analysis with Hydrometer
ASTM D4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D5084	Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

TABLE 3.3
GEOTECHNICAL TEST RESULTS FOR DISTURBED SAMPLES
US MAGNESIUM, ROWLEY, UTAH

Test Pit ID	Depth Interval (ft bgs)		Unified Soil Classification	Optimum Water Content, w (%)	Dry Unit Weight, γ_d (pcf)	Liquid Limit, LL (%)	Plastic Limit, PL (%)	Plasticity Index, PI (%)	Gravel (%)	Sand (%)	Fines (%)	Hydraulic Conductivity (cm/sec)	Comments
TP-2	6.1	13.2	CL	--	--	48	21	27	0.0%	5.0%	95.0%	--	
TP-3	3.4	11.3	CH	--	--	55	23	32	0.0%	1.1%	98.9%	--	
TP-4	2.4	7.1	CL	--	--	47	22	25	0.0%	1.9%	98.1%	--	
TP-2, TP-3, TP-4	2.4	13.2	CL	25.7	95.4	48	22	26	0.0%	2.1%	97.9%	1.3E-06	Composite sample from 3 test pits, from depth intervals of 6'1" - 13'2", 3'5" - 11'3", and 2'5" - 7'1"
TP-5	2.3	8.5	CL	--	--	48	21	27	0.0%	2.1%	97.9%	--	
TP-6	3.8	10.6	CL	--	--	47	21	26	0.0%	7.0%	93.0%	--	
TP-7	4.7	9.3	CL	--	--	47	21	26	2.7%	8.9%	88.4%	--	
TP-6, TP-7	3.8	10.6	CL	24.0	96.2	47	20	27	1.1%	7.7%	91.2%	--	Composite sample from 2 test pits, from depth intervals of 3'9"-10'7" and 4'8" - 9'3"
TP-8	4.3	10.4	CL	--	--	47	22	25	0.0%	3.5%	96.5%	--	
TP-9	2.8	10.8	CL	--	--	48	20	28	0.0%	7.5%	92.5%	--	
TP-8, TP-9	2.8	10.4	CL	22.8	98.8	47	21	26	0.0%	5.6%	94.4%	--	Composite sample from 2 test pits, from depth intervals of 4'3" - 10'5" and 2'9" - 10'10"
TP-11	3.3	10.8	CH	--	--	50	21	29	0.0%	4.3%	95.7%	--	
TP-13	5.3	15.0	CH	--	--	52	21	31	0.0%	6.6%	93.4%	--	
TP-11, TP-13	3.3	15.0	CL	23.8	96.4	49	21	28	0.0%	5.2%	94.8%	3.5E-05	Composite sample from 2 test pits, from depth intervals of 3'4" - 10'9" and 5'3" - 15'0"
TP-17	6.7	11.3	CH	--	--	51	22	29	0.1%	4.6%	95.3%	--	
TP-18	1.8	11.3	CL	--	--	46	21	25	0.0%	1.9%	98.1%	--	
TP-17, TP-18	1.8	11.3	CL	25.2	96.6	47	21	26	0.0%	3.7%	96.3%	3.4E-06	Composite sample from 2 test pits, from depth intervals of 6'8" - 11'3" and 1'9" - 11'3"
TP-22	0.8	14.3	CH	--	--	51	21	30	0.0%	4.2%	95.8%	--	
TP-5, TP-22	0.8	14.3	CL	25.4	96.3	49	21	28	0.0%	3.3%	96.7%	--	Composite sample from 2 test pits, from depth intervals of 2'3" - 8'6" and 9" - 14'4"
TP-23	3.3	9.5	CL	--	--	47	22	25	0.0%	2.2%	97.8%	--	
TP-24	4.3	9.4	CL	--	--	45	22	23	0.0%	3.2%	96.8%	--	
TP-23, TP-24	3.3	9.5	CL	25.2	97.1	44	21	23	0.0%	2.7%	97.3%	7.0E-06	Composite sample from 2 test pit, from depth intervals of 3'4" - 9'6" and 4'4" - 9'5"
TP-26	1.3	7.2	CL	--	--	48	22	26	0.0%	2.1%	97.9%	--	
TP-27	2.1	9.2	CL	--	--	48	21	27	0.0%	5.3%	94.7%	--	
TP-26, TP-27	1.3	9.2	CL	26.5	94.4	48	22	26	0.0%	3.2%	96.8%	3.5E-05	Composite sample from 2 test pits, from depth intervals of 1'3" - 7'2" and 2'11" - 9'2"
TP-29	0.1	1.3	CH	--	--	53	22	31	0.0%	3.7%	96.3%	--	
TP-30	0.1	1.3	CL	--	--	42	20	22	1.5%	7.9%	90.6%	--	
TP-29, TP-30	0.1	1.3	CH	22.9	100	50	21	29	0.3%	6.2%	93.5%	3.1E-05	Composite sample from 2 test pits, from depth intervals of 1" - 1'3" each
BTP-4	0.0	4.8	CH	--	--	50	20	30	0.4%	5.6%	94.0%	--	

'	feet
"	inches
CL	lean clay
CH	fat clay
bgs	below ground surface
cm/sec	centimeters per second
ID	identification
pcf	pounds per cubic foot

Laboratory methods used:

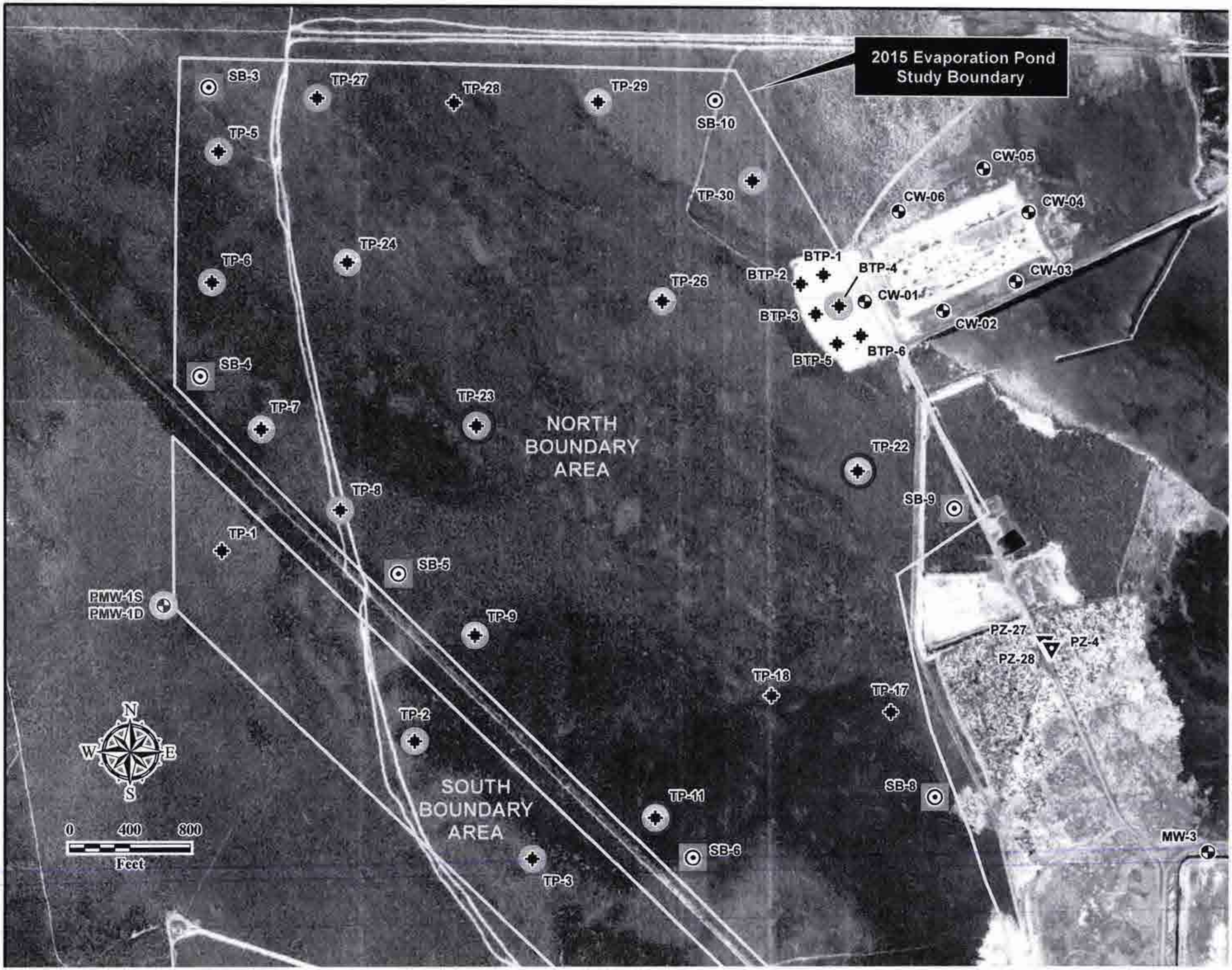
ASTM D2487	Classification of Soils for Engineering Purposes
ASTM D422	Particle Size Analysis with Hydrometer
ASTM D4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D5084	Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

FIGURES

PCL XL error

Warning: IllegalMediaSize

Appendix D – Borrow Source Data



Drawn by D. Severson

28 July 2015

Data and Refs\FIGURES\Fig 1-1_US_MAG_Site Map and Well Locations_forReport_28Jul2015.mxd

Appendix E – Design Drawings

Appendix F – Earthwork Specification

SECTION 02222 – EARTHWORKS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall be responsible for all activities required to ensure that the designated areas are free from objectionable materials, in accordance with the Contract Documents.

B. CONTRACTOR shall be responsible for the excavation and grading of the site in accordance with the details and to the lines and grades indicated by the project drawings.

C. CONTRACTOR shall be responsible for construction of the embankment to the grades and specifications presented herein.

D. The CONTRACTOR shall be responsible for development of the borrow area.

1.2 RELATED SPECIFICATION

The following specifications contain requirements that relate to this specification:

- 02100 – Site Preparation
- 02120 – Road Maintenance

1.3 APPLICABLE STANDARDS

The following are applicable standards pertaining to the Work:

- ASTM D 422 – Standard Test Method for Particle-Size Analysis of Soils
- ASTM D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
- ASTM D 1556 – Standard Test Method for Density of Soil In Place by the Sand-Cone Method
- ASTM D 2419 – Standard Test Method for Sand Equivalent Value of Soils and Aggregate
- ASTM D 2487 – Standard Practice for Classification of Soil for Engineering Purposes (Unified Soil Classification System)
- ASTM D 2922 – Standard Test Methods for Density of Soil and Aggregates In Place By Nuclear Methods (Shallow Depth)
- ASTM D 4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.4 DEFINITIONS

A. Company: US Magnesium LLC.

B. Engineer: Stantec Consulting Services, Inc.

C. Contractor: The party to whom the Contract for the work described herein has been awarded and any of its authorized representatives.

1.5 CONTRACTOR SUBMITTALS

The Contractor shall submit the following documents for Engineer approval and acceptance prior to mobilization:

A. Fill placement method and plan. Plan shall include the proposed methods for the development of the borrow area and associated haul traffic plan in accordance with Section 02130.

PART 2 -- EQUIPMENT AND MATERIALS

2.1 EQUIPMENT

A. Conventional earth-moving equipment shall be used for the construction of the embankment as required and needed for the placement and compaction of the embankment material or other equipment as approved by the Engineer. All equipment shall be clean and in good working condition prior to arrival at the site, and suitable for its intended use.

2.2 MATERIALS

A. Embankment and Foundation Fill:

1. Unless otherwise approved by the ENGINEER, Embankment and Foundation Fill shall conform to the following material specifications:

   a. Maximum Particle Size: No. 4 Sieve

   b. Liquid Limit: <55 and shall plot above the A line

   c. Plasticity Limit:>20 and shall plot above the A line

   d. % passing the 200 sieve: >50%

PART 3 -- EXECUTION

3.1 GENERAL

A. The WORK to be performed in some areas (within the limits of the OWP) has the potential to contain sediments contaminated with chlorinated organic compounds. When working within the extent of the RWP and directly on contaminated soils, the CONTRACTOR shall take necessary precautions to prevent fugitive dust and to protect employees from exposure.

3.2 EXCAVATION

A. General

1. Excavation is associated with removal of unsuitable subgrade material as indicated on the Drawings. Excavation is specific to the areas within the OWP over which the embankment will be placed.

2. Tolerances for all excavated surfaces shall be within ±0.1 foot of the elevation as specified in the design drawings or as directed by the Engineer.

3. Over-excavation required to suit CONTRACTOR construction equipment or methods shall be backfilled and re-compacted to the required grade by and at the CONTRACTOR's expense, conforming to the requirements as specified in Section 3.3.

4. Surveys shall be performed prior to beginning WORK and upon completion by a surveyor licensed in the state where the Site is located.

B. Removal and Exclusion of Water:

1. The CONTRACTOR shall remove and exclude water, including stormwater, groundwater, and wastewater from work areas.

2. Dewatering wells, wellpoints, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least 2 feet below the bottom of excavations before the excavation WORK begins at each location.

3. Water shall be removed and excluded until backfilling is complete and field soils testing has been completed.

C. OVER-EXCAVATION

1. Indicated:

   a. Where areas are indicated on the Drawings to be over-excavated, excavation shall be to the depth indicated, and backfill shall be installed to the grade indicated.

2. Not Indicated:

   a. When ordered to over-excavate areas deeper and/or wider than required by the Contract Documents, the CONTRACTOR shall over-excavate to the dimensions ordered and backfill to the indicated grade. Over excavation in areas not indicated, or beyond specified depths, may include areas where there are signs of seepage below the indicated 2-ft of over-excavation

3. Neither Indicated nor Ordered:

   a. Any over-excavation carried below the grade that is neither ordered or indicated

shall be backfilled and compacted to the required grade with the indicated material as part of the WORK at the CONTRACTOR's expense.

D. DISPOSAL OF EXCESS EXCAVATED MATERIAL

1. The CONTRACTOR shall be responsible for the removal and spreading of excavated material.

2. Excavated material shall be placed within the boundary of the OWP. Material shall be placed a minimum distance of 100 feet away from the design downstream toe of the embankment. Placed material shall be uniformly spread to achieve a uniform lift of not greater than 6 inches.

3.3 FILL PLACEMENT AND COMPACTION

A. Foundation Preparation

1. Foundation Backfill:

a. As indicated on the Drawings, over-excavated areas will be backfilled with clean suitable foundation backfill obtained from the Borrow Area.

b. Plow, scarify, divot, or break up smooth surfaces of existing material to promote bonding each subsequent lift, unless otherwise noted (i.e. top of embankment fill surface).

c. For slopes steeper than 6H:1V, the Contractor shall roughen or serrate the slope surface prior to placement of abutting soil lifts. The Contractor's proposed method proposed for this activity shall be accepted by the ENGINEER prior to commencement of the work.

d. Foundation backfill shall be placed in loose lifts not exceeding 8-inches in thickness.

e. Following placement and spreading, the lift shall be compacted to achieve the specifications provided in 3.3.A.3.a.

2. Existing Dike

a. As indicated on the Drawings, portions of the embankment will be constructed over the existing dikes associated with the OWP. In these areas, the existing dike will be scarified and recompacted to provide a suitable subgrade for placement of the embankment fill.

b. Existing dikes shall be over-excavated to a depth of 2 feet.

c. Following over-excavation, the excavated soil shall be placed and re-compacted in loose lifts not exceeding 8 inches to achieve the specifications provided in 3.3.A.2.a.

3. Compaction Requirements:

    a. The following compaction requirements shall be in accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3) where the material is graded such that 10 percent or more passes a No. 4:

Location or Use of Fill or Backfill	Percentage of Maximum Dry Density
Foundation Backfill	90% (±2%)

4. All compaction shall be performed between -2% to +2% of optimum moisture content as determined by ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

B. Embankment Fill Placement Trial Plot

1. Prior to placement of embankment fill, the Contractor shall construct a fill placement trial plot to determine the appropriate placement and compaction methods for achieving the required densities and lift thicknesses for the embankment. The main objectives of the fill placement trial plot will be to determine the number of passes of the compaction equipment to achieve the required lift thickness and density.

    a. The fill placement trial plots will be located along the alignment of the RWP embankment.

    b. The fill placement trial plots will consist of constructing a minimum of 100-feet of embankment comprising the required foundation preparation and the first three compacted lifts.

    c. If the trial fill plot results in the material being placed to the specified minimum thickness and density, the trial fill plot will be incorporated into the Work.

    d. If the trial fill plot does not result in the material being placed at the specified density and minimum thickness, the trial plot will be re-constructed until it results in the material meeting the required minimum thicknesses and density.

C. Embankment

1. Embankment Fill (including Skull Valley Diversion Ditch (SVDD):

    a. Prior to placing the first lift of embankment fill, the surface of the prepared foundation shall be moisture-conditioned (as necessary) and compacted by rolling with a tamping roller having a minimum weight of 1000 pounds.

b. Embankment fill shall be placed using the methods and thicknesses determined during the fill placement trial plot using equipment fashioned with GPS elevation grade control capability.

c. Embankment fill shall not be placed in loose lifts exceeding 8-inches in thickness.

d. Fill placed with the SVDD shall be placed in loose lifts not exceeding 8-inches in thickness

e. Following placement and grading, the surface shall be compacted with the required number of passes to achieve the specification specified in Section 3.3.C.2.

2. Compaction Requirements:

a. The following compaction requirements shall be in accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3) where the material is graded such that 10 percent or more passes a No. 4:

Location or Use of Fill or Backfill	**Percentage of Maximum Dry Density**
Lowest two lifts (including SVDD fill)	≥90%
Upper Lifts (including SVDD fill)	≥95%

3. All compaction shall be performed between 0% to 2% of optimum moisture content as determined by ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

3.4 MATERIALS TESTING

A. Samples:

1. Material testing shall be performed in accordance with the Project Construction Quality Assurance Plan (CQAP).

1. Soils testing of samples submitted by the CONTRACTOR will be performed by a certified testing laboratory of the COMPANY's choice and at COMPANY's expense.

2. The ENGINEER may direct the CONTRACTOR to supply samples for testing of any material used in the WORK.

3. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils.

4. Determination of sand equivalent value will be performed using ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

5. Atterberg limits testing shall be conducted in accordance with ASTM D 4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

6. Unified Soil Classification System:

    a. References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487.

    b. The CONTRACTOR shall be bound by applicable provisions of ASTM D 2487 in the interpretation of soil classifications.

3.5 RESIDUAL FILL

A. Residual fill material not required for embankment construction activities shall be placed back into the borrow area at the direction of the COMPANY.

3.6 FIELD TESTING

A. General:

1. Field soils testing will be performed by a testing laboratory of the COMPANY's choice at the COMPANY's expense, except as indicated below.

B. Density:

1. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

2. Field density in-place tests will be performed in accordance with ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place By Nuclear Methods (Shallow Depth), or by such other means acceptable to the ENGINEER.

C. Remediation:

1. In case the test of the fill or backfill shows non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to ensure compliance.

2. Subsequent testing to show compliance shall be by a testing laboratory selected by the COMPANY and paid by the CONTRACTOR.

- END OF SECTION -

Appendix G – Construction Quality Assurance Plan

Stantec

Retrofitted Waste Pond Construction Quality Assurance Plan – US Magnesium Rowley Facility

Revision B

June 25, 2019

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Sign-off Sheet

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ACRONYMS AND ABBREVIATIONS

ASTM American Society for Testing and Materials

CQA Construction Quality Assurance

CQAP Construction Quality Assurance Plan

CQC Construction Quality Control

DWQ Division of Water Quality

HASP Health and Safety Plan

UDEQ Utah Department of Environmental Quality

OSHA Occupational Safety and Health Administration

PLS Professional Land Surveyor

PM Project Manager

QA quality assurance

QC quality control

RWP Retrofitted Waste Pond

1.0 INTRODUCTION

This Construction Quality Assurance Plan (CQAP) describes the quality control (QC) and quality assurance (QA) activities required for construction of the earthworks associated with the Retrofitted Waste Pond (RWP) at the US Magnesium Rowley Facility. The work includes construction of an earthen embankment and associated works as presented in the RWP Phase 1 Construction Drawings and Specifications.

1.1 PURPOSE

During the course of the work, QA activities will involve reviewing Construction Contractor submittals, conducting observations of the work as it is completed, providing construction support, and performing field and laboratory testing of construction materials. A major function of the QA is to properly and adequately document that the work and associated quality control (QC) testing is completed in accordance with the approved construction drawings and technical specifications.

Procedures presented in this CQAP are intended to identify challenges that may occur during construction and to establish guidelines for documentation of the resolutions. The QC testing program described in this CQAP outlines the methods and frequencies in which construction material are to be monitored or tested.

QC testing will be implemented by a QC firm, independent of the Construction Contractor. The QC firm will be supported by a number of QC Monitors necessary to implement the requirements in this CQAP and to document the work.

1.2 SCOPE

This CQAP establishes general administrative and documentation procedures that will be applicable for selected activities of construction. With respect to responsibilities, personnel qualifications, and specific monitoring and testing activities, this CQAP addresses only those activities associated with the RWP Phase 1 earthworks.

1.3 DOCUMENT ORGANIZATION

The remainder of this document consists of the following sections:

- Section 2.0 Project Organization– Details the organizational structure for the project.
- Section 3.0 Personnel Qualifications and Training – Presents a summary of the minimum qualifications and training for QA/ QC personnel.
- Section 4.0 Construction QA Definitions and Applicable Organizations and Standards – Provides project definitions for QA/QC and defines the applicable organization standards for the project as they relate to QC testing and QA.

- Section 5.0 Construction Activities and Submittal Requirements – Details the construction activities to be performed and associated project submittal requirements as they pertain to QA.
- Section 6.0 Earthworks – Defines the minimum QC testing for project earthworks.
- Section 7.0 Construction Quality Assurance Documentation – Defines the minimum documentation requirements for QA testing.
- Section 8.0 References.
- Appendix A Soil Compaction Field Form
- Appendix B In-Place Nuclear Testing Form
- Appendix C Record of Non-Compliance Test Form
- Appendix D Daily Field Report Form
- Appendix E Notice of Non-Compliance Log
- Appendix F Weekly Progress Report Form

2.0 PROJECT ORGANIZATION

This section describes the project organization for construction and associated construction quality assurance (CQA) activities. The following subsections address the organizations involved in the construction, their respective roles for the construction activities, and the methods of interactions and communications between organizations. An organization chart is presented in **Figure 2-1** that illustrates the organizational structure pertaining to this CQAP.

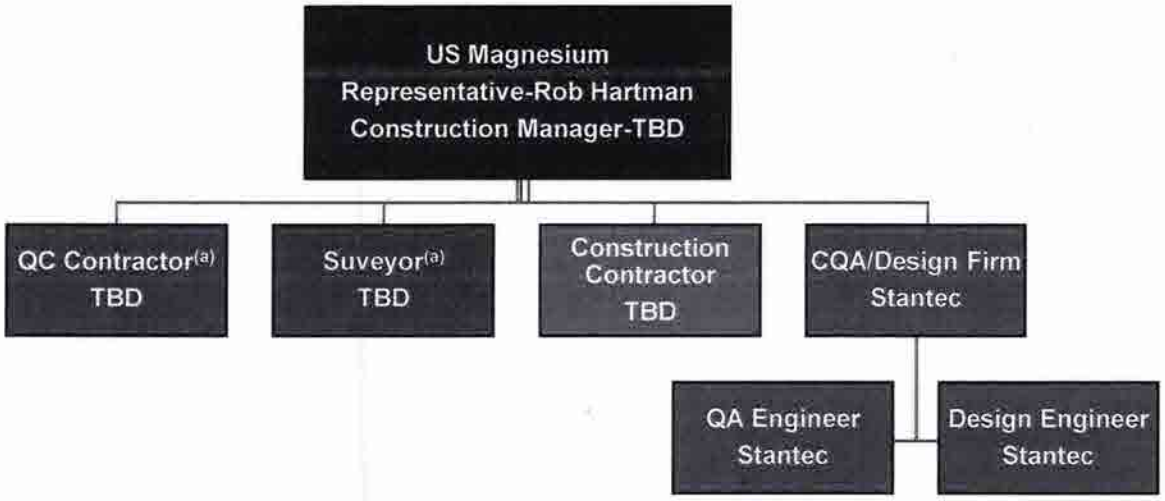


Figure 2-1 - CQA Organizational Chart

TBD – to be determined

2.1 STOP WORK AUTHORITY

The US Magnesium Representative and Construction Manager will have the authority to direct the Construction Contractor to stop work at any time. In the event that site conditions become unsafe, any person may stop work until the unsafe conditions are addressed. The US Magnesium Representative and Construction Manager shall be notified immediately if work is stopped due to unsafe conditions.

2.2 RESPONSIBILITIES AND AUTHORITY

The project organization consists of the US Magnesium Representative and Construction Manager, the Construction Contractor, a Design Engineer, a QA Engineer, QC Contractor, and

the QC Monitor(s). The responsibilities for the project and field team members are provided in the subsections below.

2.2.1 Construction Contractor

The Construction Contractor is responsible for completing the work in accordance with the project drawings and specifications. The Contractor will be responsible for coordinating access and planning for the QC Contractor(s) to perform construction quality control (CQC). The Construction Contractor will report directly to the US Magnesium's Construction Manager.

2.2.2 QC Contractor

The QC Contractor(s) shall be an independent firm that shall be responsible for performing inspections and testing as required by this CQAP.

2.2.3 QC Site Monitor(s)

The QC Site Monitor(s) is/are responsible for implementation of the QC testing program of this CQAP under the direction of the QC Contractor. The QC Site Monitor(s) will have responsibility for QC activities related to the construction, including testing and observations in accordance with the engineering drawings, technical specifications, and this CQAP. The QC Site Monitor(s) will control the day-to-day QC tasks, including communicating and coordinating daily field tests with the Construction Contractor, correctly completing all necessary field data sheets on a daily basis, photographing construction progress, keeping a field and photograph log book that describes the construction activities, and completing and providing a daily field report to the US Magnesium Construction Manager, maintaining files and correspondence on a daily basis, and preparing any samples for shipment off site. The QC Site Monitor(s) will report to the Construction Manager and correspond directly with the QA Engineer.

2.2.1 Design Engineer

The Design Engineer is responsible for preparing construction drawings and technical specifications, addressing constructability issues, addressing requests for clarifications or changes to the construction drawings or specifications, approving final Construction Contractor submittals, and addressing unforeseen field issues. The Design Engineer will closely monitor all construction and QA activities and address issues that may arise during construction. The Design Engineer will coordinate with the US Magnesium Construction Manager and have close communication with the QA Engineer to ensure all issues are being addressed and documented. The Design Engineer will be a Registered Professional Engineer in the State of Utah and will ultimately be responsible for certifying that the work has been performed in accordance with the approved plans and technical specifications.

2.2.2 QA Engineer

The QA Engineer will have the overall responsibility for ensuring construction is conducted in compliance with this CQAP and will work closely with the US Magnesium Construction Manager and QC monitors. The QA Engineer will be responsible for reviewing QC testing reports and

preparing documentation to be submitted to the Construction Manager and Design Engineer for the purpose of showing that the construction has been completed in compliance with the approved construction drawings and specifications, and any approved changes. The QA Engineer also has the responsibility to report issues and recommend remedial actions to the Construction Manager and Design Engineer, if the Construction Contractor is not adhering to this CQAP or if the work does not meet requirements in the construction drawings and specifications.

2.2.3 QC Testing Laboratory

The QC Testing Laboratory will provide independent testing as directed by the QC Site Monitor(s). The QC testing will be in accordance with this CQAP and the technical specifications.

2.2.4 Regulatory Agency

Work conducted under this project shall be coordinated with the Division of Water Quality (DWQ). A US Magnesium representative will serve as the regulatory contact.

2.3 PROJECT MEETINGS

This section includes a discussion of the various progress and status meetings that will be held throughout the performance of the work. The purpose of the meetings is to discuss work progress, plan work activities, and address issues related to construction. A portion of these meetings can be dedicated to CQA issues, as necessary, to provide an opportunity for the CQA team to express concerns regarding quality, to relay test results, and to provide regular communication between organizations involved in the construction.

2.3.1 Pre-construction Meeting

A pre-construction meeting will be scheduled and held prior to beginning construction. At a minimum, the meeting will be attended by the US Magnesium Representative and Construction Manager, the Construction Contractor's Project Manager, the QC Contractor Representative, the Design Engineer, and the QA Engineer. The DWQ will be invited to attend the meeting. A portion of the meeting will be dedicated to the discussion of QA/QC issues. These QA/QC topics will include, but are not limited to, the following:

- Reviewing safety responsibilities and requirements.
- Reviewing the responsibilities of each organization.
- Reviewing lines of authority and communication for each organization.
- Providing each organization with relevant CQA and CQC documents and supporting information.
- Familiarizing each organization with this CQAP and its role relative to the design criteria, construction drawings, and specifications.
- Determining any changes to this CQAP that may be needed to document that the facility will be constructed to meet the specified requirements.

- Discussing the established procedures or protocol for observations and tests, including sampling strategies.
- Discussing the established procedures, or protocol, for handling construction deficiencies, repairs, and retests, including "stop work" conditions.
- Reviewing methods for documenting and reporting inspection data.
- Reviewing methods for distributing and storing documents and reports.
- Reviewing work area security and safety protocol.
- Reviewing the proposed project schedule.
- Discussing procedures for locating and protecting construction materials and for preventing damage of the materials from inclement weather or other adverse events.
- Conducting a site walk-around to review construction materials and inspect equipment storage locations.

Action items, assigned actions, and minutes will be recorded and transmitted to the required distribution list and to meeting attendees.

2.3.2 Weekly Progress Meetings

Weekly meetings will be held at the site or via teleconference to discuss construction progress and plan for upcoming construction activities. At a minimum, the weekly progress meetings will be attended by the Contractor's Project Manager, US Magnesium's Representative, the QC Monitor(s), the QA Engineer, and possibly the surveyor, as needed. The purpose of the meeting is to accomplish the following:

- Review safety topics and any safety incidents.
- Review the previous week's activities and accomplishments.
- Review planned activities for the upcoming week.
- Finalize resolution of issues from the previous week.
- Discuss potential challenges with the work planned for the upcoming week.

Minutes will be recorded by a party identified by the Contractor's Project Manager and transmitted to the required distribution list and meeting attendees.

2.3.3 Problem or Work Deficiency Meetings

Meetings will be convened, as necessary, to address inspection deficiencies and nonconformances. Deficiencies observed by the QC Monitor(s) during construction will be brought to the attention of the Contractor's Project Manager and QA Engineer immediately. These deficiencies will be tracked in the QC Monitor's field log book until resolved and included in the daily summary report. These documents will include the description of the deficiency and actions taken or to be taken to resolve the deficiency.

3.0 PERSONNEL QUALIFICATIONS AND TRAINING

This section describes the qualifications and training required for CQA personnel. Documentation relating to qualifications will be maintained with the project CQA records.

3.1 CONTRACTOR'S PROJECT MANAGER

The Construction Contractor's Project Manager will have a minimum of 10 years of construction project management experience with large earthworks projects.

3.2 QA ENGINEER

The QA Engineer will have construction experience and will have sufficient practical, technical, and managerial experience to successfully support the QA activities discussed in this CQAP. The QA Engineer's qualifications will be documented by training records and a professional resume showing significant field experience with large earthworks construction.

3.3 QC MONITOR(S)

At a minimum, the QC Site Monitor(s) will have a high school diploma and at least five years of construction-related experience, including at least three years of experience in earthwork construction, or a Bachelor of Science degree from a four-year college or university, and at least two years of experience conducting CQC monitoring for earthwork construction. The QC Site Monitor(s) must be capable of performing work with little or no daily supervision. Qualifications of the QC Monitor(s) shall be documented by training records and professional resumes and shall be reviewed by the Design Engineer.

3.4 QC TESTING LABORATORY

The QC testing laboratory will be approved by the QA Engineer and will provide conformance testing required by this CQAP, as requested by the QC Site Monitor(s) and/or QA Engineer. The QC testing laboratory will be a third-party, independent testing laboratory, unaffiliated with the Design Engineer, materials supplier or manufacturer, or Construction Contractor or subcontractors.

3.5 SURVEYOR

Surveys performed to meet requirements of this CQAP shall be performed by a Utah licensed Professional Land Surveyor (PLS), contracted to US Magnesium. The surveyor selected by the Construction Contractor must be approved by the QA Engineer prior to the beginning of work

4.0 CONSTRUCTION QUALITY ASSURANCE DEFINITIONS AND APPLICABLE ORGANIZATIONS AND STANDARDS

4.1 CONSTRUCTION QUALITY ASSURANCE AND CONSTRUCTION QUALITY CONTROL

Construction Quality Assurance (CQA) — A planned and systematic pattern of the means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

Construction Quality Control (CQC) — Those actions that provide a means to measure and control the characteristics of an item or service to meet contractual and regulatory requirements.

4.2 USE OF THE TERMS IN THIS CQA PLAN

The definitions used in the context of this CQAP are provided below:

- CQA refers to means and actions employed by the QA Engineer to assure conformity with this CQAP, the technical specifications, and the construction drawings. CQA is provided by a party independent from the product manufacturer and Construction Contractor.
- CQC refers to those actions taken by manufacturers, suppliers, or Construction Contractors, and the third-party QC Contractor(s), to ensure that the materials and the workmanship meet the requirements of the technical specifications and the engineering drawings.

4.3 APPLICABLE ORGANIZATIONS

Organizations whose standards are referenced in this CQAP include:

- ASTM—American Society for Testing and Materials
- OSHA—Occupational Safety and Health Administration

4.4 APPLICABLE STANDARDS

Reference to the standards of any society, institute, association, or governmental agency will pertain to the edition in effect as of the date of this CQAP, unless stated otherwise. Specific test standards for tests cited in this CQAP are provided in the technical specifications. These standards may be modified due to technological advances since completion of the technical specifications.

5.0 GENERAL CONSTRUCTION REQUIREMENTS

5.1 PREREQUISITE CONTRACTOR TRAINING

5.1.1 Health and Safety Training

All contracted operating personnel will comply with US Magnesium's Contractor Safety Policy. As a part of contractor prequalification, US Magnesium requires that each prospective contractor receives a "US Magnesium Contractor's Safety Prequalification Form," which must be completed by the prospective contractors and reviewed by the US Magnesium safety department as a part of the contractor selection process. As specified in the Contractor Safety Policy, prior to starting work at US Magnesium, all contractor on-site supervisors and employees must attend a safety orientation. The orientation agenda consists of applicable information on the known potential fire, explosion, or hazardous chemical release hazards related to the contractor's work. The contactor's on-site employees also will be given an orientation tour of the work area they will be working to identify specific hazards and answer questions.

Applicable US Magnesium safety policies (i.e., safe work permits, hot work permits, hearing protection, emergency action procedures, etc.) also will be explained. Each contractor employee will be subject to all applicable US Magnesium safety policies and procedures as if they were US Magnesium employees.

5.1.2 Project Familiarization

Prior to the start of construction activities, the Construction Contactor and the QC Monitor(s) shall review and become familiar with the construction drawings and technical specifications. The QC Monitor(s) should also be familiar with the most recent construction schedule so that adequate resources (i.e., laboratory, field testing equipment, staff, and QC forms) including contingencies (i.e., backup equipment, alternate laboratory, and alternate QC staff) for CQC activities will be commensurate with the anticipated construction productivity and work schedule. All necessary measures should be taken to avoid delaying construction activities and the completion of the work.

5.2 SUBMITTAL AND WORK ACCEPTANCE REQUIREMENTS

The Construction Contractor will provide submittals required by the CQA team in accordance with the construction drawings and specifications. When an area of the work site has been completed to the satisfaction of the Construction Contractor, the Construction Contractor will delineate the area and communicate with the QA Engineer that the area has been completed and is ready for final QA approval. Once the area has been inspected by the QA Engineer and QC testing in the area has been performed in accordance with this CQAP, the QA Engineer will communicate, in writing, to US Magnesium's Construction Manager that the delineated area meets the requirements in the construction drawings and specifications. Approval from US Magnesium's Construction Manager must be obtained, in writing, prior to the Construction Contractor performing subsequent tasks in the delineated area. Work conducted by the Construction

Contractor prior to written approval from US Magnesium's Construction Manager will be at the risk of the Construction Contractor and is subject to re-work should an issue arise within the delineated area.

5.2.1 Construction Contractor Submittals

Construction Contractor submittals shall be submitted to US Magnesium's Construction Manager or designated representative and distributed to the CQA team unless otherwise directed by the Construction Manager. These submittals shall be reviewed and approved by the CQA team prior to procurement of respective construction materials or completion of associated work. Copies of all submittals shall be maintained with the project records.

5.2.2 Conformance Testing

Conformance testing of materials and constructed products shall be conducted at frequencies as specified in Section 6 of this CQAP. The Construction Contractor shall perform QC testing and document results for assessment and verification of conformance with project requirements. QA testing will be conducted and documented by the QA Engineer, as required. Copies of all conformance testing results shall be maintained with the project records.

5.2.3 Field Observations

The CQC and CQA teams shall observe construction activities associated with the project and record observations and testing results in assigned field books. Documentation from the field books will be organized and transferred onto daily field report forms that will be submitted to the US Magnesium Construction Manager or designated representative on a daily basis.

Non-compliance reporting shall be used by the CQC or CQA team as needed to report deficiencies, required remediation, and resolutions to issues. Completed non-compliance reports that thoroughly describe the need for additional work or suspect conditions shall be promptly submitted to the designated representative for the Construction Contractor and US Magnesium. The CQA team will regularly log each non-compliance issue as the project progresses to regularly track pending and/or resolved deficiencies.

Daily field reports and non-compliance reports will be maintained in the project records.

5.2.4 Requests for Information

The Construction Contractor shall communicate issues such as constructability, discrepancies in the construction documents, requests for design support during construction, etc., to the CQA team and US Magnesium using a formal request for information (RFI) form (**Appendix A**). The CQA team will be responsible for responding to the RFI or coordinating with the US Magnesium to determine a response. Completed RFI forms and associated responses shall be maintained in the project records.

6.0 EARTHWORKS MONITORING

This section describes the construction activities that will be the responsibility of the Construction Contractor and QC monitoring requirements during the earthwork construction, which includes the following elements of construction:

- Clearing and Grubbing
- Borrow Pit Development
- Foundation Preparation
- Embankment Construction

6.1 FOUNDATION PREPARATION

The QC Monitor(s) will verify and document that the foundation of the embankment has been prepared in accordance with the in the construction drawings and technical specifications, as determined by the test methods and frequencies specified in this CQAP.

Upon completion of the foundation preparation, the QC Monitor(s) will perform the following tasks:

- Inspect the prepared foundation and note areas of weak or excessively weathered subgrade materials.
- Observe that the surface of the prepared foundation is free of debris, wet and soft areas, ponded water, organics, mud, ice, or frozen material.
- Verify that the prepared foundation material meets the requirements of the technical specifications, as determined by the QC testing methods and frequencies provided in Table 6.1.
- Observe and document over-excavation and backfilling operations.

6.1.1 Construction Quality Control Testing

The frequency of soils testing for CQC purposes will conform to the minimum frequencies presented in **Table 6.1** for prepared foundation. Material properties will be determined from samples collected from the borrow area.

In-place nuclear density tests will be used for the verification of the in-situ dry unit weight of compacted foundation fill. If an in-place density test result fails to meet specification requirements, the QC Monitor(s) will relay to the QA Engineer the extent and nature of the defect by observations and/or additional testing, as necessary, to identify the limits of the area that do not meet project specifications. If the defect is related to adverse site conditions, such as excessively wet soils or surface desiccation, the QC Monitor(s) will define the limits and nature of the defect by testing or observation. After the extent and nature of a defect is determined and has been remedied by the Construction Contractor, the QC Monitor(s) will verify that the deficiency is corrected by retesting repaired areas before any additional work is performed by the Contractor in the area of the deficiency. All failing tests and retests will be recorded in the QC

Monitor's field book, or on a compaction testing form and provided to the QA Engineer for review and approval. The approximate location of each test will be recorded based on pre-defined stationing.

6.2 EMBANKMENT FILL PLACEMENT

This section addresses fill placement associated with the embankment construction and specifies the earthwork QC testing program to be implemented for materials selection and evaluation, laboratory test requirements, field test requirements, and corrective action requirements.

6.2.1 Embankment Fill Placement and Compaction

QC Monitor(s) shall observe the embankment fill placement and compaction to verify and document the following:

- The material being placed meets the technical specifications requirements for fill materials, as determined by the test methods and frequencies specified in **Table 6.2**.
- The placement surface has been prepared as specified in the technical specifications.
- The compacted lift thickness is in accordance with the requirements of the technical specifications.
- The dry unit weight of the compacted fill meets specifications as determined by the test methods and frequencies described in **Table 6.2**.
- The geometry of the work conforms to the construction drawings.

6.2.2 Construction Quality Control Testing

The frequency of material testing for CQC purposes will conform to the minimum frequencies presented in **Table 6.2** for embankment fill. Material properties will be determined from samples collected either immediately after placement or from stockpiles.

In-place nuclear density tests will be used for verification of the in-situ dry unit weight of embankment fill. If an in-place density test result fails to meet specifications, the QC Monitor(s) will inform the QA Engineer the extent and nature of the defect by observations and/or additional testing, as necessary, to identify the limits of the area that does not meet project specifications. If the defect is related to adverse site conditions, such as excessively wet soils or surface desiccation, the QC Monitor(s) will define the limits and nature of the defect by testing or observation. After the extent and nature of a defect is determined and has been remedied by the Construction Contractor, the QC Monitor(s) will verify that the deficiency is corrected by retesting repaired areas before any additional work is performed by the Construction Contractor in the area of the deficiency. All failing tests and retests will be recorded in the QC Monitor's field book, or on a compaction testing form submitted to the QA Engineer for review and approval. The approximate location and elevation of each test will be recorded based on predefined stationing.

6.3 SURVEYING

Surveys will be performed by, or under the direction of, a professional land surveyor registered in the State of Utah. The surveyor will record elevations and grades of the fill layers (where applicable) including, but not limited to, those listed below:

- Surface of each foundation backfill lift where QC testing will be performed
- Surface of each embankment lift where QC testing will be performed
- Top of embankment (RWP Phase 1 final design elevation of 4218 feet above mean sea level [amsl])

The results of these surveys will be compiled in reports signed by the surveyor and submitted to the QA Engineer for review. The QA Engineer will then provide guidance to the Design Engineer on whether the work has been completed in accordance with the construction drawings and technical specifications. The surveyor will be required to survey each material layer in accordance with the requirements of this CQAP. A record drawing will be submitted to the Design Engineer for each area of work as the construction progresses and will form a component for progress payments.

6.4 CONSTRUCTION TESTING

Construction material sampling and testing will be performed by the QC Monitor(s) on borrow sources and in-place materials for verification of compliance with the technical specifications. A summary of the construction material testing and frequencies is provided in **Tables 6.1** and **6.2**. Applicable laboratory testing on borrow sources shall be conducted in accordance with this CQAP and the technical specifications prior to use. US Magnesium reserves the right to have additional QA testing performed on borrow and in-place materials at desired frequencies. Cost associated with additional QA testing will be the responsibility of the US Magnesium.

Table 6.1 - Minimum Frequency of Testing for CQC Evaluation of Prepared Foundation

Test	Frequency	Standard Test Method
Testing During Construction		
Standard Proctor	1 per change in material or one for every 10,000 yd^3	ASTM D 698
Single Point Proctor	1 per 5,000 yd^3 (minimum 1 per source or soil type)	AASHTO T 272
Unified Soil Classification System	1 per 5,000 yd^3 (minimum 1 per source or soil type)	ASTM D 2487
Sieve analysis	1 per 5,000 yd^3 (minimum 1 per source or soil type)	ASTM D 422
Atterberg limits	1 per 5,000 yd^3 (minimum 1 per source or soil type)	ASTM D4318

Test	Frequency	Standard Test Method
In-Place Testing		
In-place wet unit weight	One test per 2500 yd^2 of embankment area per lift (minimum 2 tests per shift during placement of material)	ASTM D6938
In-place density (sand cone)	1 per 20 nuclear tests (minimum one test during in-place testing of material)	ASTM D 1556
In-place moisture content	One test per 2500 yd^2 of embankment area per lift (minimum 2 tests per shift during placement of material)	ASTM D6938
Standard count calibration	1 per day of fill placement (or for every 15 field tests whichever is more often)	ASTM D6938

ASTM – American Society for Testing and Materials
ft^2 – square feet

Table 6.2 - Minimum Frequency of Testing for CQC Evaluation of Embankment Fill

Test	Frequency	Standard Test Method
Testing During Construction		
Standard Proctor	1 per change in material or one for every 10,000 yd^3	ASTM D 698
Single Point Proctor	1 per 5,000 yd^3 (minimum 1 per source or soil type)	AASHTO T 272
Sieve analysis	1 per 5,000 yd^3 (minimum 1 per source or soil type)	ASTM D 422
Atterberg limits	1 pe 5,000 yd^3 (minimum 1 per source or soil type)	ASTM D 4318
In-Place Testing		
In-place wet unit weight	One test per 2500 yd^2 of embankment area per lift (minimum 2 tests per shift during placement of material)	ASTM D 6938
In-place density (sand cone)	1 per 20 nuclear tests (minimum one test during in-place testing of material)	ASTM D 1556
In-place moisture content	One test per 2500 yd^2 of embankment area per lift (minimum 2 tests per shift during placement of material)	ASTM D 6938
Standard count calibration	1 per day of fill placement (or for every 15 field tests whichever is more often)	ASTM D 6938

ASTM – American Society for Testing and Materials
ft^2 – square feet

7.0 CONSTRUCTION QUALITY ASSURANCE DOCUMENTATION

7.1 DOCUMENTATION

A major function of CQA is to ensure that the work has been properly and adequately document in accordance with the construction drawings and specifications. This section describes the minimum required QA/QC documentation.

7.1.1 QA/QC Testing Documentation

The QC Monitor(s) and QA Engineer will prepare daily field reports, field data sheets, sample labeling schemes, and chain-of-custody procedures as they are needed during the project. Below is a list of QA/QC testing field forms to be used during the project, example forms are provided as appendices:

- Soil Compaction Field Form (**Appendix B**)
- In-Place Nuclear Testing Form (**Appendix C**)
- Record of Non-Compliance Test Form (**Appendix D**)

7.1.2 Daily Field Reports

Daily field reports, provided as **Appendix D**, will be completed by the QC Monitor(s). Additionally, QA and QC personnel will record field observations and the results of field tests either in their assigned field book or on field data sheets. Field books assigned to CQC and CQA personnel will be labeled with a unique number. When not in use, field books will be left in the field records file. After each book is filled (or at the end of the project), the field book will be retained in the QA Engineer's project files. Each page of the field book will be numbered, dated, and initialed by the QA/QC personnel. At the start of a new work shift, the QA/QC personnel will list the following information at the top of the page:

- Job name
- Job number
- Date
- Name
- Weather conditions
- Page number (if pages are not pre-numbered)

The remaining individual entries will be prefaced by an indication of the time at which they occurred. If the results of test data are being recorded on separate sheets, it will be noted in the field book. Entries in the field book will include, but not be limited to, the following information:

- Reports on any meetings held and their results.
- Equipment and personnel being used in each location, including construction subcontractors.
- Descriptions of areas being observed and documented.
- Descriptions of materials delivered to the site, including any quality verification (vendor certification) documentation.
- Descriptions of materials incorporated into construction.
- Calibrations, or recalibrations, of test equipment, including actions taken as a result of recalibration.
- Decisions made regarding use of material and/or corrective actions to be taken in instances of substandard quality.
- Reporting of issues and corrective measures used to substantiate decisions made.
- Unique identifying sheet numbers of inspection data sheets.

At the end of each day, the QA/QC field personnel will summarize the day's activities on a Daily Field Report (**Appendix A**). The Field Report will include a brief summary of the day's activities and highlight any unresolved issues that must be addressed by the QA Engineer or by the QC Monitor(s) the following day. The daily field monitoring report will be filled out in triplicate or photocopied. The QC Monitor(s) will attach a copy of the field book notes for that day to each copy of the Field Report. The three copies will be distributed as follows:

- Original will be filed in the field office.
- One copy will be transmitted to the QA Engineer.
- One copy will be transmitted to the Construction Project Manager.

7.1.3 Inspection Data Sheets

All observed field and laboratory test data will be recorded on an Inspection Data Sheet and stored in the Construction Contractor's project file. At a minimum, each Inspection Data Sheet will include the following information:

- Unique identifying sheet number for cross-referencing and document control.
- Description of the inspection activity.
- If appropriate, location of the inspection activity or location from which the sample was obtained.
- Type of inspection activity and/or procedure used (reference to standard method when appropriate).
- Any recorded observation or test data, with all necessary calculations.
- Results of the inspection activity and comparison with specification requirements.
- Identification of any personnel involved in the inspection activity.
- Signature of the individual(s) performing the CQC activity.

7.1.4 Record Drawing Maintenance

The Construction Contractor will maintain a complete set of the construction drawings labeled "Red-Line" as-built drawings and will mark changes as the construction progresses. At the completion of the project, the Red-Line as-built drawings will be submitted to the Design Engineer.

7.1.5 Non-Compliance Reporting

A non-compliance is considered to be a deficiency in characteristics, documentation, or procedures that renders the quality of an item or activity unacceptable or indeterminate. If a deficiency cannot be repaired or replaced to the satisfaction of the QA Engineer within the guidelines established by this CQAP, then such a deficiency will be considered a non-compliance and will be documented in a non-compliance form (**Appendix F**). The non-compliance will be indicated to the US Magnesium Construction Manager for disposition and initiation of a corrective action process. All situations will be brought to the attention of the Design Engineer, US Magnesium Construction Manager, and the QA Engineer for concurrence. All documentation relating to these situations will be retained in the project QA records. A deficiency that is discovered during the work that has a process already established to correct the deficiency (i.e., failed compaction test) will be tracked by the QC Monitor(s) until it is corrected. A non-compliance report is not required in these cases.

7.1.6 Progress Reports

The Construction Contractor's Project Manager will prepare a progress report each week, or at time intervals established at the pre-construction meeting. An example Weekly Progress Report form is provided in **Appendix G**.

At a minimum, this report will include the following information:

- A unique identifying sheet number for cross-referencing and document control.
- The date and project name.
- A summary of work activities accomplished during the progress reporting period.
- Identification of areas or items inspected and/or tested during the reporting period that is addressed by the report.
- A summary of the quality characteristics being evaluated, with appropriate cross-references to specifications and/or drawings.
- References to the construction specifications or drawings defining the acceptance criteria for each inspected characteristic.
- A summary of inspection and test results, failures, and retests.
- A summary of construction issues, deficiencies, and/or defects occurring during the progress reporting period.
- A summary of other issue resolutions and dispositions.

The progress report will be submitted to the US Magnesium Construction Manager or designated representative no more than two days after the last reporting day in the progress reporting period.

7.1.7 Final Documentation

Daily field reports, inspection sheets, issue identification and corrective measures reports, acceptance reports, photographic records, progress reports, drawings, drawing revisions, and other pertinent documentation will be retained by the QA Engineer as permanent project QA records to be retained by the Design Engineer. At the completion of the project, a final CQA report that incorporates such information, along with as-built drawings, will be prepared by the CQA team. The report will include documentation of each construction component monitored by CQA personnel and will be signed, stamped, and certified by the Design Engineer.

The Design Engineer will be responsible for the generation of the as-built record drawings, based on survey information provided by a PLS licensed in the State of Utah (refer to Section 6.3 for survey requirements). The as-built records will include scale drawings depicting depths, plan dimensions, elevations, and fill thicknesses. The final as-built drawings will accompany the CQA report and will be submitted to US Magnesium's Construction Manager and forwarded to the appropriate regulatory agencies for approval.

7.1.8 Storage of Records

During construction, the QC Monitor(s) will be responsible for all CQC documents. This includes the QC Monitor's copy of the design criteria, plans, procedures, and specifications; the CQAP; and the originals of all the data sheets and reports. The field records will be kept in metal cabinets, or on metal shelving, within a facility designed to mitigate potential fire hazards. At the completion of the project, all completed documents will be routed to the QA Engineer including all the original field books, maintenance of a records index, access control, and duplicate records requirements. One copy of the final CQA Report and as-built drawings will be retained on-site as part of the Project File.

7.1.9 Storage of Archive Construction Material Samples

The QC Monitor(s) will be responsible for storing construction material samples collected during the duration of the project. All samples will be stored neatly in a cool, dry location as approved by the QA Engineer. The QC Monitor(s) will coordinate with the QA Engineer to determine which samples will be archived at the project completion.

8.0 REFERENCES

American Society for Testing and Materials (ASTM), 1997. 1997 Annual Book of ASTM Standards, Volume 4.08: Soil and Rock (I). American Society for Testing and Materials, Philadelphia, Pennsylvania.

Appendix A SOIL COMPACTION FIELD FORM

Soils Compaction Testing Log

Project _____ Owner _____

Job No. _____ Contractor _____

Test I.D.	Date	Location of Test	Req	Result	Retests			Remarks
					1	2	3	

Page _____ of _____

Appendix B IN-PLACE NUCLEAR TESTING FORM

NUCLEAR FIELD DENSITY/MOISTURE TEST DATA

DATE:_____

PROJECT NUMBER: **CONTRACTOR:**
OWNER:
LOCATION: **SHEET NUMBER____ OF**

TROXLER MODEL _____ SERIAL NO.:_____STANDARD COUNT: DENSITY: _____ MOISTURE:_____ REQUIRED COMPACTION (%): _____

WEATHER: _____FIELD MONITOR: _____

TEST NUMBER													
GENERAL TEST LOCATION													
	I.D. NUMBER												
	ELEVATION												
	BEARING (TO TEST)												
	DISTANCE												
MODE & DEPTH													
WET DENSITY (pcf)													
DRY DENSITY (pcf)	TROXLER	LAB	TROXLER	LAB	TROXLER	LAB	TROXLER	LAB	TROXLER	LAB	TROXLER	LAB
% MOISTURE													
% COMPACTION													
PROCTOR NUMBER													
OPTIMUM MOISTURE (%)													
MAXIMUM DRY DENSITY (pcf)													
PASS/FAIL													
LOOSE LIFT THICKNESS													
GENERAL LOCATION													

Appendix C RECORD OF NON-COMPLIANCE TEST FORM

Record of Non-Complying Tests

Project Title _____ Project No. _____ Contract No. _____

Contractor _____ Type of Work _____

General information as to type of test, results, and other available pertinent data (Cite ASTM, ACI, ANSI, AWS, etc., as applicable)	Quantity Involved	Action Taken

Appendix D DAILY FIELD REPORT FORM

Inspector's Daily Report of Work Progress

Date _____

For submittal to Resident Project Rep. to compile Daily Construction Report

Project Title _____

Project No. _____

Feature _____

Contractor _____

Type of Work _____

Day	S	M	T	W	Th	F	S
Weather	Brite Sun	Clear		Over cast	Rain		Snow
Temp.	<32	3<32		50-70	70-85		85>
Wind	Still	Moder		High	Report No.		
Humidity	Dry	Moder		Humid			

Contractor's Work Force (Indicate classifications, including subcontractor personnel) _____

Equipment in Use or Idled (Identify which) _____

Materials or Equipment Delivered

Non-Conforming Materials or Work (Describe reason for non-conformance) _____

Field Problems (Which could result in delay or claim) _____

Quantities of Pay Items Placed _____

Summary of Construction Activities _____

Follow-up Inspections of Previously Reported Deficiencies _____

Distribution: 1. Field Office
2. Inspector

Inspector _____

CM 403 (Revised 9/16/02)

Appendix E NOTICE OF NON-COMPLIANCE LOG

Notice of Non-Compliance Log

Project _____ Owner _____

Job No. _____ Contractor _____

Date Issued	Description	Date Res	Resolution

Page _____ of _____

Appendix F WEEKLY PROGRESS REPORT

Inspector's Weekly Progress Report

Week Ending _____ No. _____

Project _____ Job No. _____

Owner _____

Contractor _____

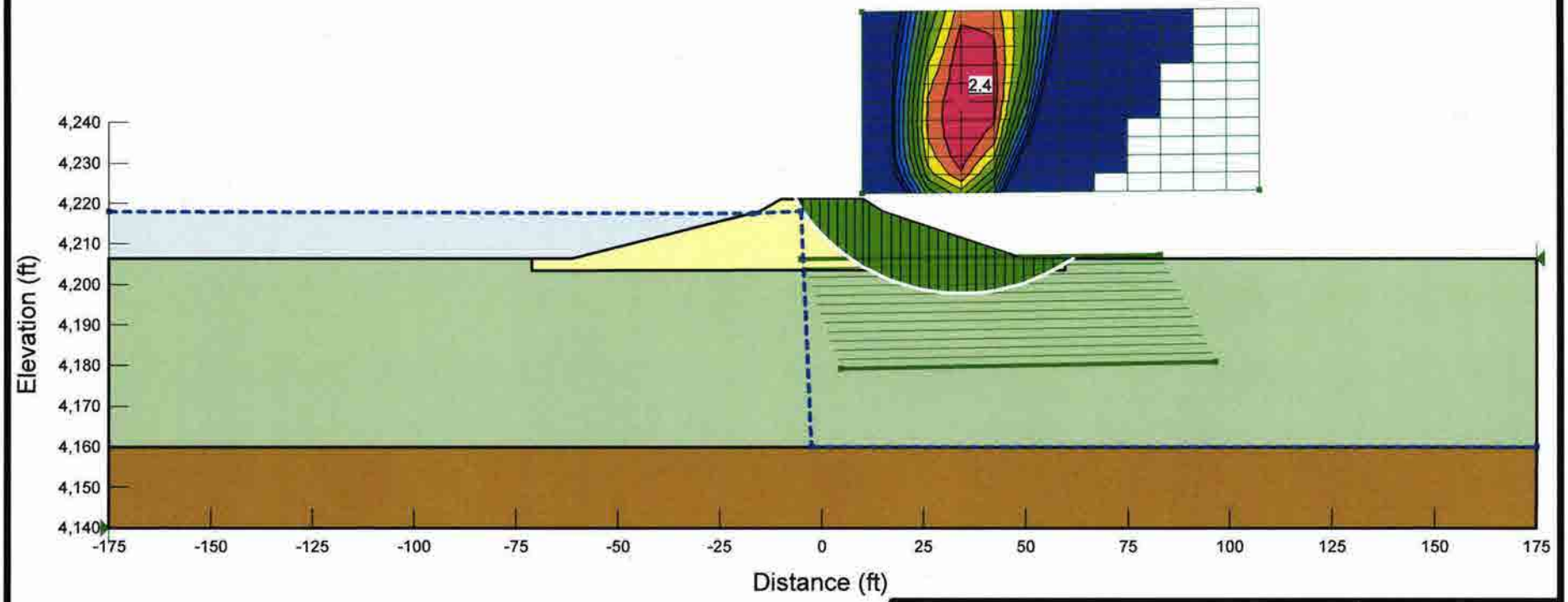
Summary of Construction Activities:

Remarks:

Signed _____

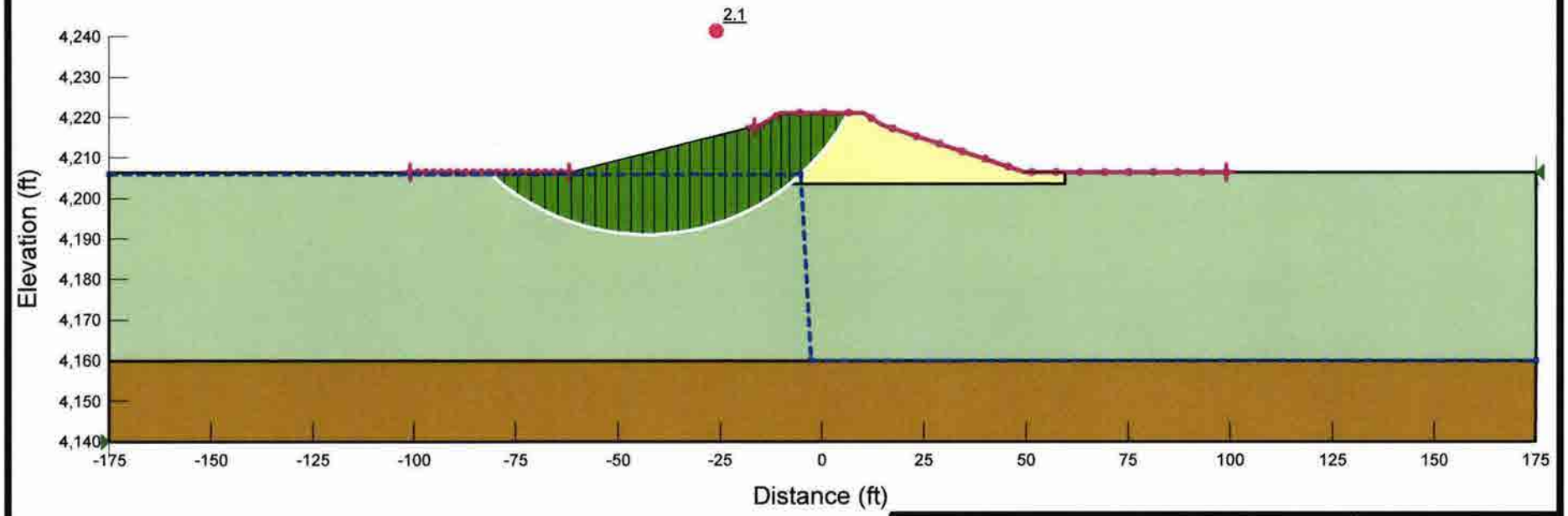
Appendix H – Slope Stability Assessment

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Deeper Silty Clay Unit	110	200	20
	Embankment Material	120	300	23
	Pond Material	110	100	20



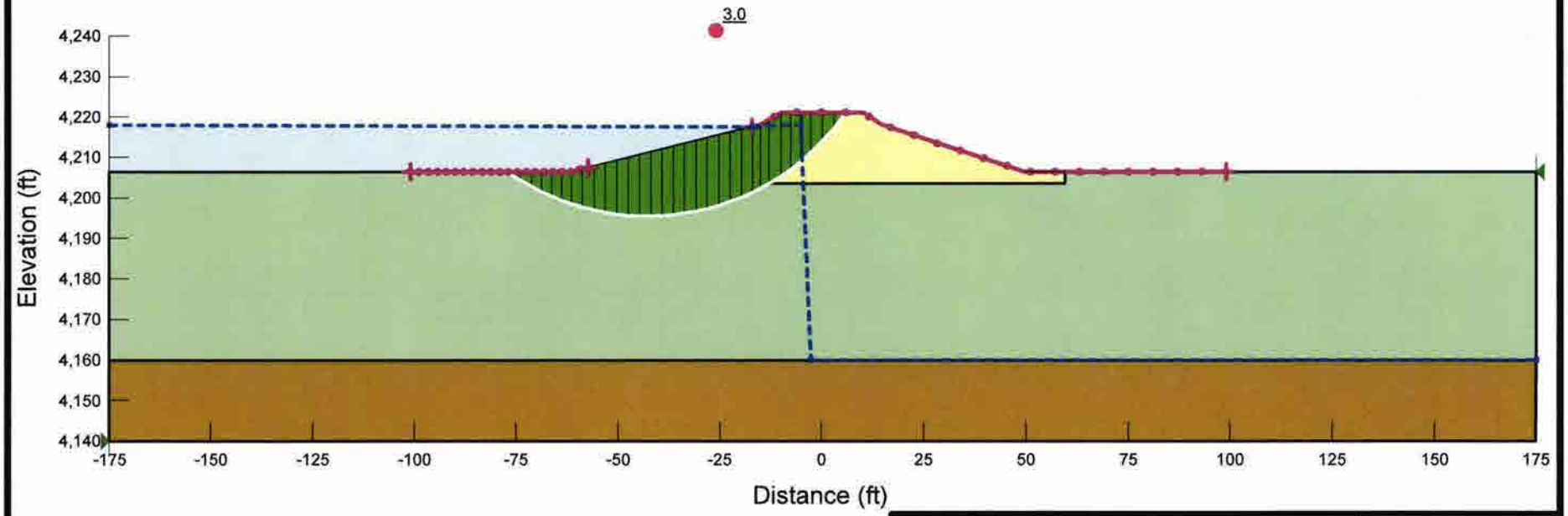
PROJECT	RETROFITTED WASTE POND BASIS OF DESIGN Phase I US Magnesium Facility	Stantec
TITLE Slope Stability (Global) (U/S 4:1 D/S D/S 3:1) (HWL)		SECTION STATION 170+00

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Deeper Silty Clay Unit	110	200	20
	Embankment Material	120	300	23
	Pond Material	110	100	20



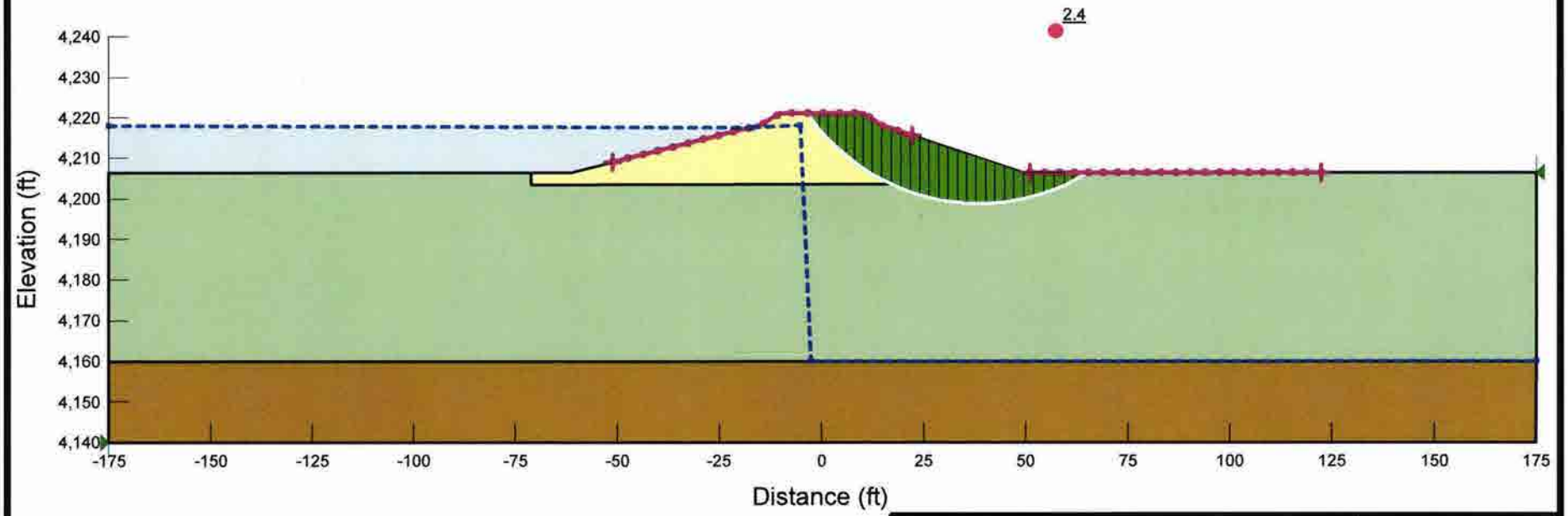
PROJECT	**RETROFITTED WASTE POND BASIS OF DESIGN Phase I US Magnesium Facility**	Stantec
TITLE	**Slope Stability (Circular) (U/S 4:1 D/S 3:1) (LWL)**	SECTION **STATION 170+00**

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Deeper Silty Clay Unit	110	200	20
	Embankment Material	120	300	23
	Pond Material	110	100	20



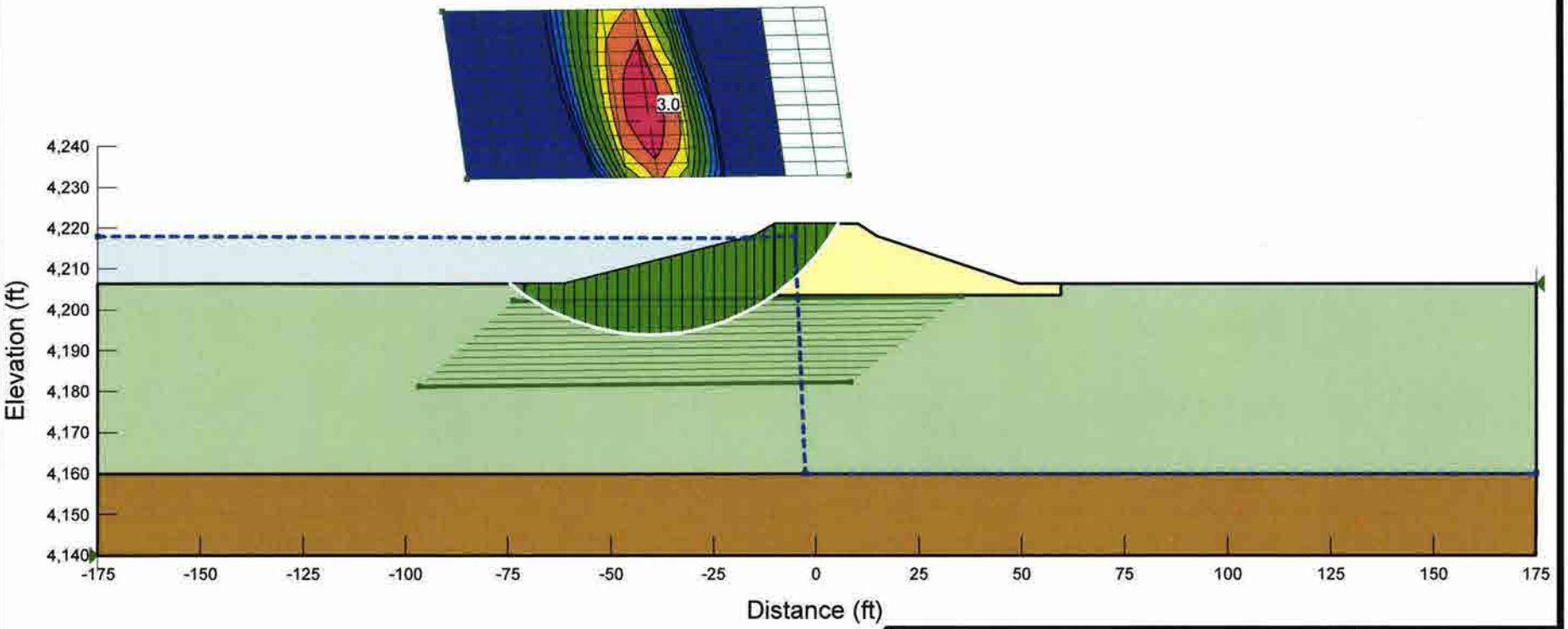
PROJECT	RETROFITTED WASTE POND BASIS OF DESIGN Phase I US Magnesium Facility	Stantec
TITLE Slope Stability (Circular) (U/S 4:1 D/S 3:1) (HWL)		SECTION STATION 170+00

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Deeper Silty Clay Unit	110	200	20
	Embankment Material	120	300	23
	Pond Material	110	100	20



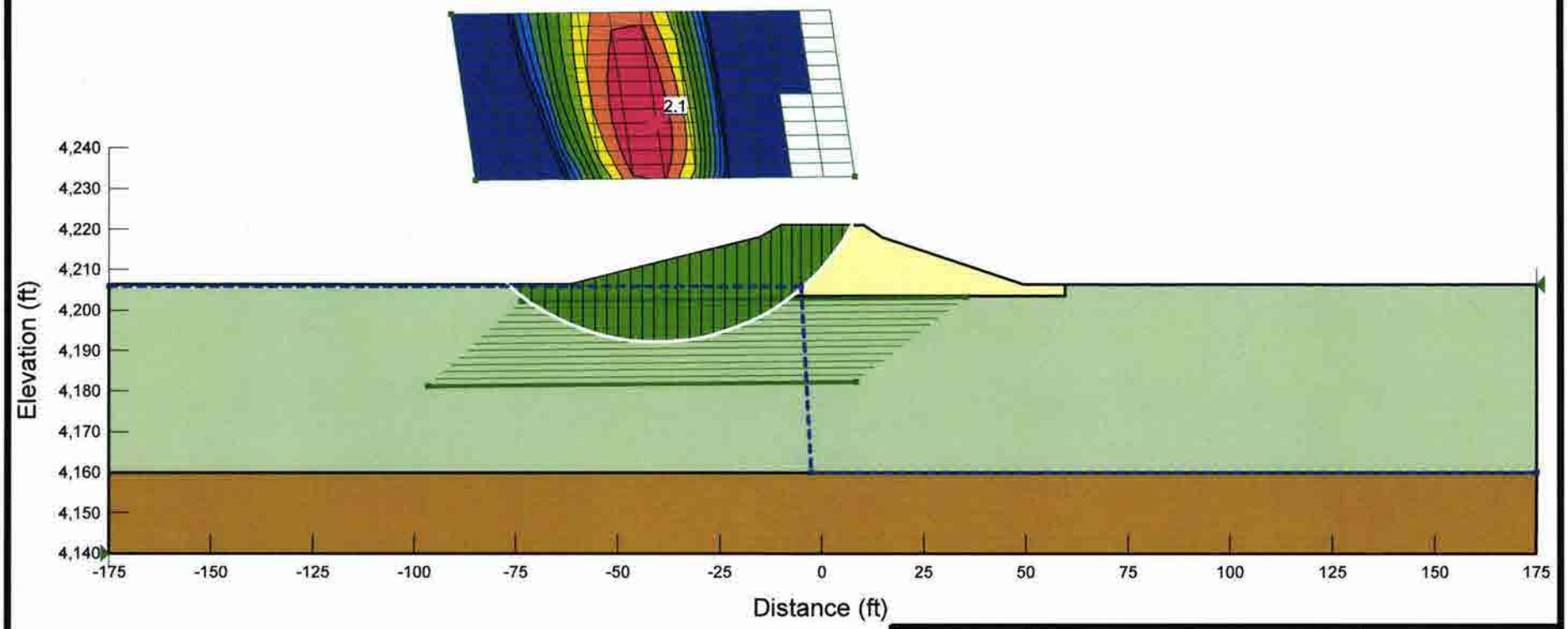
PROJECT	RETROFITTED WASTE POND BASIS OF DESIGN Phase I US Magnesium Facility	Stantec
TITLE Slope Stability (D/S Circular) (U/S 4:1 D/S 3:1) (HWL)		SECTION STATION 170+00

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Deeper Silty Clay Unit	110	200	20
	Embankment Material	120	300	23
	Pond Material	110	100	20

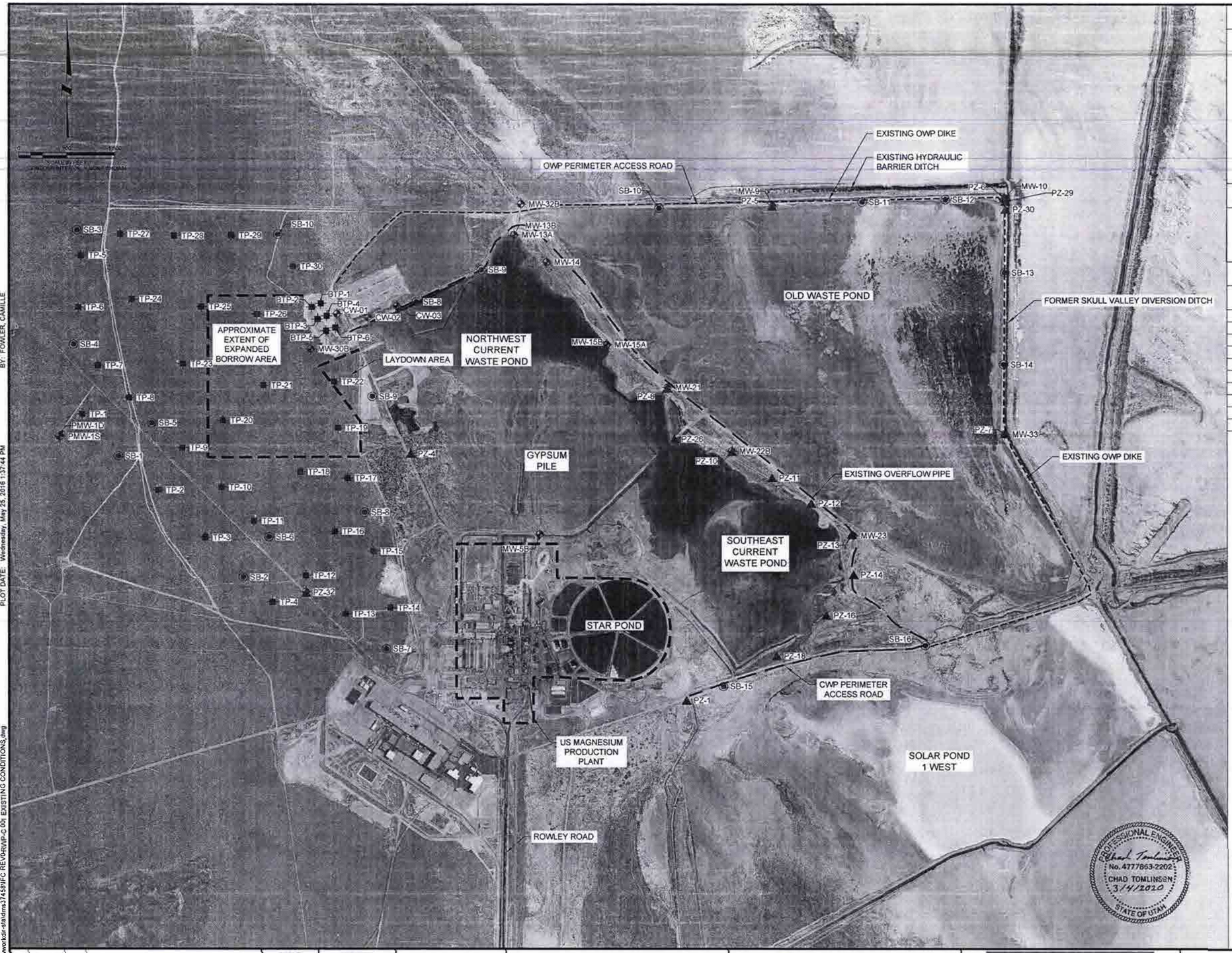


PROJECT	**RETROFITTED WASTE POND BASIS OF DESIGN Phase I US Magnesium Facility**	Stantec
TITLE	**Slope Stability (Global) (U/S 4:1 D/S 3:1) (HWL)**	SECTION **STATION 170+00**

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Deeper Silty Clay Unit	110	200	20
	Embankment Material	120	300	23
	Pond Material	110	100	20



PROJECT	**RETROFITTED WASTE POND BASIS OF DESIGN Phase I US Magnesium Facility**	Stantec
TITLE	**Slope Stability (Global) (U/S 4:1 D/S 3:1) (LWL)**	SECTION **STATION 170+00**



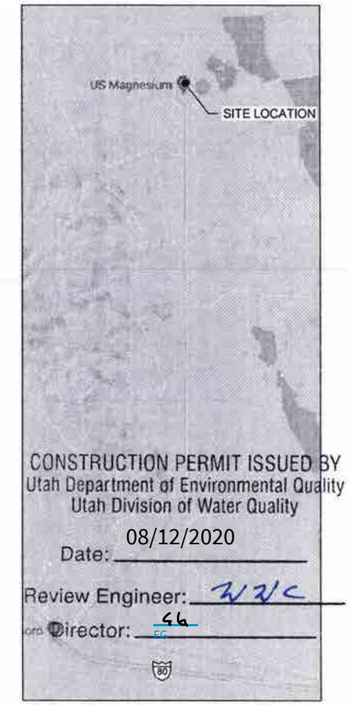
LEGEND:

◉	SOIL BORING
⊕	MONITORING WELL
▲	PIEZOMETER
✱	TEST PIT
CWP	CURRENT WASTE POND
OWP	OLD WASTE POND
— —	EXISTING ROAD

NOTES:

1. ONLY THOSE SOIL BORING, MONITORING WELLS, PIEZOMETERS, AND TEST PITS LOCATED WITHIN THE AREA OF THE WORK, OR THAT ARE APPLICABLE TO THE WORK, ARE SHOWN.
2. AERIAL IMAGERY PROVIDED BY NM GROUP, 2015.

INDEX OF DRAWINGS



VICINITY MAP
NTS

CONSTRUCTION PERMIT ISSUED BY
Utah Department of Environmental Quality
Utah Division of Water Quality
Date: 08/12/2020
Review Engineer: WJC
Director: EG

PROFESSIONAL ENGINEER
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE: 1:800

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

Stantec

USmag

PROJECT: RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
EXISTING CONDITIONS

SHEET: C001

233001376

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: FOWLER, CAMILLE
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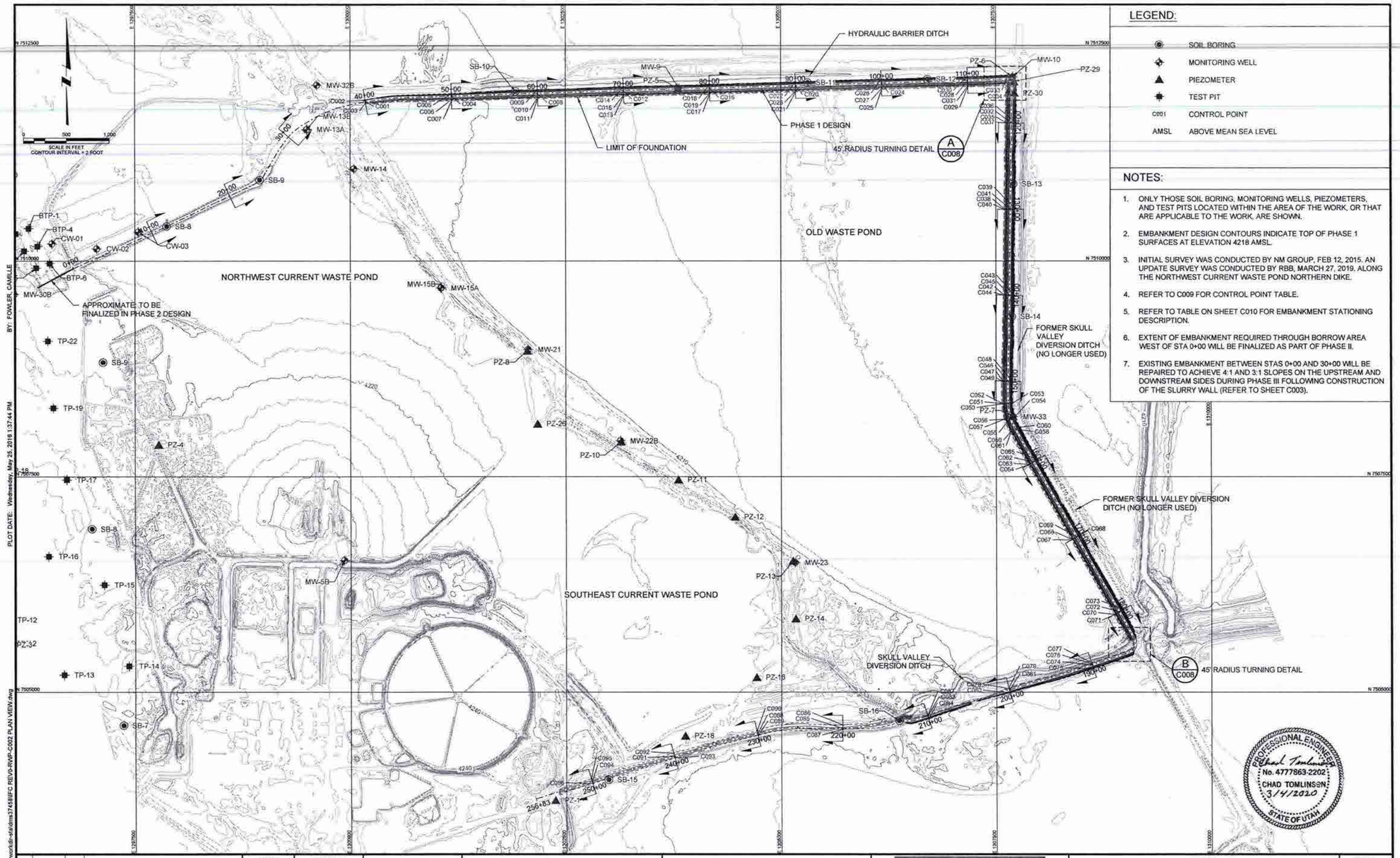

LEGEND:

◉	SOIL BORING
✥	MONITORING WELL
▲	PIEZOMETER
✸	TEST PIT
C001	CONTROL POINT
AMSL	ABOVE MEAN SEA LEVEL

NOTES:

1. ONLY THOSE SOIL BORING, MONITORING WELLS, PIEZOMETERS, AND TEST PITS LOCATED WITHIN THE AREA OF THE WORK, OR THAT ARE APPLICABLE TO THE WORK, ARE SHOWN.
2. EMBANKMENT DESIGN CONTOURS INDICATE TOP OF PHASE 1 SURFACES AT ELEVATION 4218 AMSL.
3. INITIAL SURVEY WAS CONDUCTED BY NM GROUP, FEB 12, 2015. AN UPDATE SURVEY WAS CONDUCTED BY RBB, MARCH 27, 2019, ALONG THE NORTHWEST CURRENT WASTE POND NORTHERN DIKE.
4. REFER TO C009 FOR CONTROL POINT TABLE.
5. REFER TO TABLE ON SHEET C010 FOR EMBANKMENT STATIONING DESCRIPTION.
6. EXTENT OF EMBANKMENT REQUIRED THROUGH BORROW AREA WEST OF STA 0+00 WILL BE FINALIZED AS PART OF PHASE II.
7. EXISTING EMBANKMENT BETWEEN STAS 0+00 AND 30+00 WILL BE REPAIRED TO ACHIEVE 4:1 AND 3:1 SLOPES ON THE UPSTREAM AND DOWNSTREAM SIDES DURING PHASE III FOLLOWING CONSTRUCTION OF THE SLURRY WALL (REFER TO SHEET C003).

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE 1"=500'

WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

Stantec

USmag

PROJECT
RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
PLAN VIEW

SHEET
C002
233001376

DWG FILE: C:\pwworkdir-sfd\dms3745\IFC REVD-RWP-C002 PLAN VIEW.dwg
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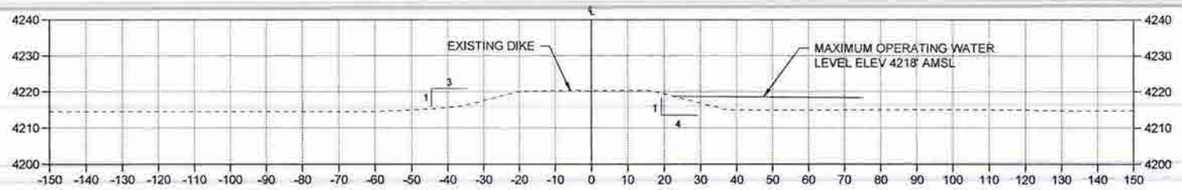
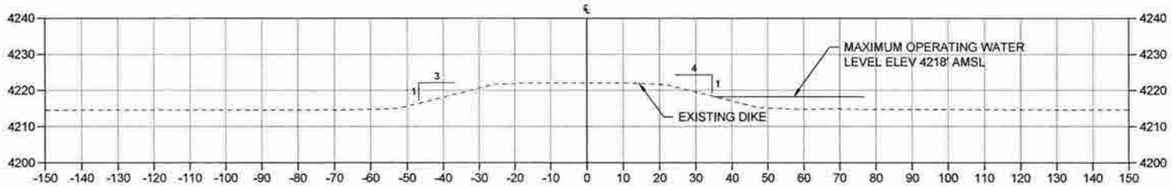
BY: FOWLER, CAMILLE



A - STATION 10+00



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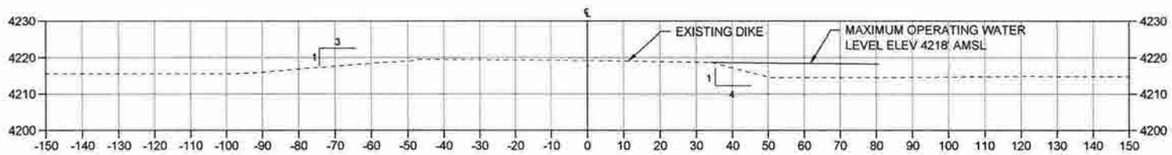
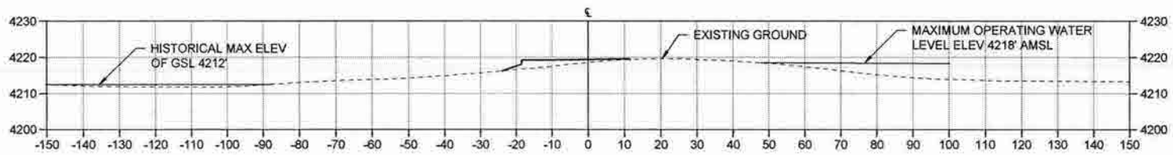


C - STATION 30+00



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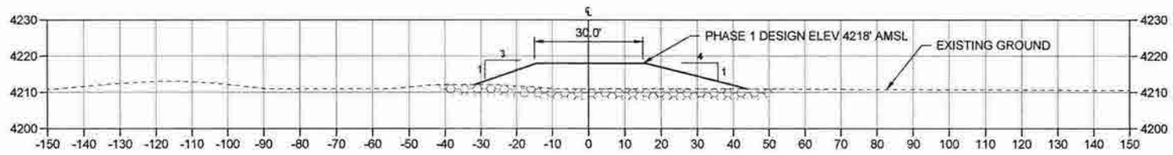

E - STATION 50+00

LEGEND:

	OVER-EXCAVATE TO 3' BGS REPLACE FILL AND COMPACT.
AMSL	ABOVE MEAN SEA LEVEL
BGS	BELOW GROUND SURFACE
ELEV	ELEVATION
GSL	GREAT SALT LAKE
MAX	MAXIMUM

NOTES:

1. PHASE 1 EMBANKMENT TO BE CONSTRUCTED TO ELEV 4218' AMSL AS INDICATED.
2. EMBANKMENT TO BE CONSTRUCTED OF MATERIALS MEETING SPECIFICATIONS FOR EMBANKMENT FILL, PER SPECIFICATION 02222-EARTHWORKS.
3. REFER TO SHEET C009 FOR CONTROL POINTS AND STATIONING AND DESCRIPTION OF FOUNDATION PREPARATION.
4. FOUNDATION PREPARATION TO BE PERFORMED IN ACCORDANCE WITH SPECIFICATION 02222-EARTHWORKS.
5. REFER TO SHEET C010 FOR TYPICAL EMBANKMENT DETAILS.
6. EXISTING EMBANKMENT BETWEEN STAS 0+00 AND 30+00 WILL BE REPAIRED TO ACHIEVE 4:1 AND 3:1 SLOPES ON THE UPSTREAM AND DOWNSTREAM SIDES DURING PHASE III FOLLOWING CONSTRUCTION OF THE SLURRY WALL (REFER TO SHEET C002).

0 20 40
SCALE IN FEET

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE: 1"=20'

WARNING: 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

Stantec

USMAG

PROJECT: RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM CROSS SECTIONS (SHEET 1 OF 5)

SHEET: C003

233001376

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: FOWLER, CAMILLE
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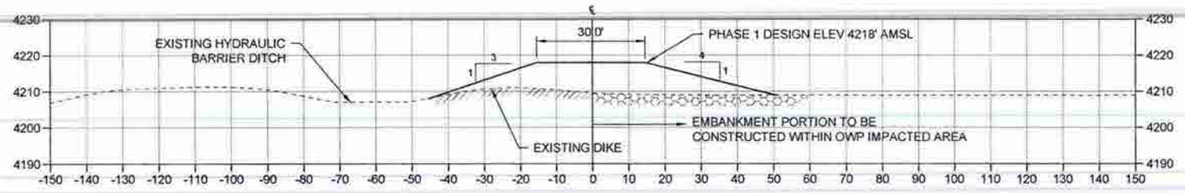

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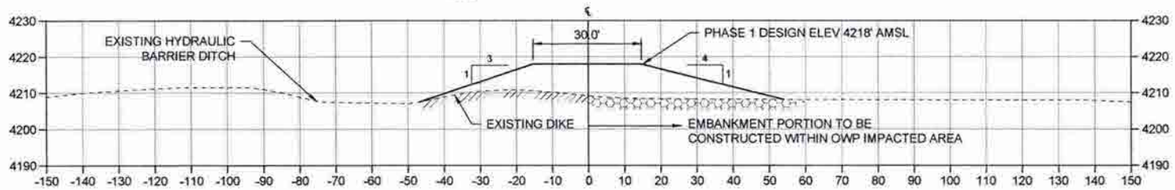
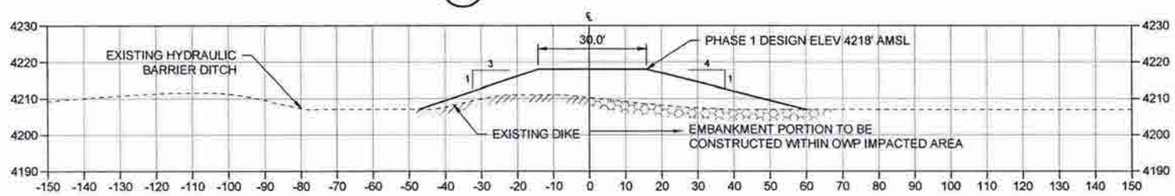


G - STATION 70+00



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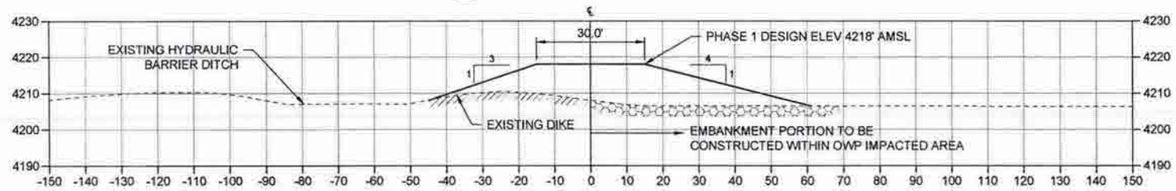
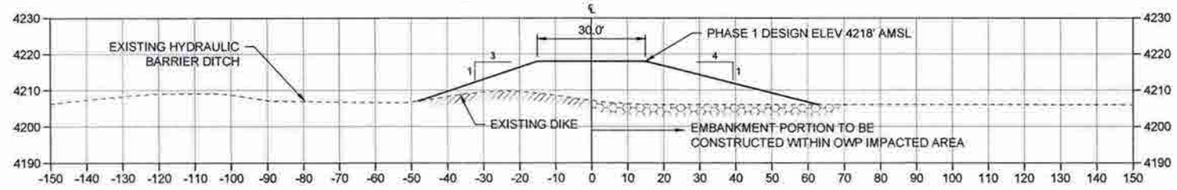


I - STATION 90+00



J - STATION 100+00

LEGEND:

	OVER-EXCAVATE TO 3' BGS REPLACE FILL AND COMPACT.
	OVER-EXCAVATE TO 2' BGS AND RECOMPACT
AMSL	ABOVE MEAN SEA LEVEL
BGS	BELOW GROUND SURFACE
ELEV	ELEVATION
OWP	OLD WASTE POND

NOTES:

1. PHASE 1 EMBANKMENT TO BE CONSTRUCTED TO ELEV 4218' AMSL AS INDICATED.
2. EMBANKMENT TO BE CONSTRUCTED OF MATERIALS MEETING SPECIFICATIONS FOR EMBANKMENT FILL, PER SPECIFICATION 02222-EARTHWORKS.
3. REFER TO SHEET C009 FOR CONTROL POINTS AND STATIONING AND DESCRIPTION OF FOUNDATION PREPARATION.
4. FOUNDATION PREPARATION TO BE PERFORMED IN ACCORDANCE WITH SPECIFICATION 02222-EARTHWORKS.
5. REFER TO SHEET C010 FOR TYPICAL EMBANKMENT DETAILS.

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

0 20 40
SCALE IN FEET

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE: 1"=20'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

Stantec

USmag

PROJECT: RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
CROSS SECTIONS (SHEET 2 OF 5)

SHEET: C004

233001376

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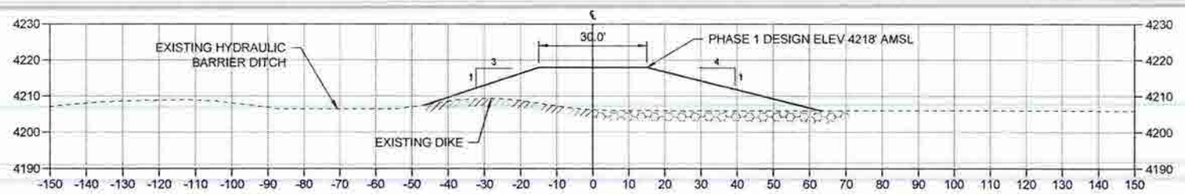
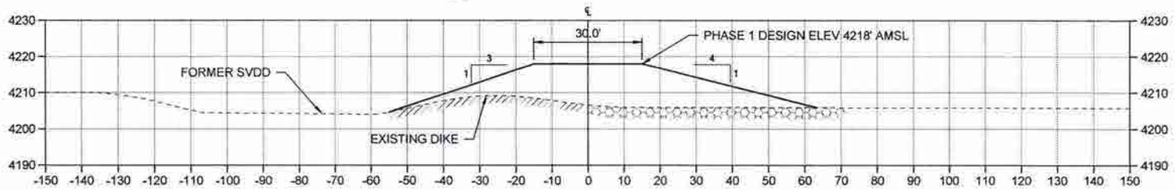
PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: FOWLER, CAMILLE



K - STATION 110+00



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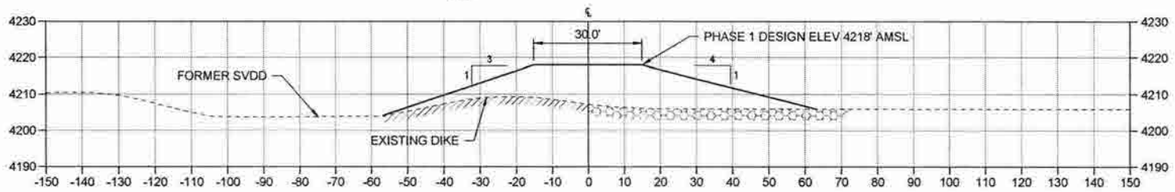
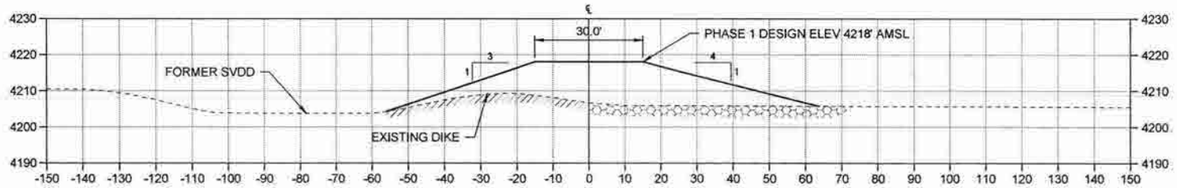
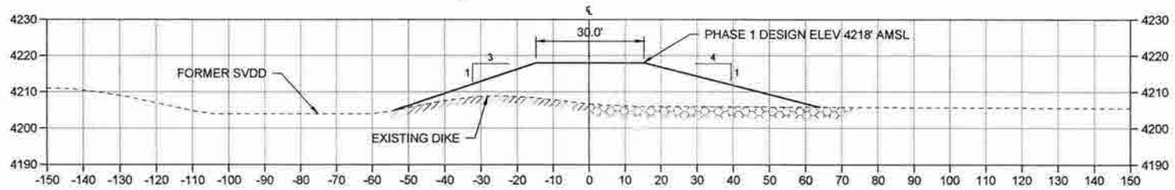


M - STATION 130+00



N - STATION 140+00



O - STATION 150+00

LEGEND:

	OVER-EXCAVATE TO 3' BGS REPLACE FILL AND COMPACT.
	OVER-EXCAVATE TO 2' BGS AND RECOMPACT
AMSL	ABOVE MEAN SEA LEVEL
BGS	BELOW GROUND SURFACE
ELEV	ELEVATION
OWP	OLD WASTE POND
SVDD	SKULL VALLEY DIVERSION DITCH

NOTES:

1. PHASE 1 EMBANKMENT TO BE CONSTRUCTED TO ELEV 4218' AMSL AS INDICATED.
2. EMBANKMENT TO BE CONSTRUCTED OF MATERIALS MEETING SPECIFICATIONS FOR EMBANKMENT FILL, PER SPECIFICATION 02222-EARTHWORKS.
3. REFER TO SHEET C009 FOR CONTROL POINTS AND STATIONING AND DESCRIPTION OF FOUNDATION PREPARATION.
4. FOUNDATION PREPARATION TO BE PERFORMED IN ACCORDANCE WITH SPECIFICATION 02222-EARTHWORKS.
5. REFER TO SHEET C010 FOR TYPICAL EMBANKMENT DETAILS.

PROFESSIONAL ENGINEER
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

0 20 40
SCALE IN FEET

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE: 1"=20'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

Stantec

USmag

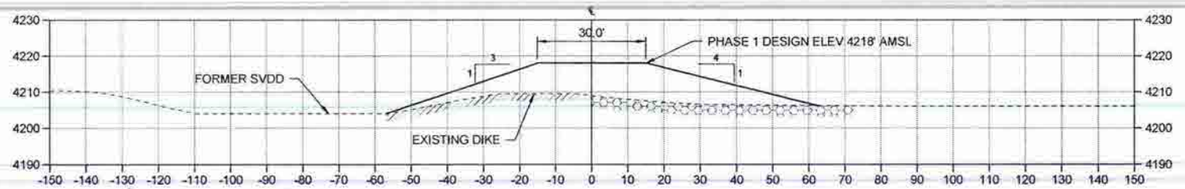
PROJECT: RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
CROSS SECTIONS (SHEET 3 OF 5)

SHEET: C005

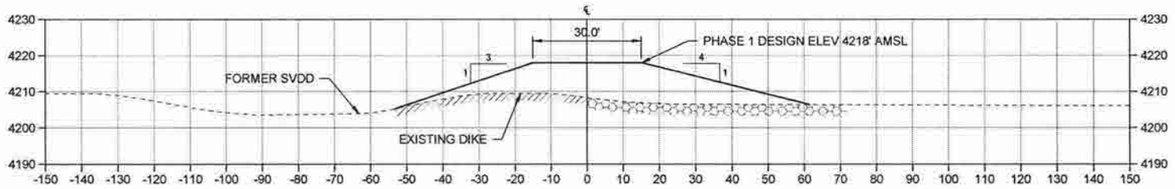
233001376

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM BY: FOWLER, CAMILLE

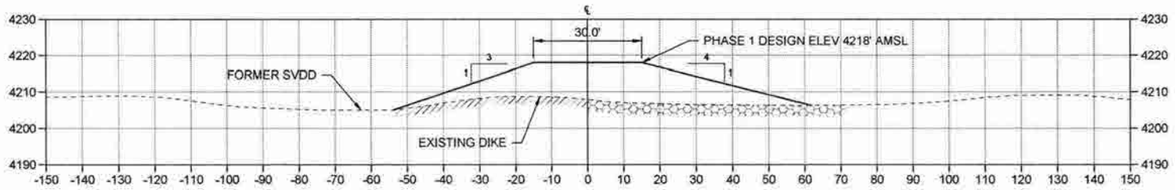
DWG FILE: C:\pwworkdir-sta\dms37458\IFC REV0-RWP-C005 CROSS SECTIONS.dwg



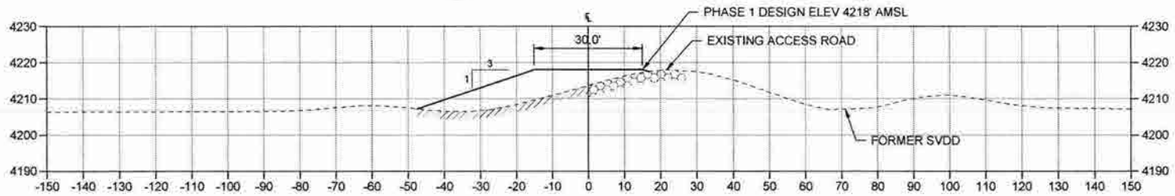
P - STATION 160+00



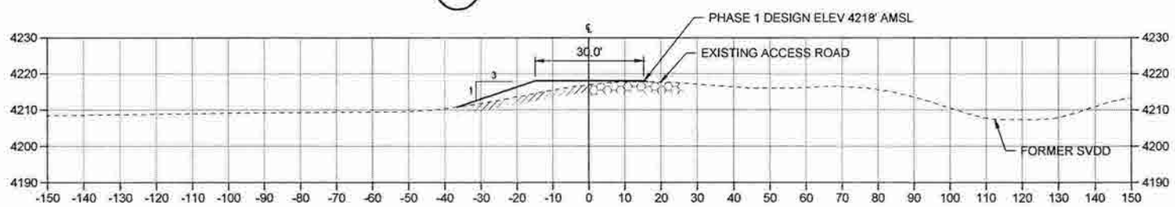
Q - STATION 170+00



R - STATION 180+00



S - STATION 190+00



T - STATION 200+00

LEGEND:

	OVER-EXCAVATE TO 3' BGS REPLACE FILL AND COMPACT.
	OVER-EXCAVATE TO 2' BGS AND RECOMPACT
AMSL	ABOVE MEAN SEA LEVEL
BGS	BELOW GROUND SURFACE
ELEV	ELEVATION
OWP	OLD WASTE POND
SVDD	SKULL VALLEY DIVERSION DITCH

NOTES:

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5. REFER TO SHEET C010 FOR TYPICAL EMBANKMENT DETAILS.

0 20 40
SCALE IN FEET

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE: 1"=20'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

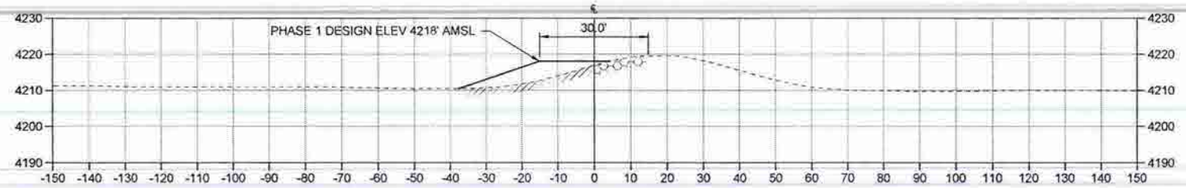
Stantec

USmag

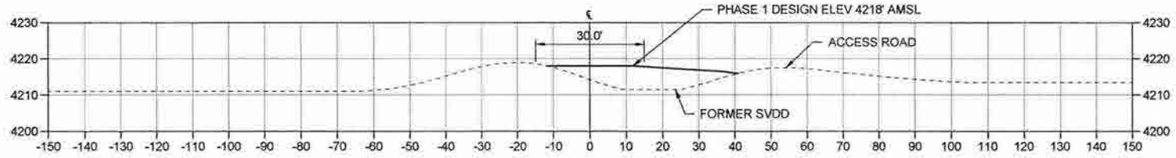
PROJECT: RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
CROSS SECTIONS (SHEET 4 OF 5)

SHEET: C006
233001376

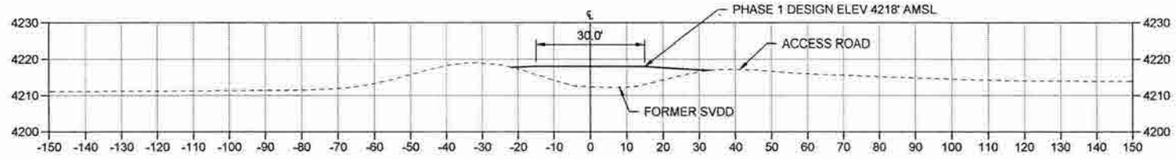
DWG FILE: C:\pwworkdir-stadms\374581\FC REVS-RWP-C006 CROSS SECTIONS.dwg
PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: FOWLER, CAMILLE



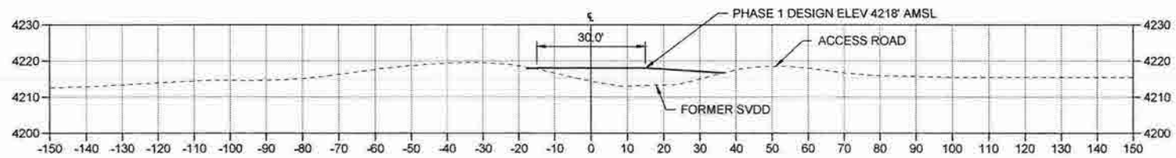
U - STATION 210+00



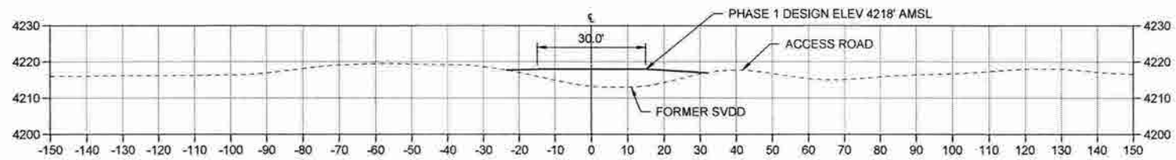
V - STATION 220+00



W - STATION 230+00



X - STATION 240+00



Y - STATION 250+00

LEGEND:

	OVER-EXCAVATE TO 3' BGS REPLACE FILL AND COMPACT.
	OVER-EXCAVATE TO 2' BGS AND RECOMPACT
AMSL	ABOVE MEAN SEA LEVEL
BGS	BELOW GROUND SURFACE
ELEV	ELEVATION
OWP	OLD WASTE POND
SVDD	SKULL VALLEY DIVERSION DITCH

NOTES:

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2. EMBANKMENT TO BE CONSTRUCTED OF MATERIALS MEETING SPECIFICATIONS FOR EMBANKMENT FILL, PER SPECIFICATION 02222-EARTHWORKS.
3. REFER TO SHEET C009 FOR CONTROL POINTS AND STATIONING AND DESCRIPTION OF FOUNDATION PREPARATION.
4. FOUNDATION PREPARATION AND BACKFILLING OF SVDD TO BE PERFORMED IN ACCORDANCE WITH SPECIFICATION 02222-EARTHWORKS.
5. REFER TO SHEET C010 FOR TYPICAL EMBANKMENT DETAILS.

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

0 20 40
SCALE IN FEET

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM BY: FOWLER, CAMILLE

DWG FILE: C:\pwworkdir-stalsms37458\IFC REVO-RWP-C007 CROSS SECTIONS.dwg

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE: 1"=20'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

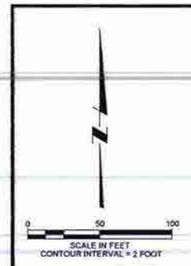
Stantec

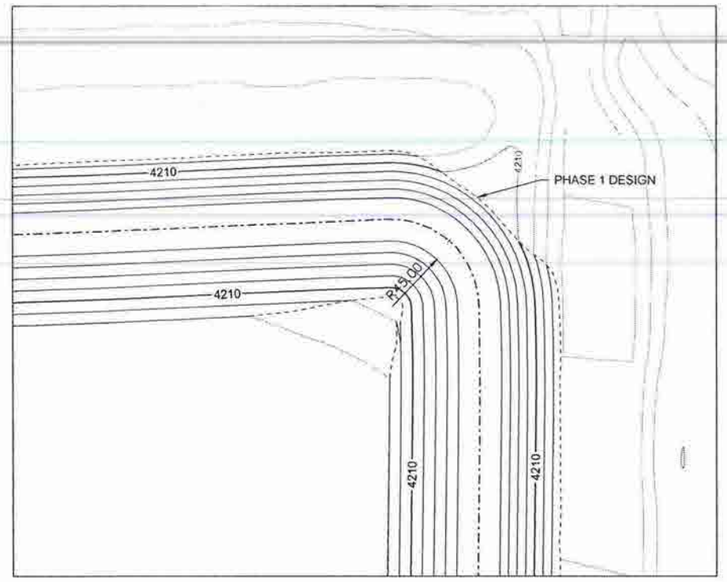
USmag

PROJECT: RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
CROSS SECTIONS (SHEET 5 OF 5)

SHEET: C007

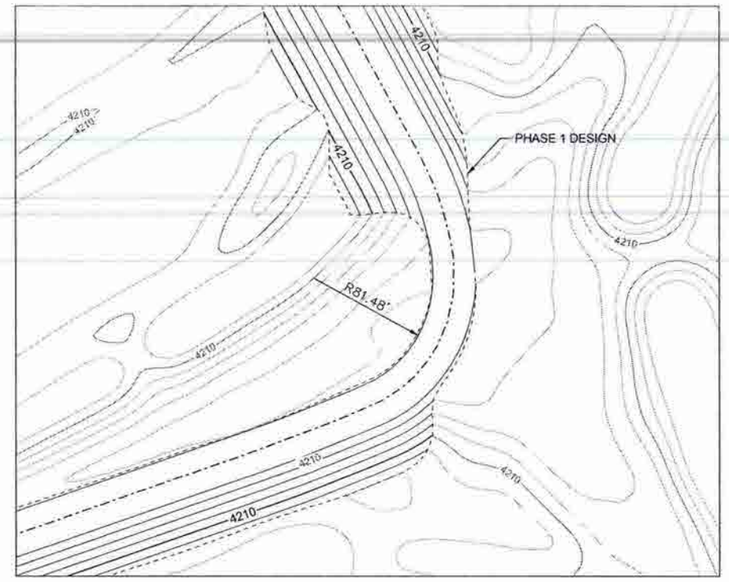
233001376





A C002 45' RADIUS TURNING DETAIL

0 50 100
SCALE IN FEET
CONTOUR INTERVAL = 2 FOOT



B C002 81' RADIUS TURNING DETAIL

0 50 100
SCALE IN FEET
CONTOUR INTERVAL = 2 FOOT

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE: 1"=500'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

Stantec

USmag

PROJECT
RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
TURNING RADIUS DETAILS

SHEET
C008
233001376

DWG FILE: C:\pwworkdir-stat\sms3745#IFC REV0-RWP-C008 ROAD TURNING DETAILS.dwg
PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: FOWLER, CAMILLE

EMBANKMENT CONTROL POINT TABLE				
ID	STATION	EASTING	NORTHING	ELEVATION
C001	STA 40+00	1300177.00	7511848.06	4219.24
C002	STA 40+00	1300173.00	7511866.96	4216.25
C003	STA 40+00	1300179.62	7511832.36	4219.47
C004	STA 50+00	1301173.81	7511911.91	4218.00
C005	STA 50+00	1301173.09	7511943.61	4212.18
C006	STA 50+00	1301175.20	7511868.86	4211.17
C008	STA 60+00	1302173.22	7511945.67	4218.00
C009	STA 60+00	1302172.00	7511989.76	4208.46
C010	STA 60+00	1302174.62	7511895.18	4209.00
C012	STA 70+00	1303172.72	7511977.26	4218.00
C014	STA 70+00	1303171.21	7512023.14	4207.82
C015	STA 70+00	1303174.63	7511923.39	4208.19
C016	STA 80+00	1304172.33	7512004.78	4218.00
C018	STA 80+00	1304171.12	7512051.97	4207.00
C019	STA 80+00	1304174.02	7511945.70	4207.17
C020	STA 90+00	1305171.91	7512033.80	4218.00
C022	STA 90+00	1305170.52	7512078.63	4208.06
C023	STA 90+00	1305173.79	7511973.10	4206.56
C024	STA 100+00	1306171.43	7512064.90	4218.00
C026	STA 100+00	1306169.93	7512112.88	4207.02
C027	STA 100+00	1306173.41	7512002.00	4206.00
C028	STA 110+00	1307171.01	7512093.77	4218.00
C030	STA 110+00	1307169.70	7512139.86	4207.63
C031	STA 110+00	1307172.80	7512030.79	4206.00
C032	STA 120+00	1307682.53	7511601.69	4218.00
C033	STA 114+54	1307625.28	7512110.26	4218.00
C034	STA 115+50	1307687.78	7512051.07	4218.00
C035	STA 120+00	1307619.29	7511602.89	4205.95
C036	STA 120+00	1307737.41	7511600.49	4204.68
C038	STA 130+00	1307606.60	7510602.92	4205.95
C039	STA 130+00	1307726.11	7510603.25	4204.22
C041	STA 130+00	1307669.61	7510603.09	4218.00
C042	STA 140+00	1307594.75	7509605.63	4206.00
C043	STA 140+00	1307713.50	7509601.29	4204.39
C045	STA 140+00	1307657.64	7509603.33	4218.00
C046	STA 150+00	1307637.61	7508604.10	4218.00
C047	STA 150+00	1307574.04	7508605.98	4205.90
C048	STA 150+00	1307691.38	7508602.51	4205.00
C050	STA 152+52	1307639.83	7508351.43	4218.00
C052	STA 152+52	1307576.32	7508347.71	4205.85
C053	STA 152+52	1307689.08	7508352.71	4206.58
C054	STA 154+24	1307714.86	7508192.01	4206.07
C055	STA 154+24	1307664.89	7508182.31	4218.00
C056	STA 154+24	1307603.62	7508167.61	4206.00
C058	STA 155+71	1307726.68	7508048.86	4218.00
C060	STA 155+71	1307777.74	7508074.27	4204.00
C061	STA 155+71	1307671.26	7508018.89	4206.00
C062	STA 160+00	1307932.82	7507672.70	4218.00
C063	STA 160+00	1307878.80	7507641.94	4206.25
C065	STA 160+00	1307981.84	7507700.52	4204.16
C066	STA 170+00	1308373.55	7506773.07	4206.42
C068	STA 170+00	1308473.03	7506829.42	4205.33
C069	STA 170+00	1308426.92	7506803.30	4218.00
C070	STA 180+00	1308868.27	7505904.21	4206.41
C072	STA 180+00	1308921.73	7505934.30	4218.00
C073	STA 180+00	1308968.31	7505960.46	4205.19
C074	STA 190+00	1308606.93	7505316.36	4218.00
C075	STA 190+00	1308621.52	7505271.59	4207.25
C076	STA 190+00	1308601.69	7505332.31	4217.60
C078	STA 200+00	1307645.25	7505042.20	4217.74
C080	STA 200+00	1307660.06	7504991.79	4210.83
C081	STA 200+00	1307649.89	7505026.71	4218.00
C083	STA 210+00	1306697.02	7504723.84	4218.00
C084	STA 210+00	1306708.61	7504688.75	4210.66
C085	STA 220+00	1305712.49	7504579.47	4218.00

EMBANKMENT CONTROL POINT TABLE				
ID	STATION	EASTING	NORTHING	ELEVATION
C086	STA 220+00	1305712.19	7504620.01	4216.04
C087	STA 220+00	1305712.58	7504568.15	4218.00
C088	STA 230+00	1304719.20	7504518.92	4218.00
C089	STA 230+00	1304724.29	7504497.60	4217.77
C090	STA 230+00	1304711.73	7504550.65	4216.92
C091	STA 240+00	1303754.65	7504257.55	4218.00
C092	STA 240+00	1303744.39	7504292.65	4216.73
C093	STA 240+00	1303759.47	7504240.52	4217.89
C094	STA 250+00	1302797.73	7503967.28	4218.00
C095	STA 250+00	1302788.55	7503997.32	4217.03
C096	STA 250+00	1302804.67	7503945.15	4217.74

FOUNDATION CONTROL POINT TABLE				
ID	STATION	EASTING	NORTHING	ELEVATION
C007	STA 50+00	1301175.49	7511858.93	4210.93
C011	STA 60+00	1302175.95	7511884.50	4208.93
C013	STA 70+00	1303174.83	7511913.06	4208.16
C017	STA 80+00	1304174.27	7511935.69	4206.96
C021	STA 90+00	1305174.13	7511962.52	4206.40
C025	STA 100+00	1306173.70	7511991.87	4205.97
C029	STA 110+00	1307173.09	7512020.67	4205.96
C037	STA 120+00	1307609.27	7511602.88	4205.92
C040	STA 130+00	1307596.48	7510602.89	4205.94
C044	STA 140+00	1307584.01	7509606.02	4205.80
C049	STA 150+00	1307563.90	7508606.28	4205.78
C051	STA 150+52	1307566.23	7508348.55	4205.82
C057	STA 154+24	1307593.90	7508165.29	4205.97
C059	STA 155+71	1307662.52	7508014.03	4206.00
C064	STA 160+00	1307870.01	7507636.99	4206.13
C067	STA 170+00	1308364.80	7506767.84	4206.34
C071	STA 180+00	1308859.24	7505899.22	4206.40
C077	STA 190+00	1308598.52	7505342.11	4217.68
C079	STA 200+00	1307642.15	7505051.71	4217.35
C082	STA 210+00	1306695.10	7504729.65	4218.40

STAGE STORAGE				
AREA (SF)	ELEVATION (FT)	VOLUME PER INTERVAL (CY)	CUMULATIVE VOLUME (CY)	CUMULATIVE VOLUME (ACRE-FT)
9168901	4206	0	0	0
19415297	4207	517611	517611	321
22832674	4208	781515	1299126	805
28653438	4209	951409	2250535	1395
32036093	4210	1123298	3373833	2091
33565475	4211	1214734	4588567	2844
34389001	4212	1258386	5846953	3624
35039871	4213	1285701	7132654	4421
35872896	4214	1313169	8445823	5235
48081264	4215	1549198	9995021	6195
51523866	4216	1844172	11839194	7338
54623910	4217	1965420	13804614	8557
56534589	4218	2058390	15863003	9832

	WALL SEGMENT	STATIONING	DESCRIPTION
1	NORTHWEST CWP	0+00 – 30+00	EXISTING RETENTION BERM
2	NW GSL-BEACH	30+00 – 40+00	NON-FILL REACH ACROSS PARENT-GROUND
3	OWP NORTH BERM	40+00 – 110+40	UPGRADE EXISTING E-W BERM ON GSL
4	OWP EAST BERM	110+40 – 180+50	UPGRADE EXISTING N-S BERM ON GSL MUDFLAT
5	SE GSL-BEACH DIAGONAL	180+50 – 212+33 (APPROX) ~	NEW BERM ATOP NATURAL SPIT/BEACH
6	SOUTHEAST CWP BERM	212+33 – 256+83	NEW EMBANKMENT OVER SVDD

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

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B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
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SCALE: 1"=20'

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DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

Stantec

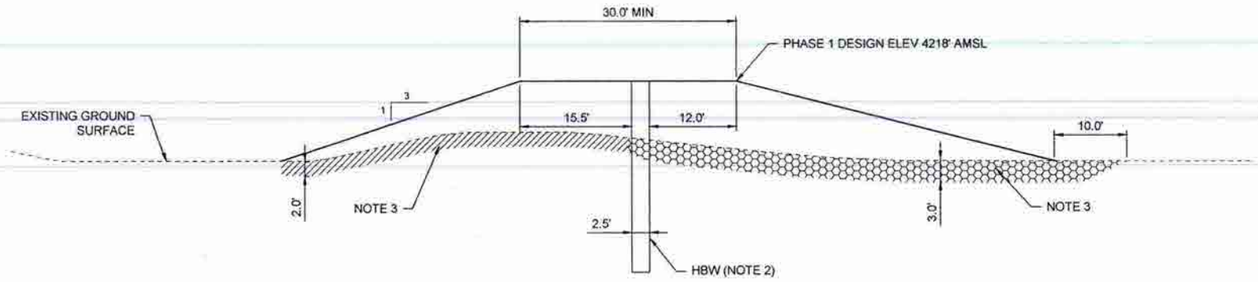
USmag

PROJECT: RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
CONTROL POINT AND STAGE-STORAGE TABLES

SHEET: C009

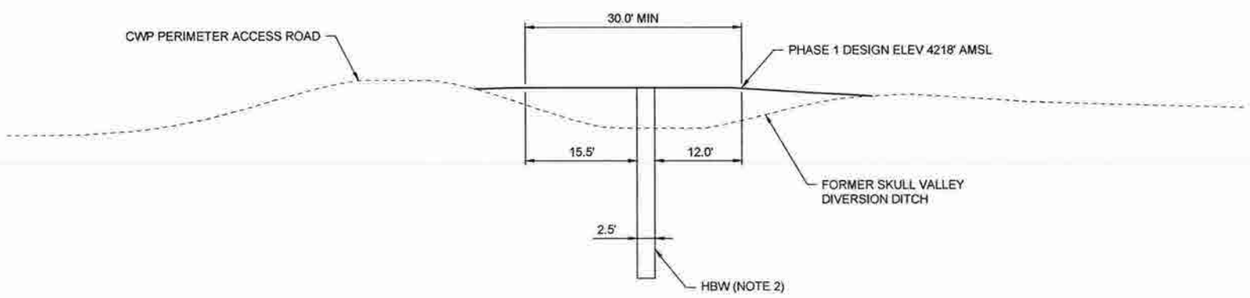
233001376

DWG FILE: C:\pwworkdir-slaldms37458\IFC REV0-RWP-C009 CONTROL POINT TABLE.dwg
PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: FOWLER, CAMILLE



TYPICAL EMBANKMENT DETAIL
STA 50+00 TO STA 212+75

0 10 20
SCALE IN FEET



TYPICAL EMBANKMENT DETAIL
STA 212+75 TO STA 253+25

0 10 20
SCALE IN FEET

LEGEND:

	OVER-EXCAVATE TO 3' BGS REPLACE FILL AND COMPACT.
	OVER-EXCAVATE TO 2' BGS AND RECOMPACT
AMSL	ABOVE MEAN SEA LEVEL
BGS	BELOW GROUND SURFACE
ELEV	ELEVATION
HBW	HYDRAULIC BARRIER WALL
MIN	MINIMUM
OWP	OLD WASTE POND
STA	STATION

NOTES:

1. CONSTRUCTION OF EMBANKMENT IS NOT REQUIRED FROM STA 0+00 TO STA 40+00.
2. LOCATION, WIDTH AND DEPTH OF FUTURE HBW IS SHOWN AS APPROXIMATE. DESIGN OF HBW TO BE COMPLETED AS PART OF PHASE 2.
3. REFER TO SHEETS C003 THROUGH C007 AND C009 FOR LIMITS OF FOUNDATION PREPARATION INCLUDING OVER-EXCAVATION, CARIFYING, AND RECOMPACTION.
4. EMBANKMENT DETAILS SHOWN ARE TYPICAL. REFER TO SHEET C003 THROUGH C007 FOR CROSS SECTIONS. REFER TO SHEET C010 FOR TYPICAL EMBANKMENT DETAILS.

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
3/4/2020
STATE OF UTAH

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: FOWLER, CAMILLE
DWG FILE: C:\pwworkdir-stat\dms374598\FC REV0-RWP-C010 TYPICAL EMBANKMENT DETAILS.dwg

REV	DATE	BY	DESCRIPTION
0	03/03/2020	CF	ISSUED FOR CONSTRUCTION
B	06/25/2019	CF	ISSUED FOR COMMENTS/REVIEW
A	05/08/2019	CF	DRAFT

SCALE: 1"=20'

WARNING: 0 ½ 1" — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C TOMLINSON
DRAWN C FOWLER
CHECKED S EYZAGUIRRE

Stantec

USmag

PROJECT
RETROFITTED WASTE POND PHASE 1 - US MAGNESIUM
TYPICAL EMBANKMENT DETAILS

SHEET
C010
233001378

Signature:

Email: egaddis@utah.gov

Signature: Woodrow Campbell
Woodrow Campbell (Aug 12, 2020 13:12 MDT)

Email: wwcampbell@utah.gov