Water Use Management Plan

Saunders Demonstration Mine

January 10,2023

Twin Pines Minerals, LLC

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GEORGIA
REGISTERED
No. PE025317
PROFESSIONAL
ENGINEER
DON W. DOTSON

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1. EXECUTIVE SUMMARY

This document describes the use and management of water for the Saunders Demonstration Mine in Charlton County, Georgia. Detailed information about the proposed mine and mining process is set forth in the Surface Mining Land Use Plan (SMLUP), to which this Water Use Management Plan is an appendix. Information about the mining operation relevant to this plan is summarized briefly below. This document supersedes all prior versions of the Water Management Plan.

Mineral-bearing sands will be excavated from a moving pit approximately 500-feet long and 100-feet wide. This pit will extend to a maximum of 50 feet below ground surface, and it will advance approximately 100-200 feet per day on average. The mine pit will be backfilled with excavated sands after heavy minerals have been removed. As described in the Post-Mining Reclamation Plan (SMLUP, Sheet 9) a 3-foot layer of 10.9% bentonite will be added at an appropriate depth (specified in the plan) to approximate pre-mining hydraulic properties.

Water management challenges addressed in this plan include: (1) securing water supply to support the beneficiation process, which will consume approximately 300 gallons per minute ("gpm") on a continual basis; (2) evacuating standing water from the active mine pit to support the dragline mining operation; (3) managing water that is removed from the active mine pit, and other water, to ensure there is no discharge to waters of the State or of the United States; (4) managing stormwater; and (5) decommissioning the Process Water Ponds and Water Management Ponds upon closure. These topics are addressed in separate sections below.

The process used to remove heavy minerals from excavated sands (the "beneficiation process") relies on water and centrifugal force, followed by electrostatic and magnetic separation. No chemicals are used in the process itself. The only exceptions are chemicals used to flocculate suspended solids and adjust the pH of recycled process water before it is used again.

No water will be discharged from the site. The beneficiation process requires approximately 3,000 gpm, of which approximately 10% or 300 gpm is consumed. Process water will be recycled until it is exhausted, and any water pumped out of the active mining pit ("seepage water") will be stored in Water Management Ponds with a total storage capacity of 146.7 million gallons, and a working storage capacity of 111.9 million gallons. An evaporator system capable of removing 1,000 gallons per minute will be installed to ensure that any excess water can removed by evaporation rather than being discharged into state or federal waters.

Two new wells screened in the Upper Floridan Aquifer will be installed. Although each well will be permitted for 500 gpm, for a total of 1,000 gpm (1.44 million gallons per day total), their primary use will be to charge the Process Water Ponds at the beginning of the process. After the Process Water Ponds have been charged and mining begins, seepage water removed from the active mine pit will provide most if not all of the required process water, substantially reducing pumping from the Upper Floridan Aquifer.

Stormwater will be managed pursuant to Georgia EPD's Industrial Stormwater General Permit (GAR050000, reissued May 20, 2022). The Water Management Ponds will not be used to manage, and will not receive, stormwater runoff. Details of the stormwater management program are provided on Sheet 6 and 7 of the SMLUP.

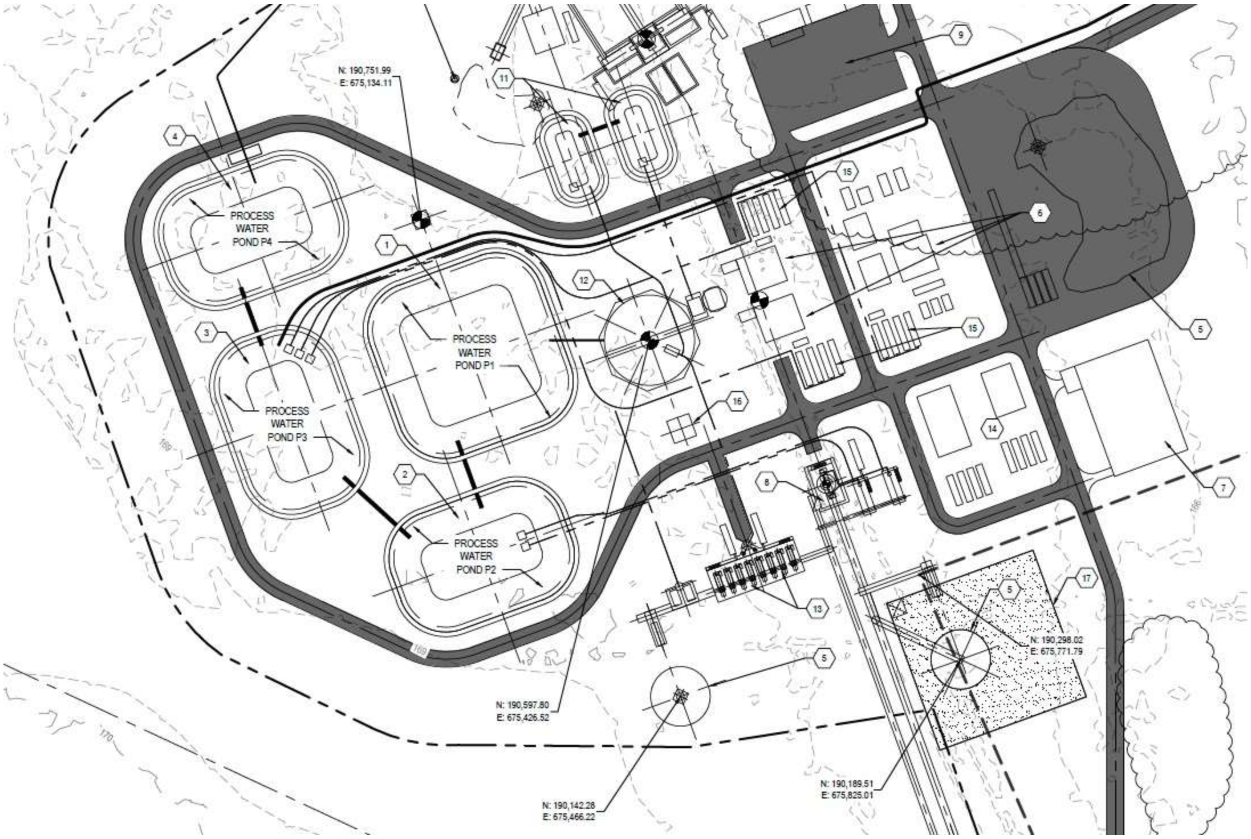
The Process Water Ponds and Water Management Ponds will be decommissioned after the mining process has concluded. The ponds will be drained from one to another starting with M1 and concluding with M4, and any water remaining in M4 will either be evaporated or trucked off site. After the ponds have been drained, their liners will be removed and trucked off site, and the soil used to create the berms will be spread over the site to final grades.

2. PROCESS WATER

Approximately 300 gallons per minute ("gpm") of water will be consumed in the beneficiation process. This is the amount that will need to be supplied on a continual basis. Process water will be withdrawn from the Process Water Ponds (P1 – P3) at an approximate rate of 3,000 gpm, but only approximately 10% will be consumed, and the rest will be returned to the ponds to be reused.

2.1 Process water ponds

A Process Flow Diagram (PFD) for process water use is shown on Sheet 5. Four Process Water Ponds (P1–P4) will be used to manage process water and to distribute it to various process components. The ponds are depicted on Sheet C-205, which is reproduced below.



The Process Water Ponds (P1–P4) will be above-ground and lined. Lining details for all ponds are shown on Sheet C-701. The individual pond volumes are shown on Sheet C-200; as shown in the table below, the total capacity of the four ponds is approximately 3.9 MG, and the working capacity with appropriate freeboard is 3.4 MG.

Table of Pond Volumes			
Process Water Ponds			
Pond Name	Total Volume	Max. Working Volume	Pond Area
Process Water Pond P1	1,500,000 GAL.	1,300,000 GAL.	0.8 Ac.
Process Water Pond P2	800,000 GAL.	700,000 GAL.	0.5 Ac.
Process Water Pond P3	800,000 GAL.	700,000 GAL.	0.5 Ac.
Process Water Pond P4	800,000 GAL.	700,000 GAL.	0.5 Ac.
Thickener Underflow Pond A	197,400 GAL.	108,380 GAL.	0.1 Ac.
Thickener Underflow Pond B	197,400 GAL.	108,380 GAL.	0.1 Ac.

Water will initially be fed to Pond P3, which will distribute it to Ponds P1, P2, and P4. The ponds are interconnected with valves and pumps, so water can be distributed as required to equalize the basins and feed water to the various ore processing components, which are labelled on Sheet C-205.

The return flow will pass through a thickener (Sheet C-205, Item 12) and underflow ponds (Sheet C-205, Item 11) to remove sediments. Sediments in the thickener (and all other ponds) will be removed by vacuum dredging as required.

Average detention time in the Process Water Ponds will be approximately 22 hours. This is determined by dividing the working storage capacity of 3.9 MG by the gross daily process water requirement of 4.32 MG.

2.2 Water supply sources

The Process Water Ponds will be filled with water from the Water Management Ponds (M1–4), described below, that will capture precipitation, drainage from the stockpile staging area, and any seepage water evacuated from the mine pit. Additionally, a back-up source of water supply will be provided by two new wells screened in the Upper Floridan Aquifer with a maximum permitted capacity of 1,000 gpm. Water from the Water Management Ponds will be utilized to the maximum extent possible before any water is withdrawn from the Upper Floridan wells. The Upper Floridan wells will be used to charge the Process Water Ponds when mining first begins, until sufficient water is available in the Water Management Ponds; but the wells will generally not be utilized during normal project operations.

If the mining operation is shut down for any reason, the beneficiation process will continue until any stockpile is depleted. After the stockpile is depleted, material processing will cease until mining resumes and additional material is available. No process water will be utilized when processing is halted.

2.2.1 Principal supply from the Water Management Ponds

The following quantities will be available from the Water Management Ponds:

Seepage water. Water evacuated from the mine pit during active mining operations will contribute substantial volumes that can be used for process water. The seepage rate will vary as the mine moves, but the long-term average across the project is conservatively estimated to be 783 gpm. *See* Sorab Panday, *Addendum to Modeling the Groundwater Flow System at the Proposed Twin Pines Mine on Trail Ridge* (Nov. 9, 2022), p. 4 (SMLUP App. O). This water will be evacuated from the mine pit as necessary to ensure that no more than 8 feet of water remains. Once the mining process is initiated, seepage water will likely supply most, if not all, of the required process water.

Precipitation. Precipitation captured in the Water Management Ponds will contribute approximately 16.2 MG/Year, or approximately 10% of the annual consumptive demand for make-up water. This is based on climate data (SMULP App. J) showing that the average rainfall in excess of evapotranspiration at the site is approximately 11.75 inches per year.

Stormwater. Water draining from wet material in the stockpile staging area will be captured and pumped to the Process Water Ponds. Any overflow from the Process Water Ponds will go to the Management Water Ponds. Similarly, while berms around the stockpile staging area are not intended to control stormwater, a portion of any precipitation falling within the pond berm will be collected and pumped to the Process Water Ponds along with the drainage water. Because the area is small, the contribution from stormwater will be negligible.[1]

2.2.2 Startup and backup supply from the Upper Floridan Aquifer

The proposed locations of the Upper Floridan wells are shown on Sheet C-200. Well FWP-01 is located east of the Fuel Storage Area on the south portion of the sheet; Well FPW-02 is located

[1] It is anticipated that approximately 17% of the water contained in excavated sands will drain from the material while it is in the stockpile. A previous submission referred to this water being "lost," but it will actually be captured and reused.

east of the Alternate Storage Pond on the north portion of the sheet.

A proposal for the construction of two new Upper Floridan wells was received from the Donald Smith Company, Inc. (DSC) of Headland, Alabama (SMULP App. T). The proposal included the installation of two 650-feet deep open bottom limestone wells installed by rotary drilling with 12-inch steel casing and 75 hp line-shaft vertical turbine pumps (VTP) set at a depth of 180 feet below ground surface (bgs). A line-shaft VTP has an above-ground motor and the one proposed by DSC can produce 600 gpm of water at 300 feet or less of total hydraulic head; the proposed discharge pipe is 8-inches in diameter. The proposed capacity of the two pumps is 600 gpm each; however, the requested permitted capacity is 500 gpm each. DSC reports that they have installed other wells in the limestones of the Floridan formation and that well screens are generally not required. Screens will be added if sand is encountered in the production zone during drilling or well development, however. For additional details, see the DSC proposal (SMULP App. T).

3. MINE PIT DEWATERING

Groundwater will seep into the mine pit. GSI conservatively estimates the average seepage rate over the entire proposed mine area to be 783 gpm. *See* Sorab Panday, *Addendum to* Modeling the Groundwater Flow System at the Proposed Twin Pines Mine on Trail Ridge (Nov. 9, 2022) [SMLUP App. O]. Because standing water reduces the efficiency of the dragline mining operation, seepage water will be evacuated as necessary to keep the water depth in the mine pit below 8 feet. Pumps will be used to remove seepage water. The pumps will be connected to large diameter hoses to convey water evacuated from the pit to Water Management Pond M1.

The depth of the mine pit will vary as it moves, but at its maximum (50 feet) the pit's volume will be 39.4 MG. Given ongoing dewatering and that the water table is below ground surface, the pit will not fill to this level, except potentially due to precipitation from an extreme weather event. Further, given that up to 8 feet of water can be maintained in the pit, the entire volume of water would not need to be removed. Nevertheless, the full volume of the pit would be approximately equal to the storage capacity of Water Management Pond M1. An additional 73.5 MG of storage capacity is available in M2-M4. As discussed below, evaporators to be installed in the Water Management Ponds will have sufficient capacity to evaporate additional seepage water added to the ponds on a daily basis.

To the extent possible, any work stoppages that could result in substantial volumes of seepage water accumulating in the mine pit will be scheduled at a time when sufficient storage capacity is available below target elevation. Evaporators will be used to draw the ponds down before such events as necessary to ensure sufficient freeboard is available.

The calculations on which these statements are based are shown in Figures 1 and 2 below.

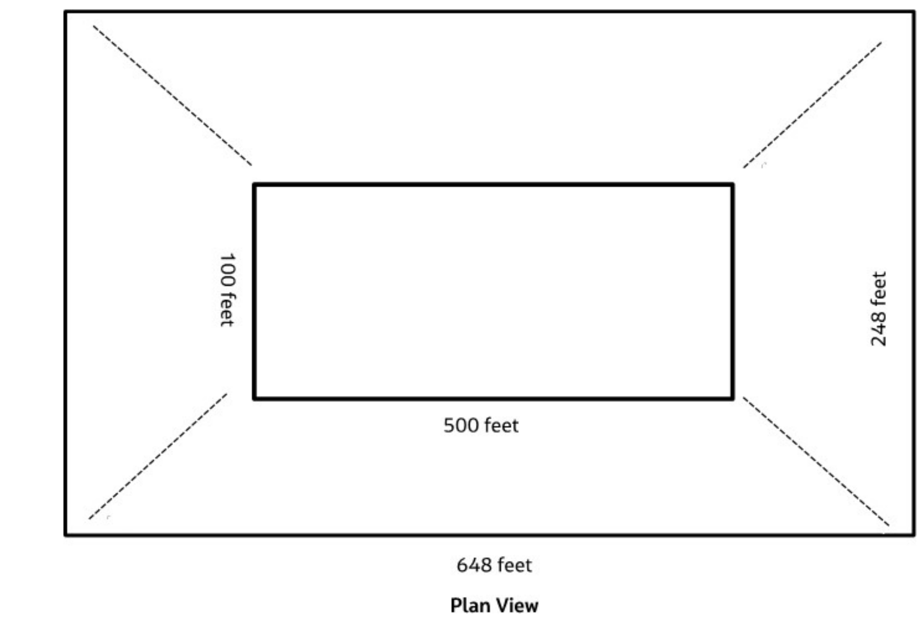


Figure 1. Mine Pit Conceptual Model
(Plan View)

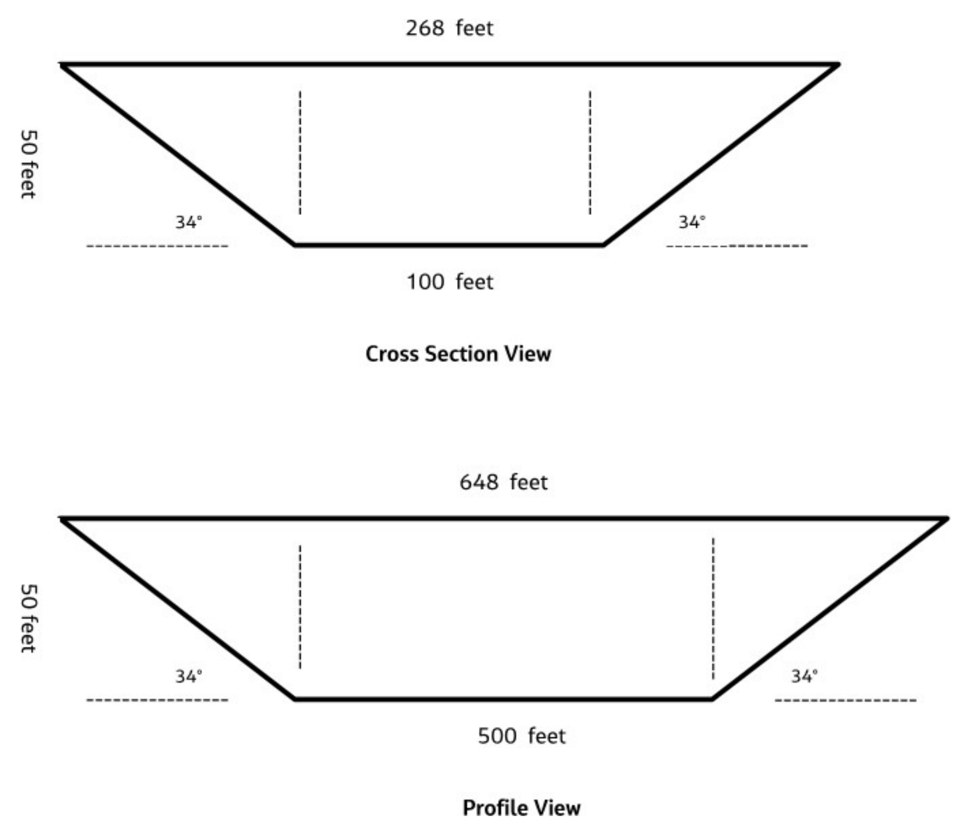


Figure 2. Mine Pit Conceptual Model (X-section and Profile)

Maximum volume of water to dewater pit

$$A_1 := 248\ ft \cdot 648\ ft = 160704\ ft^2$$

$$A_2 := 100\ ft \cdot 500\ ft = 50000\ ft^2$$

$$A_{avg} := \frac{A_1 + A_2}{2} = 105352\ ft^2$$

$$Vol := A_{avg} \cdot 50\ ft = \left(5.27 \cdot 10^6\right)\ ft^3$$

$$Vol = 39.4\ MG$$

4. WATER MANAGEMENT

Four Water Management Ponds (M1-M4) will be constructed to store water from three sources identified in Section1.1.2 above. This water will be conserved and managed to ensure there is no discharge to waters of the State or the United States.

The ponds are shown on Sheet C-200 along with their total and working storage volumes, the relevant portions of which are reproduced below. All of the ponds will be lined, as detailed in Sheet C-701.

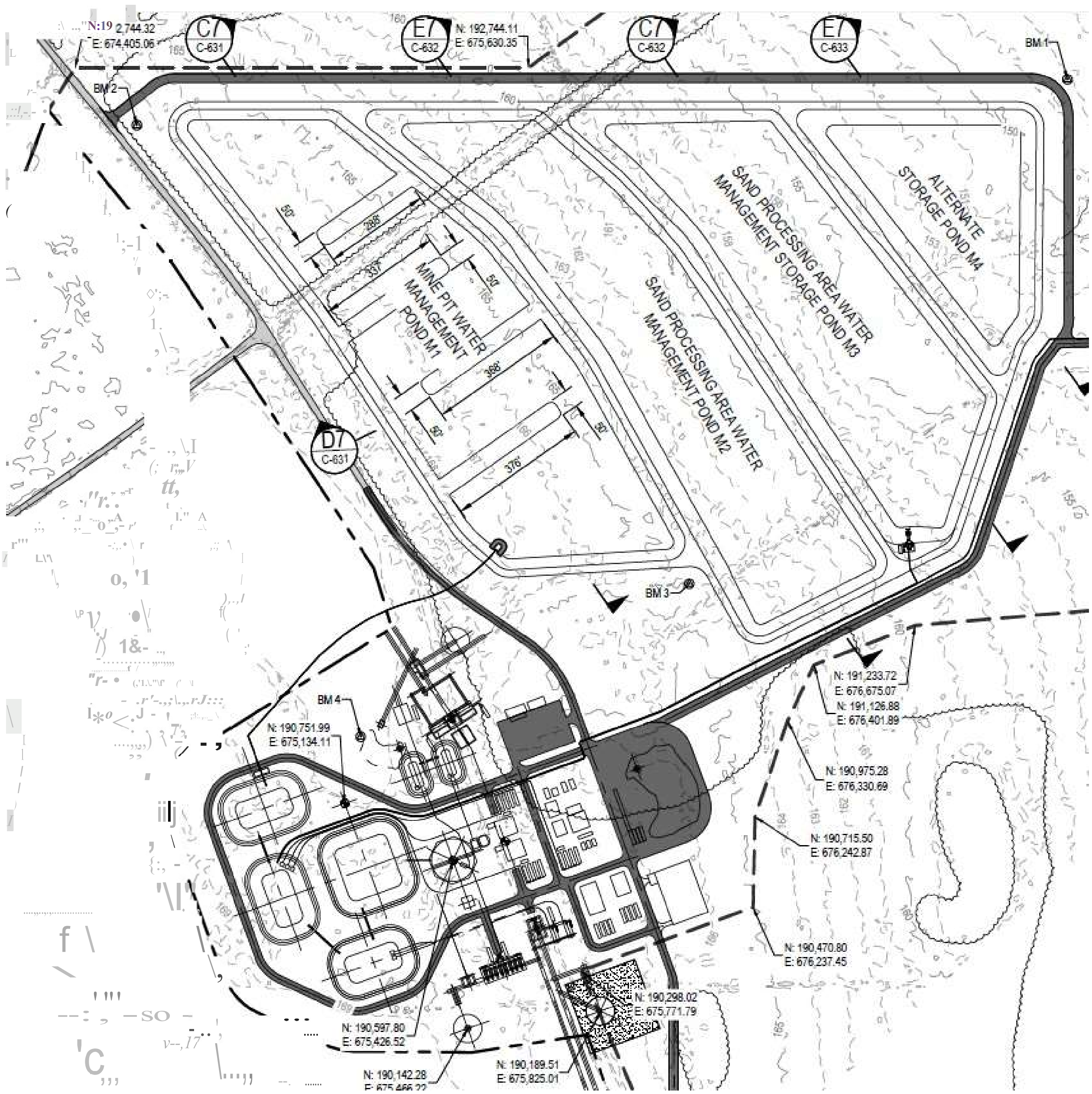

E: 674,405.06
C7
C-631
E7
C-632
N: 192,744.11
E: 675,630.35
C7
C-632
E7
C-633
BM 1
BM 2
BM 3
BM 4
D7
C-631
MINE PIT WATER
MANAGEMENT
POND M1
SAND PROCESSING AREA WATER
MANAGEMENT POND M2
SAND PROCESSING AREA WATER
MANAGEMENT STORAGE POND M3
ALTERNATE
STORAGE POND M4
50'
288'
337'
368'
376'
N: 191,233.72
E: 676,675.07
N: 191,126.88
E: 676,401.89
N: 190,975.28
E: 676,330.69
N: 190,715.50
E: 676,242.87
N: 190,470.80
E: 676,237.45
N: 190,751.99
E: 675,134.11
N: 190,298.02
E: 675,771.79
N: 190,597.80
E: 675,426.52
N: 190,189.51
E: 675,825.01
N: 190,142.28

Table of Pond Volumes			
Water Management Ponds			
Pond Name	Total Volume	Max. Working Volume	Pond Area
Mine Pit Water Management Pond M1	51,153,368 GAL.	38.356,811 GAL.	17.1 Ac.
Sand Processing Area Water Management Pond M2	41,256,921 GAL.	32,160,837 GAL	14.1 Ac.
Sand Processing Area Water Management Pond M3	37,084,466 GAL.	28,670,896 GAL.	12.6 Ac.
Alternate Storage Pond M4	17,246,725 GAL.	12,697,470 GAL.	6.0 Ac.

4.1 Storage capacity

The four Water Management Ponds have a total storage capacity of 146.7 million gallons, a working storage capacity of 111.9 million gallons, and a normal operating capacity (at a depth of 5 feet) of 59.4 MG. With this capacity, the ponds can store enough water to supply the total consumptive demand for process water with sufficient freeboard remaining to store precipitation and runoff from the stockpile staging area during extreme rainfall events.

A 25-year, 24-hour storm event is the 24-hour accumulation that is expected to be exceeded once every 25 years. The probability that the 25-year, 24-hour storm event will be exceeded in any given year is 4% or 4-in-one-hundred. The probability that a 25-year, 24-hour event will occur during the 5-year life of the project is 20%. The Water Management Ponds have sufficient capacity to store a 1,000-year, 60-day event (which NOAA estimates to be 38.2 inches or 3.18 feet) without any discharge and with 1.81 feet of freeboard remaining — that is, with enough freeboard remaining to store an additional 50% of the 1,000-year, 60-day accumulation.

As described below, evaporators capable of removing 1,000 gpm will be installed to ensure sufficient freeboard is available at all times. Because the evaporator capacity of 1,000 gpm exceeds the estimated seepage rate of about 783 gpm, the evaporators will be more than sufficient to remove seepage water discharged into the Water Management Ponds on a daily basis as well as additional water that must be removed to maintain freeboard.

The target operating depth for Ponds M1–M3 will be five (5) feet or less; M4 will be kept mostly empty to provide 12.6 MG of emergency storage. At a depth of five (5) feet, Ponds M1 – M3 have a storage volume of 59.4 MG. The normal pool elevation at a depth of five (5) feet along with the incremental 25-year, 100-year, and 1,000-year storm elevations are shown on Sheets C-631 to C-633.[2]

4.2 Evaporators

167 individual Varimax-40 evaporation units (or equivalent) will be installed within the Water Management Ponds to remove excess water. These units are capable of removing up to 1,000 gpm in South Georgia. Details of the evaporation units are provided in SMULP Appendix U. A total of 193 units can be placed in the ponds based on the manufacturer's spacing recommendations, <u>so additional units could be added if needed</u>. An overall layout of potential evaporator locations is shown on C-530, C-532, and C-533. Evaporators are mobile and will be relocated as necessary to control water in Ponds M1 – M4. The floating platforms for the 167 evaporator units displace a total of 0.022 MG of water.

4.3 Pond operation

The four Water Management Ponds are interconnected with sluice gates, so water can be moved from one pond to another. In addition, each pond has a 200-foot long broad-crested weir overflow section that is two (2) feet below the top of the berm. The overflow section is designed to pass water to the lower, adjacent pond once the water elevation exceeds the overflow elevation if necessary. The overflow section can pass about 820 cubic feet per second (0.368 MG/min) based on a weir coefficient of 1.45 ($Q = 1.45 \times 200$ feet * 2 feet $^{3/2}$ = 820 cfs).

Alarms will be installed to prevent overfilling. At 1,000 gpm, it would take approximately 50 days of continuous inadvertent pumping before the ponds were in danger of overflowing. The alarms will trigger a shutdown when the water level reaches a predetermined level (6 feet of water depth). In addition, physical water level gauges will be checked and documented at the start and end of each work shift.

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[2] https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ga

4.4 Berm Design and Construction

The Process Water and Water Management Ponds have been designed in accordance with Georgia Safe Dams Engineering Guidelines regarding subsurface exploration, testing, and engineering analyses by a Georgia Safe Dams Certified Engineer.

They will be constructed using stringent quality control procedures supervised by a Georgia-licensed professional engineer. The major failure mechanism of earthen berms is backward erosion piping caused by seepage. This is precluded by the liner system that prevents the stored water from seeping through the earthen berm. The berms will be inspected daily at the beginning of the day shift using the Georgia Safe Dams inspection checklist (SMULP App. V). The checklist will be kept on site and sent to the Georgia Safe Dams Certified Engineer for review.

Items identified by the Safe Dams Engineer can be promptly addressed in the field by onsite personnel. Earthmoving equipment will be onsite as part of normal operations and if any repair to the berms is required, the pond associated with the berm can be dewatered and repaired as directed by the Safe Dams Engineer.

The berms are not designed for stormwater, and there are no stormwater inlets into the berms.[3] There is one sump from the stockpile that feeds into the ponds. (Sheet C-425.) The area designed for the stockpile is located on a concrete pad with a concrete containment curb; the pad is sloped to drain to the sump.

4.5 Automatic Level Sensor Control

In addition to the overflow weirs, pumps P-101 (primary pump) and P-102 (secondary pump) located at pond M3 (the Sand Processing Area Water Management Storage Pond) can transfer water from pond M3 to pond P2. These pumps are equipped with an acoustic wave sensor to monitor water elevation. The acoustic wave sensor utilizes a high-powered acoustic wave that transmits a pulse that reflects off the surface of the liquid to measure the surface elevation below the sensor and control the pumps based on certain water levels of pond M3. The acoustic wave sensor will control the pumps at five (5) different levels, a low-low level (LLL), a low level (LL), normal operating levels (NOL), a high level (HL), and a high-high level (HHL). A control action will accompany each water level shown in the table below:

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[3] There are references in the standard Erosion and Sediment Control drawings referencing measures to protect inlets. This is standard language found on all erosion and sediment control drawings in the state of Georgia and simply stipulates how to handle the inlets that are on-site. There are no inlets into the ponds for stormwater.

Table 1 - Water Level Alarms

Level	Action
Low-low level	A low-low alarm will signal to the operator that a low-low level has been reached.
Low Level	The primary pump will shut off.
Normal Operating level	The primary pump will run during normal operating levels.
High Level	The secondary pump will turn on along with the primary pump until the water returns to normal operating levels.
High-High Level	Both pumps will continue to run, and a high alarm will signal to the operator that a high-high level has been reached.

The alarm levels for M3 are:

- Low-Low level is the elevation indicating that the pump intake is sucking air.
- Low Level is the elevation preventing cavitation of the intake (EL. 161) at M3.
- Normal Operating Level is between EL 161 – EL 163
- High Level is 0.5 feet below overflow crest elevation (EL 165.0 – 0.5 = EL 164.5)
- High-High Level is the overflow crest elevation EL 165.0

The Acoustic Wave Sensor will allow the monitoring of the pond's water levels automatically. Additionally, all ponds will also be equipped with a visual monitoring stick for manual readings of the pond levels.

Another acoustic wave sensor will control the water levels at the Primary Holding Pond-P4. It will control P-103 (primary pump) and P-104 (secondary pump) using the same level sequence provided in the table above. The Primary Holding Pond-P4 will also be equipped with a visual monitoring stick for manual readings of the pond levels.

4.6 Dredging

Seepage water will be deposited in pond M1 (Sheet C-302), which contains internal baffles to facilitate sedimentation by increasing the circulation path of water entering the pond. The ponds will be dredged as needed. It is anticipated that pond M1 will require annual dredging but that ponds M2-M4 will require dredging only occasionally if at all.

4.7 Equipment Maintenance

Pumps, generators, and other equipment will be inspected daily and maintained in accordance with manufacturer's instructions. A schedule for monitoring/maintenance is set forth in SMULP Appendix V.

5. STORMWATER MANAGEMENT

Stormwater will be managed pursuant to Georgia EPD's Industrial Stormwater General Permit (GAR050000, reissued May 20, 2022). The Water Management Ponds will not be used to manage, and will not receive, stormwater runoff.

The only exception is that a sump will be installed inside the berm surrounding the stockpile staging area to capture any water draining from wet material in the stockpile for reuse (Sheet C-205, rectangle with X on Item #17). Although the primary purpose of the berm is not to control stormwater, most precipitation falling within the berm will be moved to the Water Management Ponds along with water draining from the wet material. Because the staging area is small (approximately 150-feet x 150 feet), the quantities will be negligible.

6. DECOMMISSIONING UPON CLOSURE

The Process Water and Water Management Ponds will need to be decommissioned when the mining and processing operations have been concluded. The only challenge will be to dispose of any water remaining in the ponds. Evaporators will be used to draw the Water Management Ponds down as much as possible in preparation for closure, leaving only enough to supply process water for the remaining period of operations.

After all of excavated material has been processed, any water remaining in the Process Water Ponds will be pumped into pond M1. The Water Management Ponds will then be drained sequentially starting with pond M1, which will be drained into pond M2. Pond M2 will then be drained into pond M3, and pond M3 into pond M4. Any water remaining in pond M4 that cannot be evaporated will be hauled offsite. It is anticipated that less than 1 MG will need to be evaporated or hauled away. After each pond is drained, its liner will be removed. Once the last water has been removed and the final liner has been hauled off site, the soil used to construct the berms can be spread over the site to the final grades. Additional details can be found on Sheets 9, 10, and C-801.