HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL

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Stillwater Mine

Hertzler Tailings Operations, Maintenance and Surveillance (TOMS) Manual

2022/12/222

CONFIDENTIALITY STATEMENT

COMMITMENT ACCOUNTABILITY RESPECT ENABLING SAFETY

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ABBREVIATIONS

CAP	Corrective Action Plan
CFR	Code of Federal Regulations
CORP	Consolidated Operations and Reclamation Plan
DEQ	Department of Environmental Quality
DSR	Dam Safety Review
EOR	Engineer of Record
EPP	Emergency Preparedness Plan
FEAM	Failure Modes and Effects Analysis
GCL	geosynthetic clay liner
GM	General Manager
GPS	Global Positioning System
IRP	Independent Review Pane
ITRB	Independent Tailings Review Board
KP	Knight Piésold Ltd.
LAD	Land Application and Disposal
MCA	Montana Code Annotated
MDEQ	Montana Department of Environmental Quality
Mine Act	Federal Mine Safety and Health Act
MSHA	Mine Safety and Health Administration
MT	Montana
NavStar	Geomatics Ltd.
PMF	Probable Maximum Flood
QPP	Quantitative Performance Parameters
QRFG	Quick Reference Field Guide
ROD	Records of Decision
RTFE	Responsible Tailings Facility Engineer
Stillwater	Sibanye Stillwater
SWM	Stillwater Mine
SWPPP	Storm Water Pollution Prevention Plan
TOMS	Tailings Operations, Maintenance and Surveillance
tpd	tons per day
TSF	Tailings Storage Facility
UAV	Unmanned Aerial Vehicles
USFS	United States Department of Agriculture, Forest Service
VP	Vice President
VWP	vibrating wire piezometer

1.0 INTRODUCTION

1.1 SCOPE AND OBJECTIVES OF MANUAL

Sibanye Stillwater (Stillwater) owns and operates the Stillwater Mine (SWM), a platinum group metal mine located in south central Montana. The SWM consists of an underground mine, a concentrator, two tailings storage facilities (TSF): the Hertzler TSF and the Nye TSF, and ancillary facilities. This Tailings Operations, Maintenance and Surveillance (TOMS) Manual has been prepared for the Hertzler TSF and its associated facilities. A separate standalone TOMS Manual has been prepared for the Nye TSF (Stillwater, 2022a). This Hertzler TOMS Manual has been developed to meet the requirements of the Montana State Law as defined in Montana Code Annotated (MCA) Title 82 Chapter 4 Part 3 (MCA 82-4-379) (MT, 2019).

The objectives of this TOMS Manual include:

- Define the roles and responsibilities of Stillwater site personnel, third-party consultants, and government (Section 1.2)
- Define the training requirements for those involved in the operation, maintenance and surveillance of the facility (Section 1.3)
- Outline the document control and revision procedures (Section 1.4)
- Provide an overview of the key components of the facility and operating, maintenance and surveillance requirements (Sections 2 and 3)
- Define the surveillance, inspection, reporting and review requirements (Section 4)
- Present the Emergency Preparedness Plan (Section 5)

Appendix A provides a Quick Reference Field Guide (QRFG) for the operation of the TSF. The QRFG includes the Quantitative Performance Parameters (QPPs) and key information for the operation, monitoring and inspection of the tailings impoundment.

Reference documents for the Hertzler TSF are listed in Appendix B.

Appendix C includes the inspection schedules and the inspection log templates. These templates are to be utilized for daily data collection, and for information gathered during the routine inspections.

1.2 ROLES AND RESPONSIBILITIES

The following provides an overview of the responsibilities of Stillwater site personnel and third-party consultants, as well as the role of the Montana Department of Environmental Quality (DEQ) and other government agencies.

1.2.1 STILLWATER MINE SITE PERSONNEL

The General Manager (GM) & Vice President (VP) of SWM Operations has the ultimate responsibility for the safety of the Hertzler TSF. The Concentrator Manager has been designated as Safety Manager for the TSF and is the primary contact for all matters relating to the operation, maintenance and surveillance of the facility. The Concentrator Manager reports to the GM of SWM Operations and is responsible for the day-to-day operations of the Hertzler TSF.

In addition to the Concentrator Manager, other key Stillwater personnel have roles and responsibilities relating to the operation, maintenance, and surveillance of the Hertzler TSF. The organization and responsibilities chart is shown on Figure 1.1. A list of these key personnel and their responsibilities are provided on Table 1.1.

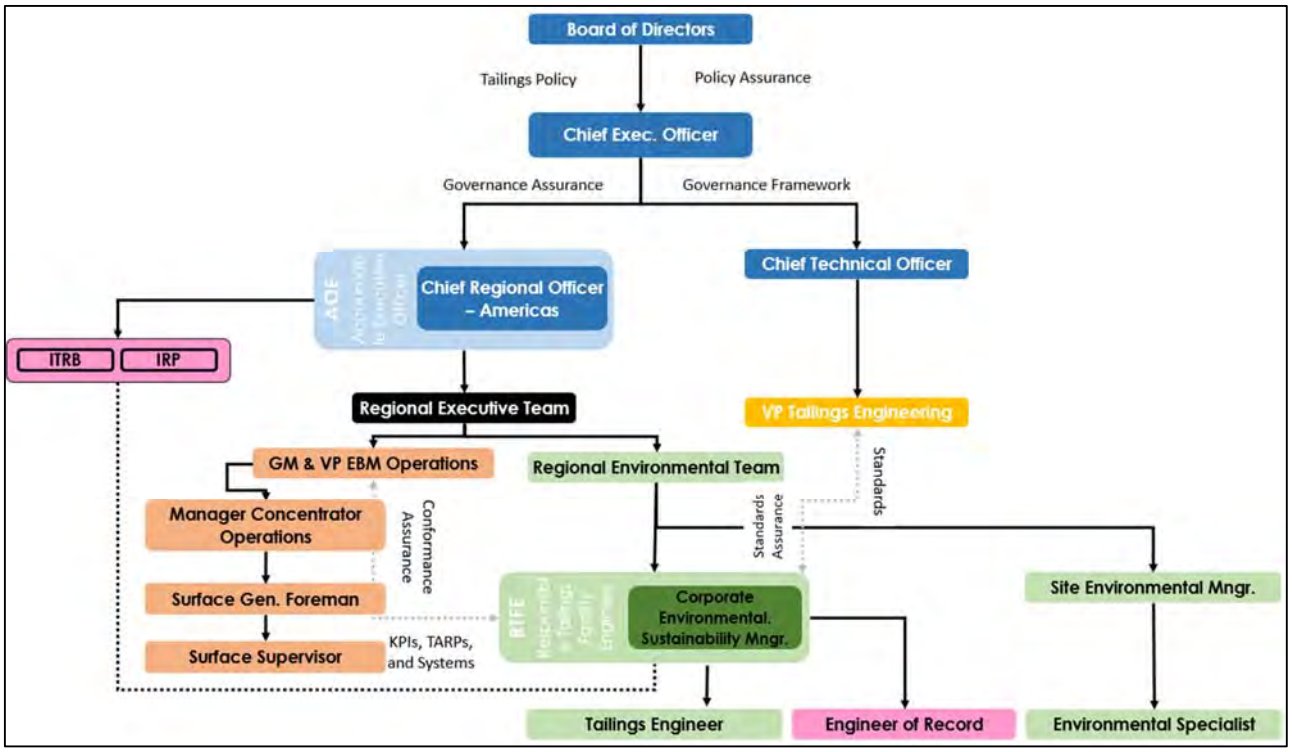


Figure 1.1 Organization and Responsibilities Chart

Table 1.1 SMC Personnel - Roles and Responsibilities

Position	Responsibilities
GM of SWM Operations	• Provide oversight and leadership of all activities required for the safe and socially responsible operation of the mine site. Overall project review and implementation, and budget allocation.
Corporate Environmental Manager	• Provide oversight and leadership of all activities required for the socially and environmentally responsible operation of the mine site • Communications with Government Agencies and Stakeholders
Environmental Sustainability Manager (Responsible Tailings Facility Engineer (RTFE))	• Accountable for the integrity of the tailings facility (Requirement 8.5) • Responsible for liaising with EOR, operations, planning, regulatory • affairs, social performance and environment teams (Requirement 8.5) • Responsible for implementation of the design • Accountable for the establishment of a change management system (Requirement 6.5) • Responsible for the monitoring system and communication of the results to the EOR, including performance reviews (Requirements 7.2, 7.3) • Responsible, with the EOR, for the Construction Records Report (Requirement 6.3) • Responsible for the OMS Manual (Requirement 6.4)

Position	Responsibilities
Concentrator Manager	• Person responsible for the safe operation of the TSF including overall operations, maintenance and surveillance and TOMS Manual updates and review • Plan, coordinate, supervise, direct and review all activities related to the TSF construction and operation, tailings delivery and water reclaim, TSF water balance, and Emergency Preparedness Plan (EPP) • Overall operations of the concentrator and supervision of concentrator personnel • Overall concentrator operations contact responsible for Tailings Delivery System and Water Reclaim System. • Person responsible for inspection, maintenance, review and oversight of all areas of the tailings management and water reclaim operations, including tailings deposition, Tailings Delivery System, Water Reclaim System and Basin Underdrains • Quarterly Dam Safety Inspections for the TSF • Responsible for TSF water management • Unusual Event inspections • Implementation of EPP • Coordinate supernatant pond surveys and soundings • Responsible for task training of all tailings personnel
Tailings Engineer	• Plan, coordinate, advise, and review all operational activities related to environmental compliance functions (quarterly inspections, leak detection, water quality, TSF water balance). Ensure Stillwater remains in compliance with all applicable permits, rules and regulations related to these areas. • Review and update TOMS Manual and EPP • Coordinate supernatant pond surveys and soundings • Quarterly TSF Inspections • Monthly TSF and instrumentation inspections • Implementation of EPP • Instrumentation monitoring and review
Environmental Compliance Manager	• Plan, coordinate, advise, and review all operational activities related to environmental compliance functions (quarterly inspections, leak detection, water quality, TSF water balance). Ensure SMC remains in compliance with all applicable permits, rules and regulations related to these areas. • Implementation of EPP • Communications with Government Agencies and Stakeholders
Surface General Foreman	• Monthly TSF inspections • Weekly TSF inspections
Surface Supervisor	• Routine inspections of the Tailings Delivery System and Water Reclaim System during dayshift • Weekly TSF inspections • Annual Tailings Delivery System Inspection and Planned Maintenance
Concentrator Operations Supervisor	• Routine inspections of the Tailings Delivery System and Water Reclaim System during dayshift and night shift (counterpart to Surface Supervisor)
Surface Crew	• Efficiently operate the TSF within SMC standards, occasional supervision to ensure regulatory compliance • Responsible for day shift inspections, report any unusual observations to Surface Supervisor Maintaining tailings operations within the SMC standards and at the highest level of safety.

Position	Responsibilities
Environmental Specialist(s)	• Operation of LAD System • Quarterly TSF inspections • Unusual Event inspections • Maintaining environmental systems, wildlife protection and annual permit reporting • Implementation of EPP • Maintain TSF water balance tracking spreadsheet • Geotechnical instrument monitoring and review (survey monuments, inclinometers, piezometers) • Geotechnical instrument support, maintenance, and installation • Monitoring and sampling of groundwater monitoring wells • Organizing and reporting on all reclamation activities • Maintaining environmental systems, wildlife protection and annual permit reporting • Implementation of EPP • Monitoring and sampling of groundwater monitoring wells • Coordinating and reporting on all reclamation activities • Annual maintenance activities: Grading of embankment crest, installation and removal of tailings discharge pipelines, wildlife fence repairs, seasonal installation and removal of evaporators
Chief Engineer	• Technical support
Projects Engineer	• Coordinate TSF embankment raises • Coordinate supernatant pond surveys and sounding
Safety Manager	• Emergency Response Team; Emergency Action Plan; Emergency Response Planning; Emergency Response Binder; Training and ensure job hazard analyses are completed as required

1.2.2 Engineer of Record (EOR) and Third-Party Consultants

A number of third-party consultants are involved in the design, construction and inspection of the Hertzler TSF. The roles and responsibilities of the various third-party consultants and the Engineer of Record (EOR) are summarized in Table 1.2.

Table 1.2 Stillwater Personnel - Roles and Responsibilities

Role and Name	Responsibilities	SMC Contact
Knight Piésold Ltd. EOR - Ken Brouwer, P.E. Deputy EOR - Craig Hall, P.Eng.	• Provide operational support to Stillwater • Preparation of construction specifications and drawings and contract documentation, prescribe and oversee QA/QC activities, provide on-site personnel for construction monitoring activities and practices • Review of instrumentation records, complete annual inspections and reporting	• Environmental Sustainability Manager • Environmental Specialist(s) • Corporate Environmental Manager • Tailings Management System Engineer • Environmental Specialist
Independent Review Engineer(s)	• Periodic independent reviews of the TSF including operation of the facility, engineering, and geotechnical reviews	• Environmental Sustainability Manager • Corporate Environmental Manager

Role and Name	Responsibilities	SMC Contact
Hydrogeology Consultant	• Provide hydrogeological support to Stillwater	• Environmental Sustainability Manager • Corporate Environmental Manager
Specialist Lining Contractor	• Qualified manufacturers and installers are used to supply and install the geosynthetics lining materials required for the TSF construction • Complete detailed inspections and make repairs to the HDPE geomembrane on a semi-annual basis	• Environmental Specialist • Concentrator Manager
Earthworks Contractor	• Local contractor with heavy equipment • Qualified to construct engineered embankments, random fills, surface preparation and assistance for liner installation, reclamation earthworks, and other earthmoving activities	• Environmental Specialist • Concentrator Manager
Reclamation Contractor	• Reclamation work	• Environmental Specialist

1.2.3 Regulatory Agencies

The jurisdiction for regulation of tailings impoundments resides with the Montana Department of Environmental Quality (MDEQ). Embankments for TSFs and water reservoirs subject to permits issued by MDEQ are specifically exempt from certain provisions of the *Montana Dam Safety Act* (MCA 85-15-107), and therefore are not subject to embankment hazard potential classification within the State (MCA 85-15-209). The MDEQ is the regulatory agency responsible for ensuring the applicable legislative requirements outlined in MCA 82-4-379, relating to this TOMS Manual, are met by Stillwater.

The Mine Safety and Health Administration (MSHA) is responsible for administering the provisions of the *Federal Mine Safety and Health Act* of 1977 (*Mine Act*) and enforcing compliance with mandatory safety and health standards. Title 30 Code of Federal Regulations (CFR) part 56.20010 requires that 'if failure of a water or silt retaining dam at a mine will create a hazard, it shall be of substantial construction and inspected at regular intervals'. The *Mine Act* requires MSHA inspection of underground mines at least four times per year.

1.3 Training

Training is required for any personnel involved in the operation, maintenance, surveillance and inspection of the TSF. Training must be conducted by the Concentrator Manager, Concentrator General Foreman or a suitably qualified individual familiar with the design, operation, maintenance and inspection of all civil and mechanical works associated with the facility. Training sessions will be documented, and a record kept on file on Stillwater's electronic filing system.

The GM of SWM Operations, Environmental Sustainability Manager, Concentrator Manager, Tailings Engineer, and Surface Supervisor must fully understand and be able to implement the TOMS Manual requirements and also ensure that all applicable mine personnel and contractors understand the requirements presented in the TOMS Manual.

Appropriate site personnel are responsible for being continually observant of the visual indications of the TSF performance. Anything observed that is outside of normal operating parameters, as outlined in this TOMS Manual, must be reported to the Concentrator Manager and/or Environmental Sustainability Manager immediately.

1.4 CONTROL AND REVISIONS TO THE MANUAL

This TOMS Manual is a controlled document and specific procedures have been defined for the distribution, revision, and review as outlined below.

1.4.1 DISTRIBUTION

The TOMS Manual will be controlled by the Environmental Sustainability Manager. The Environmental Sustainability Manager will be responsible for maintaining the latest version of the TOMS Manual on Stillwater's electronic file management system. The latest version of the TOMS Manual is also available on Knight Piésold's Ltd. (KP) FULCRUM data management site. The TOMS Manual location on FULCRUM is shown in Figure 1.2

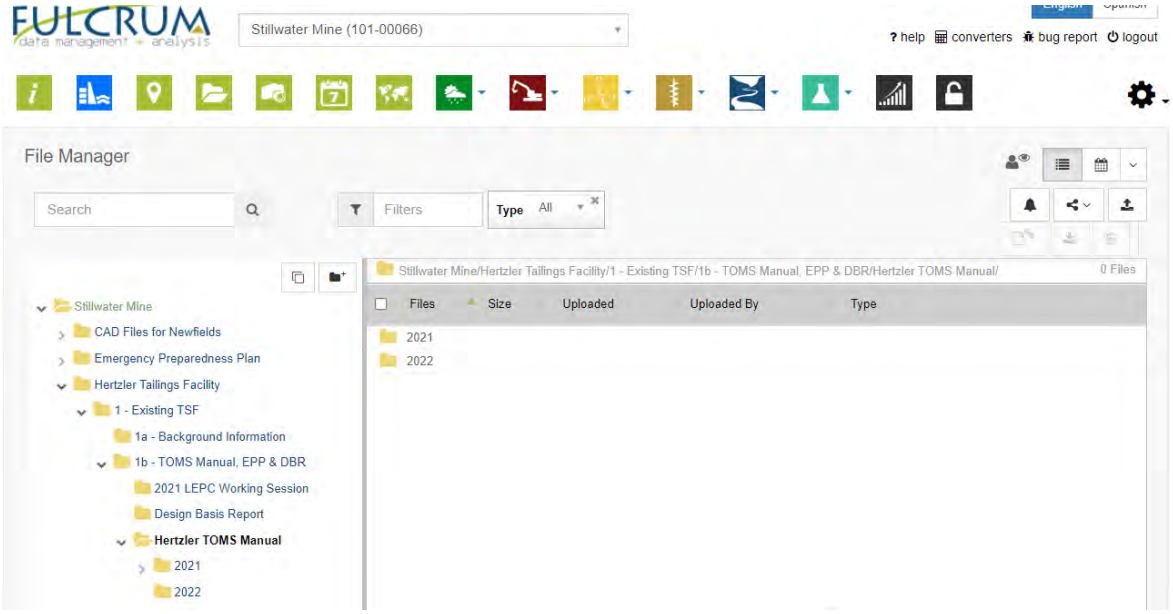


Figure 1.2 TOMS Manual Location on FULCRUM

1.4.2 REVISIONS

The TOMS Manual is required to be reviewed on an annual basis to ensure that it reflects the current operating conditions. The TOMS Manual will be reviewed in conjunction with the annual inspections and third-party reviews outlined in Section 4.

The EOR shall certify any revisions made to the TOMS Manual. The Environmental Sustainability Manager notify Stillwater's responsible personnel when revisions to the TOMS Manual are made.

1.5 REFERENCE DOCUMENTS

Pertinent references for the Hertzler TSF and associated infrastructure are included in Appendix B. Electronic copies are available from Stillwater's electronic file management system.

1.6 REGULATORY REQUIREMENTS

The regulatory requirements and commitments that pertain to the construction, operation, and closure of the Hertzler TSF are summarized in the Stillwater Mine Consolidated Operations and Reclamation Plan (CORP). The CORP includes all Environmental Impact Statements, associated Records of Decision (RODs), stipulations for the SWM and its facilities, and a list of applicable statutes and regulations.

1.7 INDEPENDENT TAILINGS REVIEW BOARD

Stillwater's Corporate Tailings Management Framework requires the appointment of an Independent Tailings Review Board (ITRB) to fulfill an oversight role of the operation of the Hertzler TSF. An Independent Review Panel (IRP) has been assembled to review the design of the future Stage 4 and Stage 5 Hertzler TSF as per 82-4-377 MCA (MT, 2019).

The ITRB's overall responsibility includes completing a review of the full TSF life cycle from design though closure planning. The ITRB reports directly to the Accountable Executive. ITRB responsibilities include the following as per the Sibanye Global Tailings Management System:

- Review Corporate Tailings Mgmt. documents (Global Tailings Management System, Terms of Ref, etc.) against local legislation, the GISTM, ICMM Guidelines, and international best practice
- Review Tailings Roles (RTFE, EOR, etc.) regarding responsibilities and competency
- Site Review
- Documents - Tailings Operations, Surveillance, and Maintenance manual (i.e. TOMS)
- Compliance - with the Corporate and Site specific documentation
- Review TSF Design and Engineering Documents – Design Reports, Design Criteria, Investigation Reports, etc.
- Understand the current TSF performance
- Reporting on any deviances and risks posed by the TSF to the Accountable Executive

2.0 DESCRIPTION OF THE TAILINGS STORAGE FACILITY

2.1 GENERAL

The following sections provide a brief summary of the design and management of the Hertzler TSF and associated facilities. Additional information is available in the cited references listed in Appendix B.

2.2 PROJECT DESCRIPTION

2.2.1 SITE LOCATION

The SWM is located in south central Montana, approximately 5 miles south of Nye, Montana. The Hertzler TSF is located approximately 7 miles northeast of the mine site adjacent to Stillwater County Road 420. The locations of the SWM and Hertzler TSF are shown on Figure 2.1. The overall site plan for the Hertzler TSF is shown on Figure 2.2.

2.2.2 PROJECT HISTORY

Stillwater has operated the SWM, an underground platinum and palladium mine, within Stillwater County since 1986. Ore is sent to an on-site concentrator with a designed production rate of approximately 3,000 tons per day (tpd). The concentrate is shipped to SMC's Smelter and Base Metals Refinery located in Columbus, Montana for further processing. The mine has been developed and expanded since initial construction was completed in 1986. The SWM workings extend laterally approximately six miles east to west and vertically more than one mile.

The Nye TSF was part of the original 1984 operating plan. The Hertzler TSF was proposed in SMC's 1996 Mine Waste Management Plan. The management of water during closure along with additional reclamation details for both tailings facilities were proposed under a revised plan. The plans were subsequently approved by the Montana Department of Environmental Quality and U.S. Forest Service (DEQ and USFS, 2012).

Construction of the Hertzler TSF began in 1999 at the Hertzler Ranch, as the Nye TSF was reaching full capacity. The TSF has been built and expanded in stages. The design and construction are documented in numerous reports, which are listed in Appendix B and briefly summarized here:

- The Stage 1 Hertzler TSF and Land Application and Disposal (LAD) Storage Pond were completed in 2000 and commissioned in 2001
- Construction of the Stage 2 Hertzler TSF began in 2003 and was completed and commissioned in 2004
- Construction of the Stage 3 Hertzler TSF began in 2014 and was completed and commissioned in 2015

2.2.3 PROCESS DESCRIPTION

Ore is delivered from the underground workings to the concentrator where it is crushed and upgraded to a concentrate that is shipped offsite to SMC's smelter and base metal refinery in Columbus, Montana for further upgrading. Milling involves a combination of crushing, grinding, flotation and filtration processes to produce the concentrate. The tailings predominantly consist of sand and silt sized rock fragments left over from the milling process. The tailings are pumped as slurry from the Concentrator to the underground Sand Plant or the Paste Plant located adjacent to the Nye TSF. The tailings pumped to the Sand Plant are separated into coarse sand and slimes fractions. The coarse sand fraction is dewatered and utilized as backfill in the underground mine. The remaining tailings (predominantly slimes fraction) are pumped to the Hertzler TSF as slurry. Tailings are occasionally sent to the Nye TSF from the concentrator, Sand Plant or Paste Plant during maintenance periods or during upset operating conditions. The process flow sheet is illustrated on Figure 2.3.

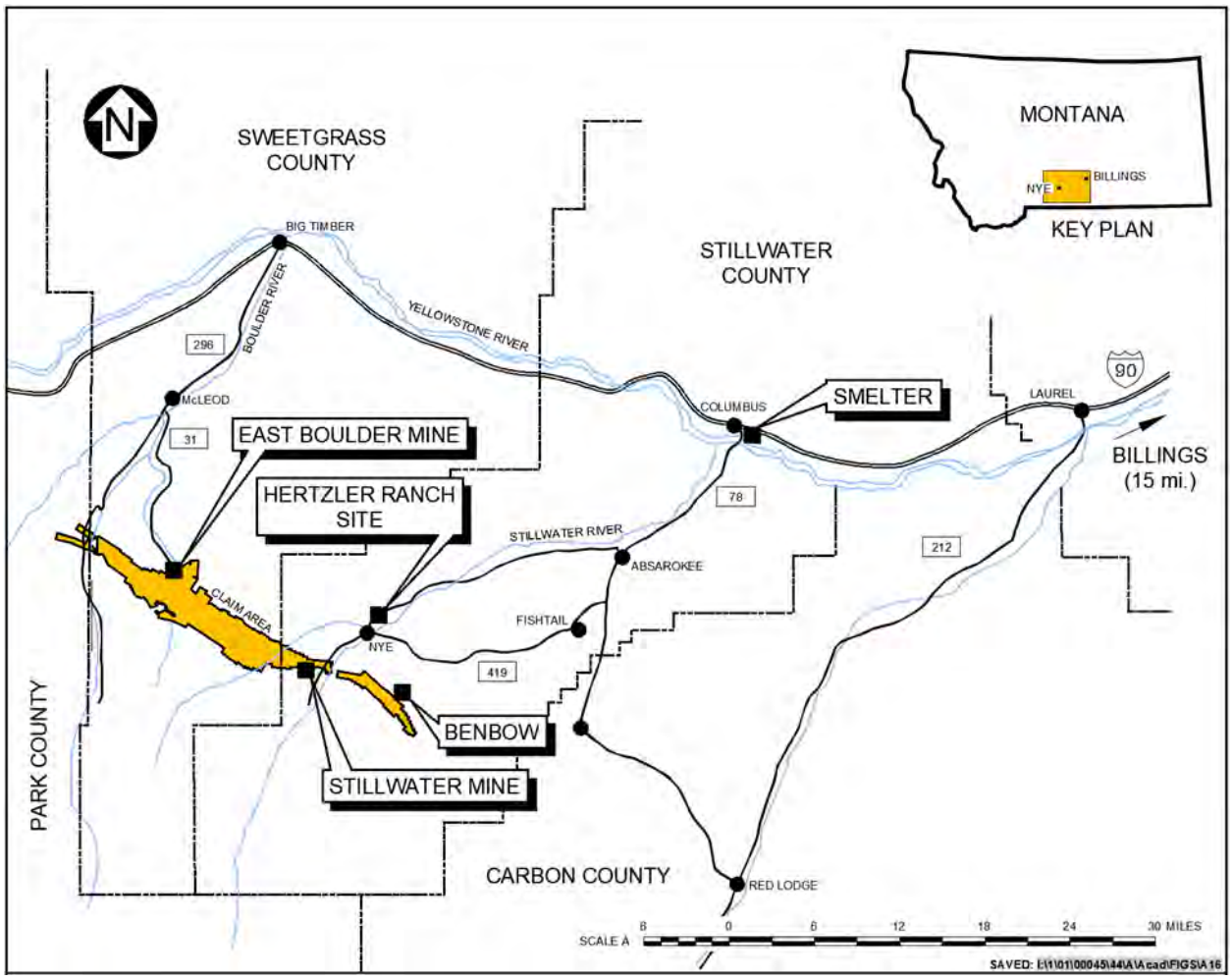
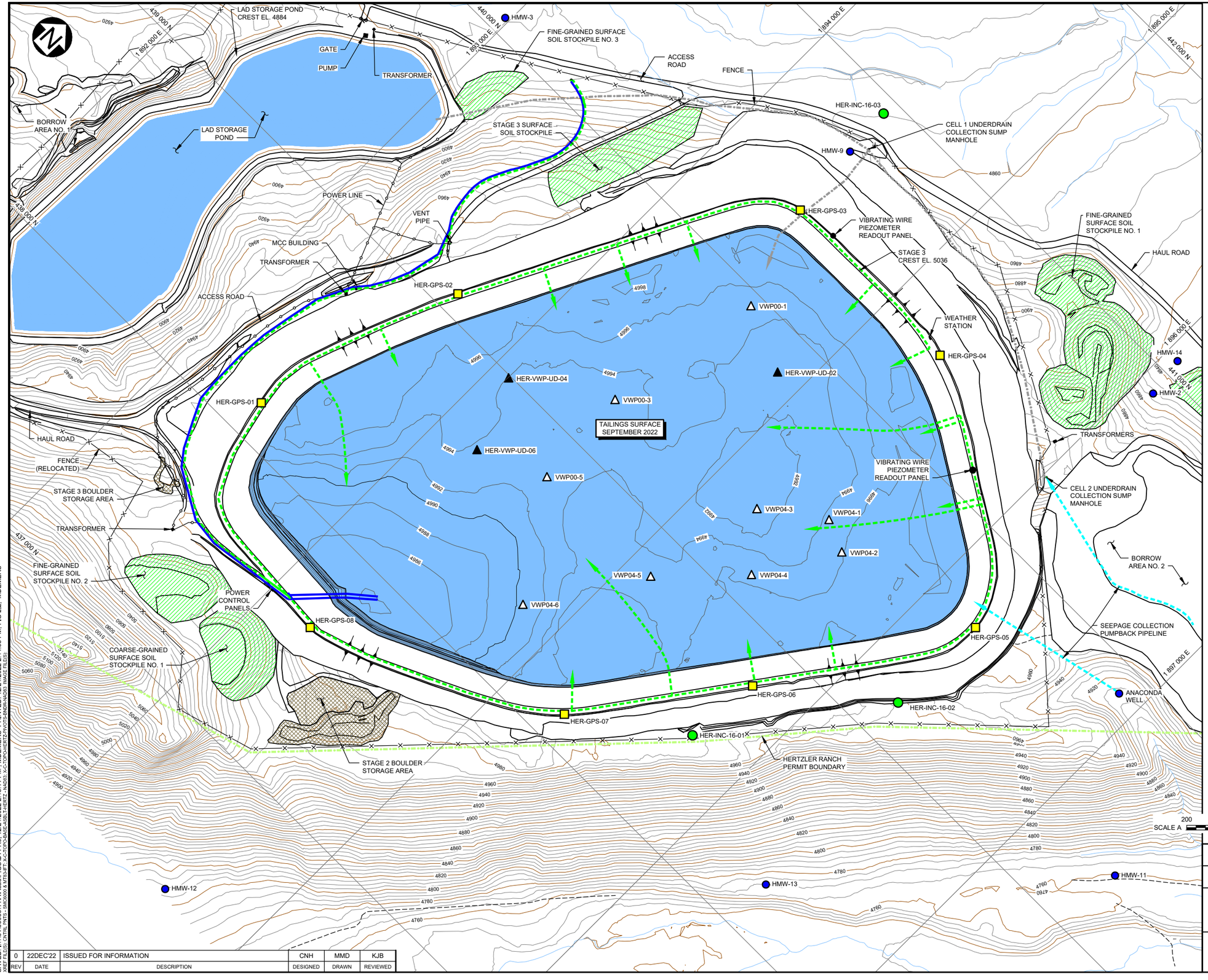


Figure 2.1 Site Location



LEGEND:

- WATER
- TAILINGS
- BOULDER STORAGE AREA
- SURFACE SOIL STOCKPILE
- HERTZLER RANCH PERMIT BOUNDARY
- RECLAIM PIPELINES
- TAILINGS DISCHARGE PIPELINE
- SEEPAGE COLLECTION PUMPBACK PIPELINE
- BASIN UNDERDRAIN RETURN PIPELINE
- EXISTING ROAD
- WILDLIFE FENCE
- POWER LINE
- TRAIL
- MONITORING WELL
- STAGE 3 SURVEY MONUMENTS
- VIBRATING WIRE PIEZOMETER READOUT PANEL
- SLOPE INCLINOMETER LOCATION (APPROXIMATE)
- BASIN UNDERDRAIN PIEZOMETER LOCATION (ACTIVE)
- BASIN UNDERDRAIN PIEZOMETER LOCATION (DECOMMISSIONED)

NOTES:

1. HORIZONTAL DATUM IS MONTANA COORDINATE SYSTEM, NAD83, INTERNATIONAL FEET. VERTICAL DATUM IS NGVD 29.
2. STAGE 3 AS-BUILT SURVEY DATA PROVIDED BY RED LODGE SURVEYING NOVEMBER 17, 2015. OTHER DETAILED TOPOGRAPHY PROVIDED BY HKM ENGINEERING INC. SEPTEMBER 24, 2004, FEBRUARY 10, 2000, AND SEPTEMBER 29, 2000. THE 2022 TAILINGS SURFACE DATA PRESENTED ON THIS FIGURE WAS SURVEYED BY SURVEY SYSTEMS SEPTEMBER, 2022.
3. CONTOUR INTERVAL OUTSIDE OF TAILINGS IMPOUNDMENT IS 5 FEET. CONTOUR INTERVAL WITHIN TAILINGS IMPOUNDMENT IS 2 FEET.
4. SOME INFRASTRUCTURE NOT SHOWN FOR CLARITY.
5. MONITORING WELL LOCATIONS PROVIDED BY SIBANYE STILLWATER.

SCALE A: 200 0 200 400 600 800 1000 ft

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	22DEC'22	ISSUED FOR INFORMATION	CNH	MMD	KJB

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
GENERAL ARRANGEMENT
AND INSTRUMENTATION LOCATIONS

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB101-66/44	NB22-01392

FIGURE 2.2 REV 0

SAVED: I:\101\00\66\44\A\cad\FIGS\B11 R0, 12/21/2022 2:13:11 PM, MDEMERS PRINTED: 12/21/2022 2:14:05 PM, FIG 2.2, MDEMERS
XREF FILE(S): CNTRL PNTS- SMO000 & MTB3-FT, XC=TOPO-BASE-ASBLT-HERTZ-NAD83, XC=TOPO-HERTZ-PIVOTS-BNDRY-NAD83 (IMAGE FILE(S))

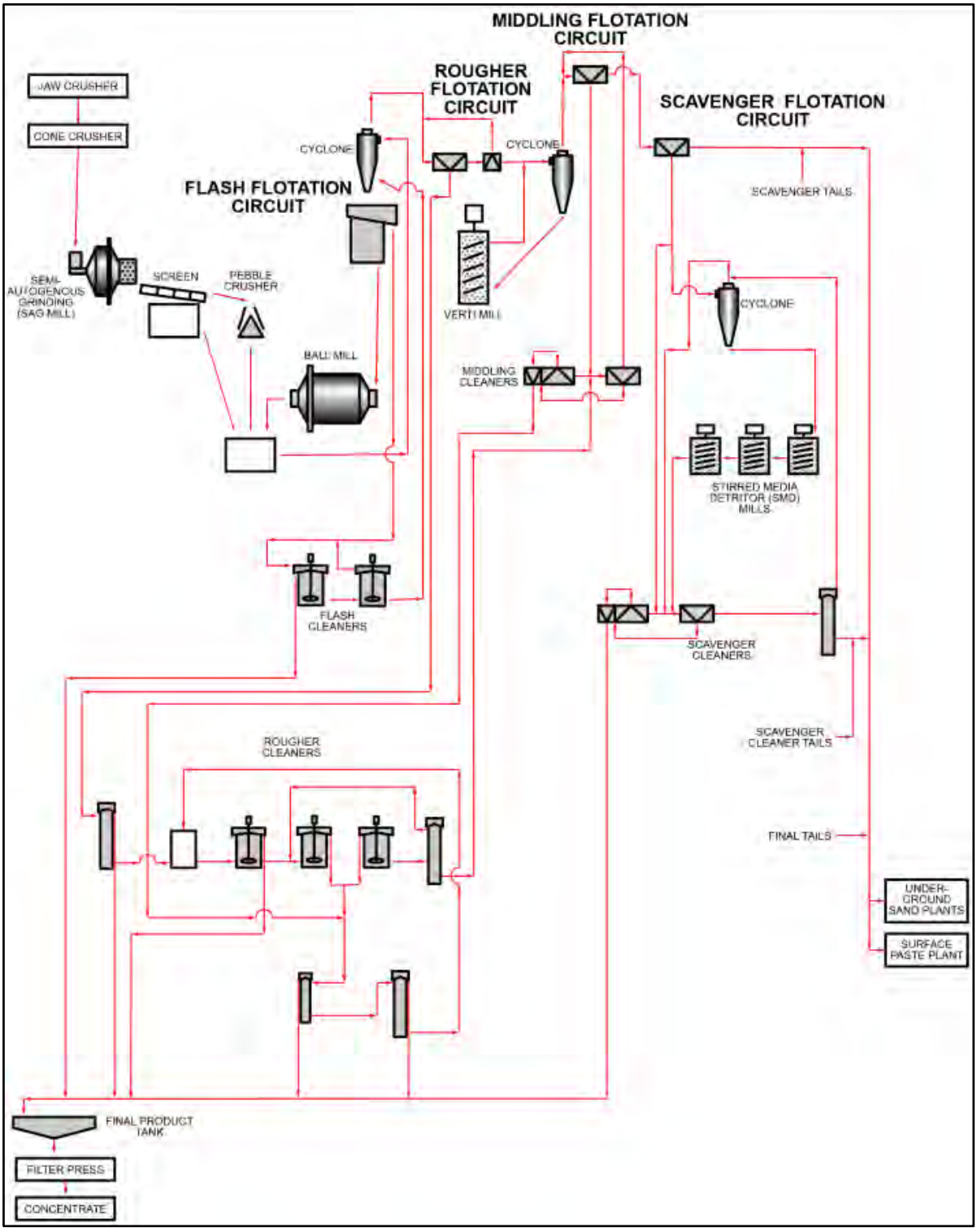


Figure 2.3 Process Flow Sheet

2.2.4 TAILINGS MANAGEMENT

Historically, flotation tailings were pumped from the concentrator to the underground Sand Plant where they were separated by cyclones into a coarse fraction (sand) and a fine fraction (slimes). The sand material was used underground as backfill and the slimes were pumped to the Nye TSF for disposal. At times, the entire bulk tailings stream reported to the Nye TSF. In early 1999 SMC commissioned a paste tailings mine backfill system. The Paste Plant dewaters the whole tailings product and cement is added to generate high strength backfill. The current operations primarily utilize the underground Sand Plant for backfilling and the tailings slimes are pumped to the Hertzler TSF.

The Hertzler TSF was designed to store the fine tailings (slimes) that are not suitable for use as sand backfill as well as the whole tailings. Since commissioning of the Stage 1 Hertzler TSF in 2001, approximately 50% of the total tailings (predominantly tailings slimes) have been pumped from the mine site to the Hertzler TSF for storage. Supernatant pond water is recycled to the Concentrator for re-use in the milling process via the Reclaim Water System.

Tailings are discharged into the Hertzler TSF from a series of spigots located around the perimeter of the facility. The tailings discharge is rotated round the impoundment in order to develop a low permeable tailings deposit against the upstream slope of the lined embankment and maintain the operating pond away from the embankment.

Stillwater currently utilizes both the Hertzler and Nye TSFs to maintain operational flexibility and manage process water.

2.3 DESIGN BASIS AND OPERATING CRITERIA

2.3.1 OVERVIEW

The principal objectives for the design and staged construction of the Hertzler TSF are to safely and securely manage tailings materials and to ensure protection of the regional groundwater and surface water quality (both during operations and in the long term) and to achieve effective reclamation at mine closure. The principal design features are as follows:

- Permanent, secure and total confinement of all solid waste materials within an engineered storage impoundment
- Control, collection and removal of free-draining liquids from the tailings during operations and to the maximum practical extent, the prevention of uncontrolled leakage from the TSF
- The inclusion of monitoring features for all aspects of the impoundment to ensure performance goals are achieved
- Staged development of the TSF to distribute capital expenditure over the life of the mine

The design basis and operating parameters for the Hertzler TSF and associated facilities are provided in detail within the various design and construction reports listed in Appendix B. The main components of the Hertzler TSF are the tailings embankment, tailings basin which includes a geosynthetic lining system and Basin Underdrain, tailings delivery system, water reclaim system and Land Application and Disposal (LAD System). The LAD Storage Pond provides temporary store of treated mine water from SWM's biological treatment system prior to disposal via percolation and irrigation pivots at the Hertzler Ranch. The key design and operating parameters are summarized in Table 2.1. The TSF components are briefly described below.

TABLE 2.1

STILLWATER MINING COMPANY
STILLWATER MINE

HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
KEY DESIGN AND OPERATING PARAMETERS

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Item No.	Component	Design Criteria/Operating Criteria
1.0 General Design Criteria		
1.1	Codes and Standards	• MCA, ASTM, AASHTO, ACI, ANSI, MSHA, OSHA, UBC and related codes
1.2	Site Elevation	• Approximately 5000 ft.
1.3	Meteorological Parameters	• Average Annual Precipitation = 25 inches (approx. 15-20% as snow)
		• Annual Evaporation = 23 inches (est.)
		• Mean Annual Temp = 46 degrees F
		• Design Storm Event is the 72-Hour PMF = 38 inches
1.4	Hydrologic Evaluation and Hazard Rating (U.S. Army Corps of Engineers)	• Size Classification: Large (Dam Height >100 feet)
		• Hazard Potential: Low to High Hazard
		• Design Storm: 72-Hour Probable Maximum Flood (PMF)
1.5	Seismic Design	• Maximum Design Earthquake (MDE): (The MDE corresponds to the Maximum Credible Earthquake (MCE))
		• Earthquake Magnitude = 7.0
		• Maximum Bedrock Acceleration = 0.15g
		• Seismic Coefficient = 0.10g (Seismic Zone 2)
2.0 Tailings Production		
2.1	Tailings Production Information	• Approximately 50% of the total tailings production will report to the Hertzler Tailings Impoundment
		• Design Mill throughput = 3,000 tpd
		• Projected Average Mill throughput = 2,450 tpd
2.2	Solids Content of Tailings Slurry	• 35% (approximate)
2.3	Tailings Average Dry Density	• 70 pcf
2.4	Tailings Solids Specific Gravity	• 2.67
2.5	Water Reclaim	• Design capacity = 1,500 gpm
		• Reclaim pipe from tailings impoundment: 12" DR7.3 HDPE
3.0 Tailings Basin		
3.1	Storage Capacity	• Stage 1 - 2.6 million cubic yards
		• Stage 2 - 9.0 million cubic yards
		• Stage 3 - 16 million cubic yards
3.2	Operating Pond Volume	• Minimum Operating Pond Volume = 50 million gallons (153.6 acre-ft.), equivalent to 1.7 ft. of water, El. 5028.7 to 5030 ft.
		• Maximum Recommended Operating Pond Volume = 150 million gallons (460.6 acre-ft.), equivalent to 5.2 ft. of water, El. 5024.8 to 5030 ft.
3.3	Design Freeboard	• During operations the total freeboard is 6 ft. including the following: o Storage capacity for the 72-hour PMF, storage volume approximately 378 acre-ft. o Approximately 3 ft. for wave run up protection
		• After closure the tailings surface will be graded to control runoff. Stormwater drainage provisions at final reclamation to provide routing for the PMF. No freeboard or spillway required.
3.4	Lining System	• Stage 1 (Cell 1) - Low permeability soil liner overlain by 60 mil HDPE
		• Stage 2 - Low permeability geosynthetic clay liner (GCL) overlain by 60 mil HDPE
		• Stage 3 - Low permeability GCL overlain by 100 mil HDPE
		• Textured wearsheets included on ramp and at tailings discharge locations
3.5	Basin Underdrain System	• Basin Underdrain layer (granular filter, free draining layer (gravelly sand), perforated CPT collection pipes and HDPE conveyance pipes) installed over the 60 mil HDPE geomembrane within Cells 1 and 2. Coarse granular material was placed over the drain sections as a protective layer.
		• The underdrain collection pipeworks connect into valved solid steel outlet pipes (concrete encased). Both the underdrain collection systems and the conveyance pipe outlet structures drain by gravity to collection sumps downstream of Cells 1 and 2.

TABLE 2.1

STILLWATER MINING COMPANY
STILLWATER MINE

HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
KEY DESIGN AND OPERATING PARAMETERS

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Item No.	Component	Design Criteria/Operating Criteria
4.0 Tailings Embankment		
4.1	Embankment Crest Width	• 30 feet (minimum)
4.2	Embankment Height (Max.)	• Stage 1 - 98 ft. (Crest El. 4,956 ft.)
		• Stage 2 - 134 ft. (Crest El. 4,992 ft.)
		• Stage 3 - 178 ft. (Crest El. 5,036 ft.)
4.3	Embankment Crest Length	• Stage 1 - 2,800 ft. approx.
		• Stage 2 - 7,850 ft. approx.
		• Stage 3 - 8,600 ft. approx.
4.4	Embankment Slopes	• Downstream fill slope: 2H:1V
		• Upstream fill slope: Stage 1 = 3H:1V Stage 2 and 3 = 2.5H:1V
4.5	Embankment Fill Material	• Glacial materials excavated from within Cells 1 and 2 of tailings basin for Stage 1 and 2
		• Glacial material and bedrock for Stage 3 excavated from external borrow areas for Stage 3
4.6	Stability Requirements	• The Minimum Acceptable Factors of Safety for each case considered are as follows: o End of embankment construction 1.5 o Long term (full tailings pond) 1.5 o Seismic loading (pseudo-static) 1.1
5.0 LAD Storage Pond		
5.1	Function	• Storage of mine water for application by LAD pivots during the summer months
5.2	Hazard Rating	• Low hazard potential
5.3	Capacity	• Additional storage capacity for approximately 67 million gallons of water (204 acre-feet). Total storage capacity = 192 million gallons of water (588 acre-feet).
5.4	Design Freeboard	• 4 ft. to provide storage for the PMF and provide wave run-up protection
5.5	Dam Height	• Dam height (from crest to downstream toe) - 18 ft.
5.6	Crest Width	• 30 ft.
5.7	Embankment Slopes	• Upstream slope 3H:1V
		• Downstream slope 3H:1V
5.8	Lining System	• 100 mil HDPE Geomembrane

I:\1\01\00066\44\A\Report\Hertzler TOMS Update\Hertzler TOMS Manual\[Table 2.1 - Hertzler Key Design and Operating Parameters.xlsx]Design Criteria

2.3.2 TAILINGS EMBANKMENT

The tailings embankment has been constructed with a finer upstream zone (Zone A) and a coarser downstream zone (Zone B). The embankments were constructed with Random Fill excavated from within the impoundment and adjacent borrow areas. The staged impoundment construction is summarized below.

- The Stage 1 impoundment was constructed in 1999 and 2000 and consisted of a single cell, with North and South confining embankments constructed to a minimum elevation of 4,956 ft.
- The Stage 2 Impoundment was completed in 2004 and involved an expansion to the east, with excavation of a second tailings storage cell adjacent to the existing Stage 1 cell (Cell 1). A divider berm separated the two cells, which allowed for independent operation until the tailings surfaces reached the minimum divider berm elevation of 4,956 ft. at the north end. The Stage 2 expansion also involved construction of embankments around the entire facility, to a minimum crest elevation of 4,992 ft.
- The Stage 3 impoundment was complete in 2015 and included raising the embankment around Cells 1 and 2 to El. 5,036 ft. The embankment was raised using the downstream construction method. The Stage 3 embankment was constructed with Random Fill excavated from external borrow areas adjacent to the tailings impoundment. The embankment construction included a finer upstream zone (Zone A) and a coarser downstream zone (Zone B). The Stage 3 construction was completed in 2015. The maximum operating level for the Stage 3 impoundment is El. 5,030 ft.

2.3.3 TAILINGS BASIN

The Stage 3 Hertzler TSF is projected to provide storage until 2028 based on current mining plans. The total capacity of the tailings impoundment is approximately 16 million cubic yards (15.1 Mt). The tailings basin filling is dependent on actual concentrator throughput rates, tailings deposition characteristics, water inputs and outputs and in situ settled tailings density. The estimated filling schedule of the tailings impoundment is illustrated on Figure A.1 (Appendix A).

The minimum freeboard requirement for the Tailings Basin is 6 ft., which includes storage of the Probable Maximum Flood (PMF) and a dry freeboard allowance of 3 ft. for wave run-up. The maximum operating level of the Stage 3 Hertzler TSF is 5,030 ft. The recommended operating pond volumes for the tailings basin are as follows:

- The minimum operating pond volume is approximately 50 million gallons (153.6 acre-ft.). SMC has indicated that this is the minimum water required to maintain sufficient water volume for operations. This is equivalent to an average of approximately 1.7 ft. of water over the basin area (El. 5,028.3 to 5,030 ft.).
- The maximum recommended operating pond volume is approximately 150 million gallons (460.6 acre-ft.). This is equivalent to an average of approximately 5.2 ft. of water over the basin area (at fill El. 5,025 to 5,030 ft.). The current maximum recommended operating pond volume is based on maintaining a sufficient water cover over the tailings surface to prevent dusting during the winter months. It is noted that the Hertzler TSF may be safely operated with an operating pond volume that is greater than 150 million gallons as long as the 6 ft. minimum freeboard requirement is maintained.

The tailings basin is lined with a composite lining system and a Basin Underdrain is installed over the floor of Cells 1 and 2 to promote tailings consolidation and reduce the pressure head on the lining system, thereby minimizing the potential for seepage from the impoundment. The composite lining system was constructed using low permeability soil, geosynthetic clay liner (GCL) and HDPE geomembrane. The composite lining system for each impoundment stage is described below.

- The Stage 1 lining system included a low permeability soil liner overlain by 60 mil HDPE geomembrane to form the primary seepage barrier. The soil liner provided suitable bedding for the overlying geomembrane and acts a secondary liner in the event of potential defects in the geomembrane.
- The Stage 2 lining system included installation of a 60 mil HDPE geomembrane as the primary seepage barrier. The underlying secondary liner consisted of a low-permeability soil liner within the Cell 2 basin floor area, and a GCL installed on all of the Stage 2 upstream slopes.
- The Stage 3 lining system included installation of a 100 mil HDPE geomembrane as the primary seepage barrier and an underlying GCL as the secondary seepage barrier.

The Basin Underdrain layers include a granular drainage layer (gravelly sand), perforated CPT collection pipes and HDPE conveyance pipes installed over the 60 mil HDPE geomembrane on the floor of Cells 1 and 2. Coarse granular material was placed over the collection and conveyance pipe alignments as an erosion protective layer. The underdrain collection pipework is connected to concrete encased steel outlet pipes, which drain to the Basin Underdrain Collection Sumps.

The Stage 1 Basin Underdrain in Cell 1 flows by gravity to the Stage 1 Collection Sump located north of Cell 1 and water is pumped back to Cell 1 via a buried 3-inch HDPE pipe. The pipeline extends from the Stage 1 Basin Underdrain collection sump to the northwest corner of the north embankment of Cell 1. There is also a 3-inch HDPE pipeline that extends from the Cell 1 Underdrain sump to the LAD Storage Pond. This pipeline allows water to be transferred from the Underdrain to the LAD Storage Pond.

The Stage 2 Basin Underdrain in Cell 2 flows by gravity to the Stage 2 Collection Sump located north of Cell 2. Water flows by gravity through the Stage 2 Collection Sump to the Stage 1 Collection Sump and is either pumped back to the impoundment via the buried Basin Underdrain return pipeline or is transferred to the LAD Storage Pond.

2.3.4 Seepage Collection System

An external seepage collection system is located within Borrow Area No. 2 adjacent to the northeast corner of the Hertzler TSF. Collected seepage is pumped back to the supernatant pond within the TSF. Water is also pumped from the Anaconda pump-back well into TSF Basin. The composite lining system and Basin Underdrain layers in Cells 1 and 2 are the primary method for reducing seepage losses from the tailings impoundment. There are monitoring wells located downstream of the TSF which could be utilized to recover collected seepage back to the Hertzler TSF, if required. Additional collection wells could also be installed downgradient of the TSF if needed.

2.3.5 Tailings Delivery System

Tailings are pumped from the mine site to the Hertzler TSF via two buried 8 inch steel pipes lined with an HDPE inner sleeve. The pipeline right of way is located along Stillwater County Roads 419 and 420 as illustrated on Figure 2.1. The pipeline right of way follows the site Access Road to Vault 19. The tailings delivery pipelines extend from Vault 19 along the access road to the crest of the impoundment.

The tailings delivery pipelines are connected to tailings discharge pipelines which are installed on the upstream side of the impoundment embankment. The tailings discharge pipeline consists of a butt fusion welded 8-inch diameter DR 17 HDPE pipe. The tailings slurry is discharged into the Hertzler TSF from sixteen spigot locations that extend from the embankment crest down toward the tailings and supernatant pond surface.

Tailings slurry flow is monitored at both ends of the pipeline system. Visual monitoring of the tailings slurry flow is also carried out at the Hertzler TSF. Emergency shutoff for the tailings delivery system is located in the Concentrator. The tailings delivery pipelines include a leak detection system within five automated vaults to notify the Concentrator of any fluid releases through the HDPE inner sleeve.

2.3.6 Water Reclaim System

Three inclined reclaim pumps and pipelines are located at the south end of Cell 2. The pumps are connected to 8-inch diameter DR17 HDPE pipes which are connected to the steel Reclaim Pipe Manifold located on the crest of the impoundment. The Reclaim Pipe manifold is connected to a 12 inch diameter DR 11 HDPE pipeline. The water reclaim pipeline is installed in the pipeline right of way located along Stillwater County Roads 419 and 420 as illustrated on Figure 2.1. A booster station for the water reclaim system is located just north of the mine site adjacent to County Road 419. Pressures within the water reclaim pipeline are monitored and pressure alarms output at the concentrator and Hertzler pumphouse control rooms.

2.3.7 Land Application Disposal (LAD) System and Percolation Ponds

The LAD system was designed to beneficially dispose of treated mine water via agronomic application. The system is operated during the summer months and consists of the treated mine water pipeline, LAD Storage Pond, irrigation pivots and associated infrastructure (e.g., pumps and pipelines). SMC also employs percolation ponds to dispose of treated mine water as needed, primarily during months that the center pivots cannot be operated.

Treated mine water is pumped from the SWM to the LAD Storage Pond for storage prior to being applied with the irrigation pivots or percolated to groundwater. The mine water pipeline is 12-inch HDPE which is buried in the pipeline right of way located along Stillwater County Roads 419 and 420, as illustrated on Figure 2.1.

The LAD Storage Pond was expanded as part of the Stage 3 TSF construction program. The design basis and key operating parameters of the LAD Storage Pond are included in Table 2.1. The total storage capacity of the LAD Storage Pond is 192 million gallons (588 acre-feet).

The LAD Storage Pond is lined with a 100 mil HDPE geomembrane overlying a 12 oz/yd^2 non-woven geotextile. The depth-area-capacity curve for the LAD Storage Pond is shown on Figure A.4 (Appendix A). The location of the LAD Storage Pond at the Hertzler Ranch site is shown on Figure 2.2.

2.3.8 Mechanical Evaporation

Mechanical evaporators were installed on the crest of the West Embankment in 2022. The evaporators will be utilized on a seasonal basis to remove water from the TSF. Supernatant water is supplied to the evaporators via a water supply pump and HDPE pipeline. The water supply pump is located on the South Embankment adjacent to the reclaim pumps.

2.4 Water Management

2.4.1 General

The Hertzler TSF supernatant water consists of tailings water and basin runoff. Supernatant water is recycled back to the concentrator via the Reclaim Water System described in Section 2.3.6. Seepage control for the Hertzler TSF is provided by a geomembrane liner system and Basin Underdrain. Water collected from the Basin Underdrain is pumped back into the tailings impoundment or may be removed from the Hertzler TSF by transferring water from the Basin Underdrain to the LAD Storage Pond.

There are no upstream catchment areas reporting to the Hertzler TSF. Meteoric water reporting to the impoundment includes direct precipitation to the tailings basin and runoff from the embankment crest. Surface water management measures for the facility include ditches and sedimentation basins located along the access roads and adjacent areas.

2.4.2 WATER BALANCE

The water balance for the Hertzler TSF is maintained by SMC. The water balance is updated on a monthly basis to reflect the operating conditions. The following data are pertinent to the operation of the TSF and are tracked and included as part of the water balance:

- Tailings throughput and process water volumes delivered to the TSF
- Reclaim water volumes recycled to the Concentrator
- Water volumes transferred to the LAD Storage Pond via the Basin Underdrains
- Meteorological data
- Water volumes transferred to the mechanical evaporator

The water balance flow sheet is illustrated on Figure A.3 (Appendix A) and includes the average annual water additions and losses. The TSF water balance is reviewed monthly by the Tailings Engineer and on a quarterly and annual basis as part of the EOR reviews and annual inspection.

2.5 CLOSURE PLAN

Per the approved plan (DEQ and USFS, 2012) reclamation of disturbed areas at the Hertzler TSF is being carried out during operations to the maximum extent practicable. The objectives of the reclamation plan are to stabilize disturbed areas to prevent soil loss, minimize visual impacts, and prevent air and water pollution. These objectives are accomplished through surface drainage, concurrent reclamation of downstream embankment slopes and interim revegetation of borrow areas using approved seed mixes. Final reclamation of the Hertzler TSF will generally include the following:

- Dewatering - Natural drying and evaporation will reduce the moisture content in the tailings. In addition, the Basin Underdrain will promote consolidation of the tailings mass. At closure, ponded water on the tailings surface will be pumped out of the TSF. This water will be disposed of by spray evaporation techniques over the exposed tailings surface or combined with mine water for disposal through LAD application. The Basin Underdrain may be operated for some time after closure.
- Capping - The TSF will be capped with cover material and soils. The capping layer will have a minimum thickness of 4 ft., which includes 2 ft. of borrow material and 2 ft. of soil or sub-soil.
- Revegetation - Revegetation measures will include seedbed preparation and seeding with approved seed mixes in the upper soil layer of the capping layer.

Final reclamation will include the construction of a closure spillway (i.e. drainage channel) for storm water runoff management. During closure, the underdrain waters will be redirected to either the LAD Storage Pond for land application or returned to the surface of the impoundment for management. During the post-closure period, the underdrain sump will be converted to a percolation structure by removing the liners and pumps; and then filling with gravel. At that point, the underdrain seepage will be directed to this percolation structure and either percolate or overflow onto native ground beyond the sump.

Additional information on the reclamation of the TSF is presented in the CORP which is structured to meet the requirements of the *Montana Metal Mine Reclamation Act*.

3.0 OPERATIONS, MAINTENANCE AND SURVEILLANCE

3.1 INTRODUCTION

The Hertzler TSF components and associated facilities are shown on Figure 2.2. These components and facilities must be inspected and maintained regularly to ensure that any changes to the conditions, performance, or any potentially hazardous condition can be identified and promptly addressed. Selected photographs of the facility and associated components are included in Appendix D. Inspection and surveillance schedules are provided in Appendix C1.

The Concentrator Manager is responsible for ensuring that surveillance is carried out regularly. The Surface Supervisor is responsible for daily management of the TSF and directs the surface crew to carry out routine activities. The roles and responsibilities for the inspections are summarized in Section 1.2 of this TOMS Manual.

Routine inspections of the Hertzler TSF will be completed by the Surface Supervisor, Environmental Specialists, Concentrator Manager and Environmental Sustainability Manager as per Table C1.1 (Appendix C1).

Inspection reports should be reviewed by the Concentrator Manager and stored in SMC's electronic filing system. The quarterly Dam Surveillance reports should be reviewed by the GM of SWM Operations

Additional (non-routine) inspections may be required as outlined following any unusual event or observation (e.g., earthquake or extreme rainfall event). A summary of the recommended actions following an unusual event is outlined in Appendix C2.

If an inspection is performed by the EOR following an unusual event or observation, and corrective actions are identified by the EOR, the same procedural framework outlined in Section 4.1 for an annual inspection will be followed for preparing, submitting and implementing the corrective action plan and schedule.

The Concentrator Manager and/or Environmental Compliance Manager must be made aware of any unusual events or observations and must contact the EOR as required. Typical examples of unusual events and observations to be made during such walkovers are outlined in Appendix C2.

Inspection forms are provided in Appendix C3 to help guide the observation and surveillance process. The inspection forms cover major items related to the TSF and the associated facilities.

Copies of completed inspection forms, data sheets and field notes must be provided to, and kept in Stillwater's electronic filing system, by the Environmental Compliance Manager. Any unusual observations must be reported to the Concentrator Manager and/or Environmental Compliance Manager immediately and will be responded to in accordance to the appropriate response level outlined in Section 5.3.

Additional details for each component of the facility are provided in the following sections.

The operation, maintenance and surveillance of the TSF is based on the use of current technologies. It is recognized that technology is evolving and other technologies should be considered as part of the future monitoring for the TSF. Several technologies that should be considered as part of future monitoring include:

- Landsat images to track tailings pond water volumes and construction progress over months and years, both for ongoing monitoring and for forensic evaluation
- Airborne or satellite-based InSAR to monitor ground movements
- Land-based time-lapse photography to document construction
- Unmanned aerial vehicles (UAVs or drones) to collect high-resolution imagery, LiDAR or Photogrammetry surveys to collect detailed topographic data on a regular basis
- Real-time and continuous record keeping

3.2 TAILINGS EMBANKMENT

3.2.1 OVERVIEW

The tailings embankment is constructed of zoned earthfill materials and has been raised in stages using the downstream construction method as described in Section 2.3.2. Eight survey monuments were installed on the Stage 3 embankment crest to monitor for settlement and/or displacement. The survey monuments include Global Positioning System (GPS) monitoring units that are programmed to collect 24 readings per day. An as-built survey of the Stage 3 embankment crest was completed following the completion of Stage 3 construction in October 2015. An annual survey of the embankment crest should be completed by SMC for comparison with the as-built embankment survey. This survey could be completed with conventional surveying methods or using a drone or other technology. Three slope inclinometers are located along the downstream toe of the east and north embankments to monitor for potential movement in the embankment foundation. Vibrating wire piezometers (VWPs) were installed at the base of each slope inclinometer to monitor pore pressures in the embankment foundations. Monitoring requirements for instrumentation are summarized in Section 3.7.

3.2.2 SURVEILLANCE AND MAINTENANCE

Regular surveillance of the embankments and associated structures should follow the schedule outlined in Appendix C1. Inspection forms are provided in Appendix C3. Typical observations to be made during surveillance include:

- Evidence indicating embankment structure deformation (e.g. slope bulging, cracks on the crest or crest settlement)
- Evidence indicating seepage, runoff or erosion
- Possible evidence suggesting internal erosion (piping) within the embankments (wet spots, seepage, etc.)
- Other unusual conditions in the TSF area

The embankments and associated structures do not require regular maintenance; however, specific maintenance items may be identified because of regular observations and surveillance of the embankments. Maintenance items may include:

- Fill erosion gullies with properly compacted soil material. Seed or riprap repaired areas to stabilize against future erosion
- Fill wildlife burrows
- Maintain grass cover by spraying weeds, fertilizing and watering as needed
- Maintain grading of the embankment crests to prevent potholes, rutting or other potential for standing water to accumulate
- Maintain fences to provide site security and to exclude livestock and wildlife from the embankments. Repair and/or revegetate damaged embankment surfaces.
- Perform regular inspections of the embankments and abutments to identify potential maintenance items

Additional inspections are required after any unusual event. Appendix C2 outlines additional observations that will need to be documented. Appropriate repairs to the TSF will be implemented should any damage occur from an unusual event.

3.3 TAILINGS BASIN

3.3.1 OPERATIONAL OBJECTIVES

The projected rate at which the tailings accumulate within the basin, combined with storage provisions for make-up and storm water, determine the schedule for raising the embankments. The filling curve and staged construction sequence is shown on Figure A.2 (Appendix A). The minimum freeboard requirement for the impoundment is 6 ft. which includes storage of the PMF and a dry freeboard allowance of 3 ft. for wave run-up. The maximum operating level is 6 ft. below the embankment crest (El. 5,030 ft.).

Tailings deposition is to cease if the pond level exceeds the maximum operating level and the removal of water from the pond will commence using the water reclaim system. There are no restrictions on the rate of filling or on the rate of drawdown for the supernatant pond, with respect to dam safety.

The tailings basin is lined with a geosynthetic lining system and a basin underdrain is installed above the liner along the base of Cells 1 and 2. Surveillance and maintenance for tailings basin filling, geosynthetic lining systems and the basin underdrains is required as part of the operation of the tailings basin. VWPs are installed in the Basin Underdrain to monitor the response to pumping of the basin underdrain. Monitoring requirements for the piezometers are summarized in Section 3.7.

3.3.2 SURVEILLANCE AND MAINTENANCE

The pond level must be at least 6 ft. below the crest elevation under normal operating conditions. Emergency procedures, discussed in Section 5, must be followed if the pond exceeds the maximum operating level. Regular inspections of the pond level must be carried out as part of the routine inspections according to the schedule outlined in Appendix C1 and the pond elevation should be recorded on a monthly basis. Inspection forms are included in Appendix C3.

Additional pond level inspections are required after an unusual event. The additional inspections are summarized in Appendix C2.

Maintaining the integrity of the geosynthetic lining system is integral for the safe operation of the TSF to minimize seepage from the TSF over the long-term. Inspection of the geomembrane should be completed as part of the routine monthly inspections according to the schedule outlined in Appendix C1. An inspection log is provided in Appendix C3. Typical observations to be made for the geosynthetics lining system during surveillance include:

- Identification of defects in the geomembrane such as tears and holes
- Damage or degradation to geomembrane as a result of environmental exposure (e.g., ice, wind, UV damage, etc.)
- Identification of excess tension and trampolining in the geomembrane

Appropriate repairs are to be completed by a third party geosynthetics installer if any defects or damage are identified.

Stillwater contracts a third-party geosynthetics installer to complete detailed inspections of the HDPE geomembrane on a semi-annual basis. The semi-annual inspection reports include a summary of repairs made to the HDPE geomembrane and are kept on file in the Environmental Department and/or on SMC's electronic filing system.

Operation of the Basin Underdrains minimizes the head on the geomembrane thereby reducing the potential for seepage from the facility and promoting consolidation of the deposited tailings. The Basin Underdrains should be operated continuously. Typical observations for the Basin Underdrains to be made during surveillance include:

- Monitoring and documenting the Basin Underdrain flows
- Recording volumes pumped from the Cell 1 and Cell 2 Underdrain Sumps

- Recording the volume of water transferred to the LAD Storage Pond
- Monitoring the clarity of water from the Basin Underdrain return pipeline
- Monitoring the Basin Underdrain pipeline for ice buildup during freezing conditions

The VWPs installed in the Cell 1 and Cell 2 Basin Underdrains were installed to confirm the effectiveness of the underdrains. The VWPs monitor the pressure in the underdrains and the response to the Basin Underdrain pumping. Monitoring requirements for the VWPs are summarized in Section 3.7. Close monitoring of the pond elevation, depth, area and volume is important for the following reasons:

- To ensure that there is a sufficient volume of water available as make-up water while the pond is frozen and precipitation is at a minimum
- To enable monitoring of the supernatant pond depth/area/volume so that tailings characteristics such as settled dry density can be determined
- To monitor water recoveries
- To enable the correlation of the pond level with other data, such as the pore pressures (from the VWPs) and underdrain flow rates

3.4 SEEPAGE COLLECTION SYSTEM

There is no external seepage collection system for the Hertzler TSF. If additional seepage collection measures are deemed to be necessary, based on environmental monitoring data, a seepage collection system would be designed and implemented. This TOMS Manual will be revised to integrate the required operating, monitoring and surveillance measures related to the seepage collection system.

3.5 TAILINGS DELIVERY SYSTEM

3.5.1 OPERATIONAL OBJECTIVES

The tailings slurry is pumped from the Concentrator to the Hertzler TSF. The components of the tailings delivery system are described in Section 2.3.5. Discharge locations for tailings delivery will be rotated whereby one group of spigots are operated for a period of time and then deposition is transferred to another group of spigots for a period of time, etc. This strategy controls the supernatant pond location and develops a well-drained and relatively flat tailings surface that optimizes the storage capacity within the impoundment. The updated 2 year (January 2021 to December 2022) tailings deposition plan for the TSF is illustrated in Appendix E. The tailings deposition plan is reviewed on an annual basis as part of the EOR annual inspection.

3.5.2 SURVEILLANCE AND MAINTENANCE

The tailings discharge pipeline does not require significant external adjustments during normal operations. However, the following must be implemented during operation of the pipeline:

- Do not close all of the valves along the tailings discharge pipeline as they may be permanently blocked from sanding or suffer damage from excessively high pressures.
- Ensure that there is an open pathway for tailings to exit the pipeline before switching tailings lines or after any spigots are relocated.
- Flush the pipeline with water prior to shut down or relocation.

The tailings delivery and discharge pipelines will be inspected and maintained regularly to ensure that the system operates properly. The tailings discharge locations are noted during the routine inspections. Appendix C1 provides a schedule for regular surveillance of the tailings delivery system. Inspection forms are provided in Appendix C3. Typical surveillance observations should seek to identify:

- Locations of excessive wear of the pipeline
- Any evidence indicating leakage from the pipeline

- Wear at the bends on the butt-welded joints in the section of the pipeline installed on surface at the TSF
- Identification of pipe sections that are worn on one side that may be rotated so the unworn section conveys the tailings; or, worn sections must be replaced

Additional inspections are required after an unusual event. Appendix C2 outlines additional observations that will need to be documented. Repairs to the system may be required after any unusual event.

In addition, the Surface Supervisor conducts a visual inspection and measurement of the HDPE inner sleeve thickness at each automated vault location. This inspection is performed every 5 years and is documented by the Surface Supervisor. Documentation of this inspection is maintained in the Environmental Department offices and/or as an electronic copy in Stillwater's electronic filing system.

3.6 WATER RECLAIM SYSTEM

3.6.1 OPERATIONAL OBJECTIVES

Supernatant water is recycled from the Hertzler TSF to the SWM site for use as process water in the Concentrator. The components of the tailings water reclaim system are described in Section 2.3.6. The reclaim pumps can be operated from the Concentrator control room or from the breaker panel located on the crest of the TSF embankment adjacent to the reclaim manifold.

The reclaim pipeline does not require any external adjustments during normal operations. However, the reclaim system should be drained during maintenance periods or during a prolonged shutdown under extreme cold conditions.

3.6.2 SURVEILLANCE AND MAINTENANCE

The water reclaim system shall be inspected according to the schedule outlined in Appendix C1 and an inspection log will be completed as provided in Appendix C3. Typical items to inspect during surveillance of the reclaim pipeline include:

- Flow rates
- Locations of excessive wear of the pipeline
- Any evidence indicating leakage from the pipeline
- Monitor supernatant pond and reclaim pump elevations
- Monitor the tailings surface elevation adjacent to the reclaim pumps
- Ice buildup around the reclaim pumps and pipelines during freezing conditions

Additional inspections are required after any unusual event. Appendix C2 outlines additional observations that need to be documented.

3.7 INSTRUMENTATION

3.7.1 OPERATIONAL OBJECTIVES

Instrumentation is installed to assist with the monitoring of the tailings impoundment in order to evaluate compliance with design objectives. The instrumentation includes the following:

- Survey Monuments on the Stage 3 embankment crest to measure vertical and lateral movement of the embankment.
- Slope Inclinometers at the downstream toe of the embankment to monitor potential movement in the foundation.

- VWPs in the Basin Underdrains to monitor the effectiveness of the Basin Underdrain.
- Groundwater Monitoring Wells to monitor water levels and quality downstream of the TSF. Water quality is monitored and reported separately under the Water Resources Monitoring Plan.

The locations of the survey monuments, slope inclinometers and piezometers are shown on Figure A.1 (Appendix A). The locations of the monitoring wells are shown on Figure 2.2.

3.7.2 Surveillance and Maintenance

Instrumentation components are regularly monitored. Instrumentation is connected to and viewable in real-time in GeoExplorer, an instrumentation monitoring software package (NavStar, 2017). The instrumentation data is collected, plotted and reported according to the schedule outlined in Appendix C1. The instrumentation data is reviewed by the EOR on a quarterly basis. The EOR must be notified of any anomalous trends or values above the specified trigger levels. Additional readings and inspections as outlined in Appendix C2 will be required after any unusual event or observation. The survey monuments, slope inclinometers, vibrating wire piezometers locations and associated trigger levels are provided in the QRFG (Appendix A1).

The instruments may require occasional maintenance which could include:

- The piezometer wires may need to be cut and re-attached if the readout box is unable to acquire data.
- Piezometer wires that are exposed may become corroded and may need to be trimmed until a fresh surface is exposed to allow readings to be taken.
- Protection of survey monuments from equipment traffic on embankment crest and other disturbances may be required during maintenance work. Survey monuments need to be re-established and protected after construction of each new embankment stage.
- Instrumentation must be maintained according to the manufacturer's instructions.

3.8 LAD Storage Pond

3.8.1 Operational Objectives

The LAD Storage Pond is operated on an as-needed basis in accordance to its design and operating criteria. Treated mine water is pumped to the LAD Storage Pond from the Mine Site for temporary storage prior to being applied in the LAD area via irrigation pivots or at the percolation ponds. The LAD Storage Pond is lined with an HDPE geomembrane to reduce seepage from the basin. Additional monitoring of the LAD system is completed by SMC personnel and is outside of the scope of this TOMS Manual.

3.8.2 Surveillance and Maintenance

The LAD Storage Pond will be inspected according to the schedule outlined in Appendix C1. An inspection log is provided in Appendix C3. Typical observations to be made during surveillance include:

- Water levels in the LAD Storage Pond
- Evidence indicating leakage from the pipelines
- Evidence of slope deformation or erosion (i.e. cracks at the crest)
- Evidence indicating seepage out of the pond
- Condition of the HDPE geomembrane liner

Additional inspections are required after an unusual event. Appendix C2 outlines additional observations that will need to be documented.

3.9 SURFACE WATER MANAGEMENT

There are no upstream catchment areas reporting to the Hertzler TSF. Meteoric water reporting to the TSF includes direct precipitation to the tailings basin and runoff from the embankment crest. Surface water management measures for the facility include ditches and sedimentation basins located along the access roads and adjacent areas. The ditches and sedimentation basins are inspected and maintained as part of the Storm Water Pollution Prevention Plan (SWPPP).

4.0 SAFETY INSPECTIONS, REPORTING AND REVIEWS

4.1 QUARTERLY AND ANNUAL INSPECTIONS

Quarterly and Annual inspections of the TSF and associated facilities are required to evaluate current and past performance and to observe potential deficiencies in condition, performance and/or operation. The Environmental Sustainability Manager is responsible for arranging the inspections. The level of dam safety evaluation will be based on detailed observations made by the EOR and/or Deputy EOR and on relevant information on the TSF operations collected by site personnel. Additional reviews may also be required to follow up on reports of unusual events or observations.

The Environmental Sustainability Manager, Concentrator Manager and/or Environmental Specialist will accompany the EOR during the annual inspection. The EOR will evaluate the safety of the TSF and incorporate a review of the following:

- TOMS Manual
- The availability of all documents pertaining to dam safety on site
- Site surveillance practice
- Changes in relevant regulatory requirements since the last inspection

The EOR will issue an annual inspection report after completing the review. The report will include the following at a minimum:

- Conclusions on the status of the TSF
- Statement indicating completion of recommendations from previous inspections and reviews
- New recommendations if necessary

The annual inspections and reporting for the Hertzler TSF includes the following:

- The EOR shall inspect the TSF annually during operations or as required during closure pursuant to a reclamation plan.
- The EOR will prepare a report describing the scope of the inspection and recommended actions for the proper operation and maintenance of the Hertzler TSF.
- The EOR will submit the report to Stillwater and the DEQ and will immediately notify the DEQ and Stillwater if the facility presents an imminent threat or has the potential for an imminent threat to human health or the environment.

Should the annual inspection report contain recommendations, the following actions will be taken:

- Stillwater will prepare a Corrective Action Plan (CAP) and schedule to guide the implementation of the recommendations made by the EOR.
- Stillwater will submit the CAP and implementation schedule to the EOR.
- The EOR will review the CAP and schedule and verify that the proposed corrective actions are reasonably expected to effectively address the recommendations made in the annual report.
- Stillwater will submit the verified CAP and schedule to the DEQ within 120 days following the date of the inspection.
- Stillwater will implement the CAP in accordance with the implementation schedule.

4.2 INDEPENDENT REVIEW

The ITRB completes annual reviews of the TSF as per Stillwater's internal corporate governance document.

4.3 THIRD-PARTY REVIEW

The principle objective of a third-party Dam Safety Review (DSR) is to ascertain that a dam has an adequate margin of safety, based on the current engineering practice and on updated design input data. A third-party review may also be carried out to address a specific problem.

A third-party qualified engineer will be responsible for conducting the DSR at the Hertzler TSF. The engineer conducting the review must be qualified to conduct safety evaluations and be familiar with designs and other site-specific conditions and requirements pertaining to the operation of the TSF and associated facilities; but ideally should not have been involved in the design, construction or operations of the TSF.

A third-party review at the Hertzler TSF will be carried out every 5 years and this scheduling requirement will be confirmed or revised at the time of each annual inspection. The next third party review scheduled for the Hertzler TSF is in 2025, as a third-party review was completed in 2020.

5.0 EMERGENCY PREPAREDNESS PLAN

5.1 GENERAL

An Emergency Preparedness Plan (EPP) (Stillwater, 2022b) has been developed to enable SMC to:

- Identify emergency and hazardous conditions threatening the facility
- Expedite effective response actions to prevent failure
- Reduce loss of life, minimize property damage, and protect the environment, should failure of the facility occur

In the event that Stillwater is unable to comply with any of the terms and conditions of the operating permit, that would lead to emergency or hazardous conditions that would threaten the facility, due to any cause, Stillwater will:

- Immediately notify the MDEQ and USFS CGNF of the emergency or hazardous conditions that threaten the facility and the response actions taken to prevent failure.
- Immediately take action to stop, contain, and clean up correct the problem, and if applicable, immediately conduct sampling and analysis of any release.
- Submit a detailed written report to the MDEQ and USFS CGNF ten days. The report will contain a description of the condition; details including date and time and monitoring conducted;, if the problem has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the condition.

5.2 FAILURE MODES AND EFFECTS ANALYSIS

A high-level Failure Modes and Effects Analysis (FMEA) was completed for the TSF to inform the dam breach assessment that was completed to support the development of the EPP. Credible failure modes that have been identified for the Hertzler TSF are related to a breach of the facility that would lead to a release of water and tailings solids. These potential failure modes are related to hypothetical structural, foundation, and/or erosional failures.

Therefore, Stillwater has developed an EPP for the scenario of a hypothetical failure of either the Hertzler or Nye TSF that would result in a flash flood downstream of the facilities due to the release of water and tailings solids. A breach analysis has been completed for the Hertzler TSF to estimate the downstream flood inundation zone. In turn, this identified the residences and roads that are at risk downstream of the TSF. The Hertzler TSF breach analysis is incorporated into the EPP (Stillwater, 2022b).

The Hertzler TSF has been classified as having Low to High Hazard Potential (U.S. Army Corps of Engineers). The hypothetical failure modes and the factors that would contribute to a breach have been taken into consideration in determining the potential extent of the downstream flood inundation zone.

5.3 EMERGENCY CONDITIONS

The EPP (Stillwater, 2022b) will be implemented if emergency conditions are expected or have been identified. Two levels of emergency conditions (or warning signs) can be identified with respect to the site operations. These are defined as follows:

- Level 1 - Conditions that represent a potential emergency are those that if sustained or allowed to progress may result in an emergency, but no emergency situation is imminent.
- Level 2 - An emergency condition is defined by either failure of a significant component of the TSF and/or associated facility, or a significant failure of the performance of a component of the TSF that would result in a potential loss of life and/or property damage. Such failure may have already occurred or be imminent.

For each level of emergency condition, the EPP identifies subsequent response and/or corrective actions, including emergency notification contacts.

6.0 REFERENCES

Montana Department of Environmental Quality (DEQ) and U.S.D.A. Forest Service (USFS), 2012. *Record of Decision for the Final Environmental Impact Statement for the Stillwater Mining Company's Revised Water Management Plans and Boe Ranch LAD*.

NavStar Geomatics Ltd. (NavStar), 2017. *GeoExplorer 6*. Version 2.4.0.0. Kelowna, British Columbia.

Sibanye Stillwater(Stillwater), 2022a. *Nye Tailings Operations, Maintenance and Surveillance (TOMS) Manual*. December 22. V1.X. .

Sibanye Stillwater (Stillwater), 2022b. *Tailings Storage Facilities - Emergency Preparedness Plan (EPP)*. December 21. Nye, Montana. V1.5.

State of Montana (MT), 2019. *Montana Code Annotated (MCA) 2017, Title 82.* Minerals, Oil, and Gas. Chapter 4. Reclamation. Part 3. Metal Mine Reclamation.

7.0 CERTIFICATION

This report was prepared and reviewed by the undersigned.

We hereby certify that the following:

- This TOMS Manual is consistent with the design of the Stage 3 Hertzler TSF;
- The inspections and monitoring described in this TOMS Manual are reasonably sufficient to ensure the Stage 3 Hertzler TSF will perform as intended and will reasonably be expected to detect deviations if they occur; and
- The Emergency Preparedness Plan (EPP) describes reasonable measures that can be taken to protect human health and the environment.

Prepared:

Craig N. Hall, P.Eng.
Knight Piésold Ltd. - Managing Principal
Deputy Engineer of Record for Hertzler Tailings Storage Facility

Reviewed:

Matt Wolfe
Environmental Sustainability Manager - US Region

The Engineer of Record has reviewed this manual and hereby certifies the following:

- This TOMS Manual is consistent with the design of the Stage 3 Hertzler TSF;
- The inspections and monitoring described in this TOMS Manual are reasonably sufficient to ensure the Stage 3 Hertzler TSF will perform as intended and will reasonably be expected to detect deviations if they occur; and
- The Emergency Preparedness Plan (EPP) describes reasonable measures that can be taken to protect human health and the environment.

Reviewed: _____

Ken J. Brouwer, P.E.
Knight Piésold Ltd. – Principal Engineer
Engineer of Record for Hertzler Tailings Storage Facility

Appendix A

Quick Reference Field Guide

(Pages A-1 to A-9)

APPENDIX A
QUICK REFERENCE FIELD GUIDE

1.0 INTRODUCTION

This Quick Reference Field Guide (QRFG) provides a concise summary for the operation, monitoring and surveillance of the Stage 3 Hertzler Tailings Storage Facility (TSF). The Quantitative Performance Parameters (QPPs), instrumentation trigger levels and locations, and tailings and water management details for the tailings impoundment and Land Application and Disposal (LAD) Pond are summarized below.

2.0 QUANTITATIVE PERFORMANCE PARAMETERS

QPPs represent measurable parameters to confirm that the TSF is being operated in accordance with the design intent. The QPPs for the Hertzler TSF and LAD Storage Pond are summarized on Tables A.1 and A.2, respectively.

Table A.1 Stage 3 Hertzler TSF Quantitative Performance Parameters

Parameter	Value
Crest Elevation	5,036 ft.
Minimum Freeboard	6 ft.
Maximum Operating Level	5,030 ft.
Crest Width	30 ft.
Embankment Slope Angle	Upstream: 2.5H:1V Downstream: 2H:1V
Minimum Operating Pond Volume	50 M gal
Maximum Operating Pond Volume	Filling El. 5,000 to 5,010 ft.: 200 to 250 M gal Filling El. 5,010 to 5,020 ft.: 150 to 200 M gal Filling El. 5,020 to 5,030 ft.: < 150 M gal

Table A.2 LAD Storage Pond Quantitative Performance Parameters

Parameter	Value
Crest Elevation	4,884 ft.
Minimum Freeboard	4 ft.
Maximum Operating Level	4,880 ft.
Crest Width	30 ft.
Embankment Slope Angle	Upstream: 3H:1V Downstream: 3H:1V
Operating Pond	Maximum: 192 M gal

3.0 INSTRUMENTATION

Instrumentation has been installed in the Hertzler TSF to monitor the performance of the embankment and the Cell 1 and Cell 2 Basin Underdrains. The embankment survey monuments, embankment slope inclinometers and select vibrating wire piezometers (VWPs) are designated as QPPs for monitoring the performance of the TSF. The QPPs specify a displacement trigger level for the survey monuments and slope inclinometers and a piezometric trigger elevation for the piezometers. If trigger levels for the survey monuments, slope inclinometers and piezometers are reached, appropriate notifications are provided, and Unusual Event monitoring and reporting is triggered. The instrumentation locations for the tailings impoundment are shown in Figure A.1. The slope inclinometer sections are illustrated on Figure A.2. Instrumentation trigger levels are summarized in Table A.3 and A.4.

If an instrumentation trigger level is exceeded, inspections of the embankment crest and slopes are required to be completed to determine if indications of displacement such as cracking, sloughing, slumping or seepage are present. If no indications of displacement or adverse operating conditions are observed, the inspection observations should be documented and the instrumentation should continue to be monitored. If indications of displacement or adverse operating conditions are observed, refer to the Emergency Preparedness Plan (EPP) (Stillwater, 2022b) and contact the Engineer of Record (EOR).

Table A.3 Survey Monument Trigger Levels

Embankment Survey Monuments	Standard Operations	Level 1 Trigger Level	Level 2 Trigger Level
HER-GPS-01	24-hour average displacement (ΔEl, ΔN, ΔE) < 2 in. (25 mm) and 24-hour average 3D displacement < 2 in. (50 mm)	24-hour average displacement (ΔEl, ΔN, ΔE) > 2 in. (25 mm) or 24-hour average 3D displacement > 2 in. (50 mm)	N/A
HER-GPS-02			
HER-GPS-03			
HER-GPS-04			
HER-GPS-05			
HER-GPS-06			
HER-GPS-07			
HER-GPS-08			
Monitoring and Reporting Requirements	Regular Instrumentation Monitoring and Reporting	Increase monitoring frequency, inspect Survey Monument and Embankment and Complete Unusual Condition Report	N/A

Table A.4 Slope Inclinometer Trigger Levels

Embankment Slope Inclinometers	Standard Operations	Level 1 Trigger Level > 0.4 in. (10 mm) [1]	Level 2 Trigger Level > 1.0 in. (25 mm) [1]
HER-IPI-16-01-01	<0.188 Degrees Displacement	>0.188 Degrees Displacement	>0.47 Degrees Displacement
HER-IPI-16-01-02			
HER-IPI-16-01-03	<0.094 Degrees Displacement	>0.094 Degrees Displacement	>0.235 Degrees Displacement
HER-IPI-16-01-04			
HER-IPI-16-01-05			
HER-IPI-16-01-06			
HER-IPI-16-02-01	<0.188 Degrees Displacement	>0.188 Degrees Displacement	>0.47 Degrees Displacement
HER-IPI-16-02-02			
HER-IPI-16-02-03			
HER-IPI-16-02-04	<0.094 Degrees Displacement	>0.094 Degrees Displacement	>0.235 Degrees Displacement
HER-IPI-16-02-05			
HER-IPI-16-02-06			
HER-IPI-16-03-01	<0.188 Degrees Displacement	>0.188 Degrees Displacement	>0.47 Degrees Displacement
HER-IPI-16-03-02			
HER-IPI-16-03-03			
HER-IPI-16-03-04			
HER-IPI-16-03-05			
HER-IPI-16-03-06			
HER-IPI-16-03-07	<0.094 Degrees Displacement	>0.094 Degrees Displacement	>0.235 Degrees Displacement
HER-IPI-16-03-08			
HER-IPI-16-03-09			
Monitoring and Reporting Requirements	Regular Instrumentation Monitoring and Reporting	Level 1 exceedances require daily review of inclinometer readings to be implemented and contingency or remedial measures to be developed if trigger levels continue to be exceeded	Level 2 exceedances require an Unusual Condition investigation and action plan

NOTES:

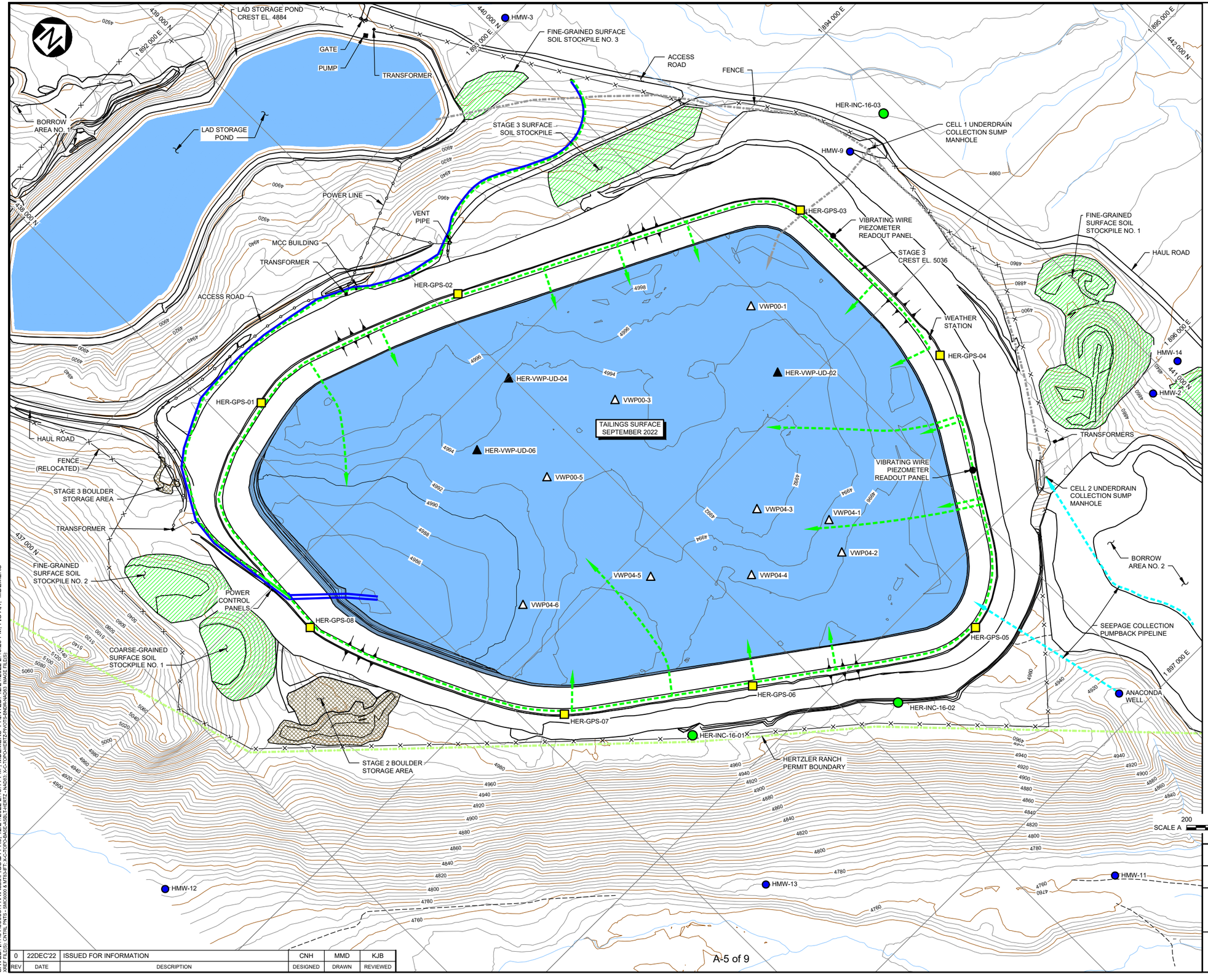
1. TRIGGER LEVELS WERE CONVERTED TO DEGREES OF DISPLACEMENT FOR USE IN SIBANYE STILLWATER'S MONITORING SYSTEM, GEOEXPLORER. DEGREES OF DISPLACEMENT ARE CALCULATED BASED ON 10 OR 20 FT. TILTMETER SPACING.

Table A.4 Vibrating Wire Piezometers Trigger Levels

Piezometers	Standard Operations	Level 1 Trigger Level	Level 2 Trigger Level
Embankment Slope Inclinometer VWPs [1]			
HER-VWP-16-01	< 4,920 ft.	> 4,920 ft.	N/A
HER-VWP-16-02	< 4,900 ft.	> 4,900 ft.	
HER-VWP-16-03	< 4,820 ft.	> 4,820 ft.	
Monitoring and Reporting Requirements	Regular Instrumentation Monitoring and Reporting	Increase Monitoring Frequency, Review Piezometer Data with precipitation and Hertzler flow monitoring records to determine reason for exceedance and Complete Unusual Condition Report	N/A
Basin Underdrain VWPs [2]			
HER-VWP-UD-02	No trigger level - underdrain performance monitoring only (Piezo head fluctuated with Basin Underdrain pumping) [3]		
HER-VWP-UD-04			
HER-VWP-UD-06			

NOTES:

1. MONITORS PHREATIC SURFACE IN THE EMBANKMENT FOUNDATION.
2. MONITORS BASIN UNDERDRAIN RESPONSE TO PUMPING.
3. NOTIFY THE ENGINEER OF RECORD IF BASIN UNDERDRAIN PIEZOMETERS ARE NOT RESPONDING TO BASIN UNDERDRAIN PUMPING.



LEGEND:

- WATER
- TAILINGS
- BOULDER STORAGE AREA
- SURFACE SOIL STOCKPILE
- HERTZLER RANCH PERMIT BOUNDARY
- RECLAIM PIPELINES
- TAILINGS DISCHARGE PIPELINE
- SEEPAGE COLLECTION PUMPBACK PIPELINE
- BASIN UNDERDRAIN RETURN PIPELINE
- EXISTING ROAD
- WILDLIFE FENCE
- POWER LINE
- TRAIL
- MONITORING WELL
- STAGE 3 SURVEY MONUMENTS
- VIBRATING WIRE PIEZOMETER READOUT PANEL
- SLOPE INCLINOMETER LOCATION (APPROXIMATE)
- BASIN UNDERDRAIN PIEZOMETER LOCATION (ACTIVE)
- BASIN UNDERDRAIN PIEZOMETER LOCATION (DECOMMISSIONED)

NOTES:

1. HORIZONTAL DATUM IS MONTANA COORDINATE SYSTEM, NAD83, INTERNATIONAL FEET. VERTICAL DATUM IS NGVD 29.
2. STAGE 3 AS-BUILT SURVEY DATA PROVIDED BY RED LODGE SURVEYING NOVEMBER 17, 2015. OTHER DETAILED TOPOGRAPHY PROVIDED BY HKM ENGINEERING INC. SEPTEMBER 24, 2004, FEBRUARY 10, 2000, AND SEPTEMBER 29, 2000. THE 2022 TAILINGS SURFACE DATA PRESENTED ON THIS FIGURE WAS SURVEYED BY SURVEY SYSTEMS SEPTEMBER, 2022.
3. CONTOUR INTERVAL OUTSIDE OF TAILINGS IMPOUNDMENT IS 5 FEET. CONTOUR INTERVAL WITHIN TAILINGS IMPOUNDMENT IS 2 FEET.
4. SOME INFRASTRUCTURE NOT SHOWN FOR CLARITY.
5. MONITORING WELL LOCATIONS PROVIDED BY SIBANYE STILLWATER.

SCALE A: 200 0 200 400 600 800 1000 ft

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	22DEC'22	ISSUED FOR INFORMATION	CNH	MMD	KJB

SIBANYE STILLWATER

STILLWATER MINE

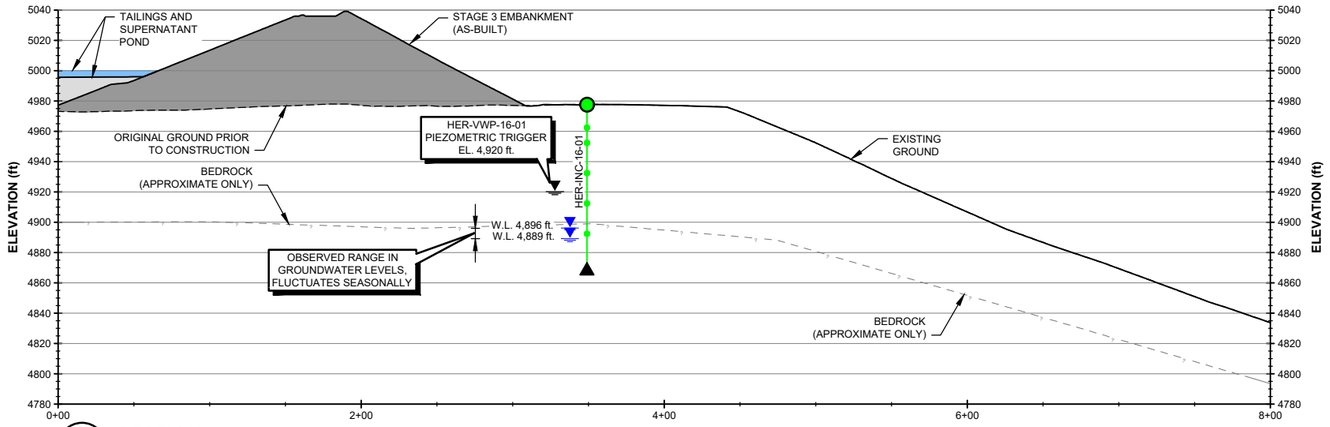
HERTZLER TSF
2022 TAILINGS SURFACE
PIPEWORK AND INSTRUMENTATION LOCATIONS

Knight Piésold CONSULTING

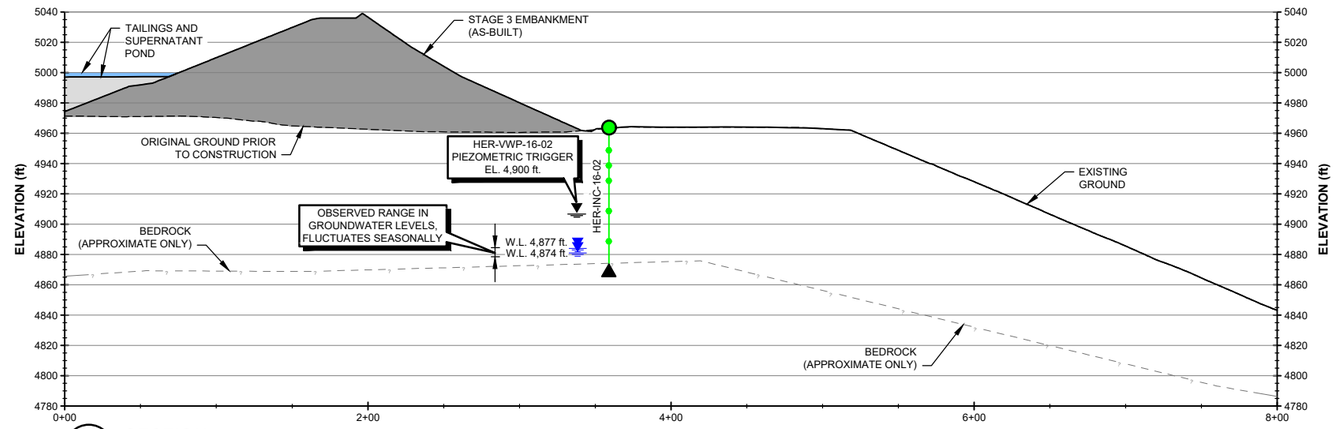
P/A NO.	REF NO.
NB101-66/44	NB22-01392

FIGURE A.1 REV 0

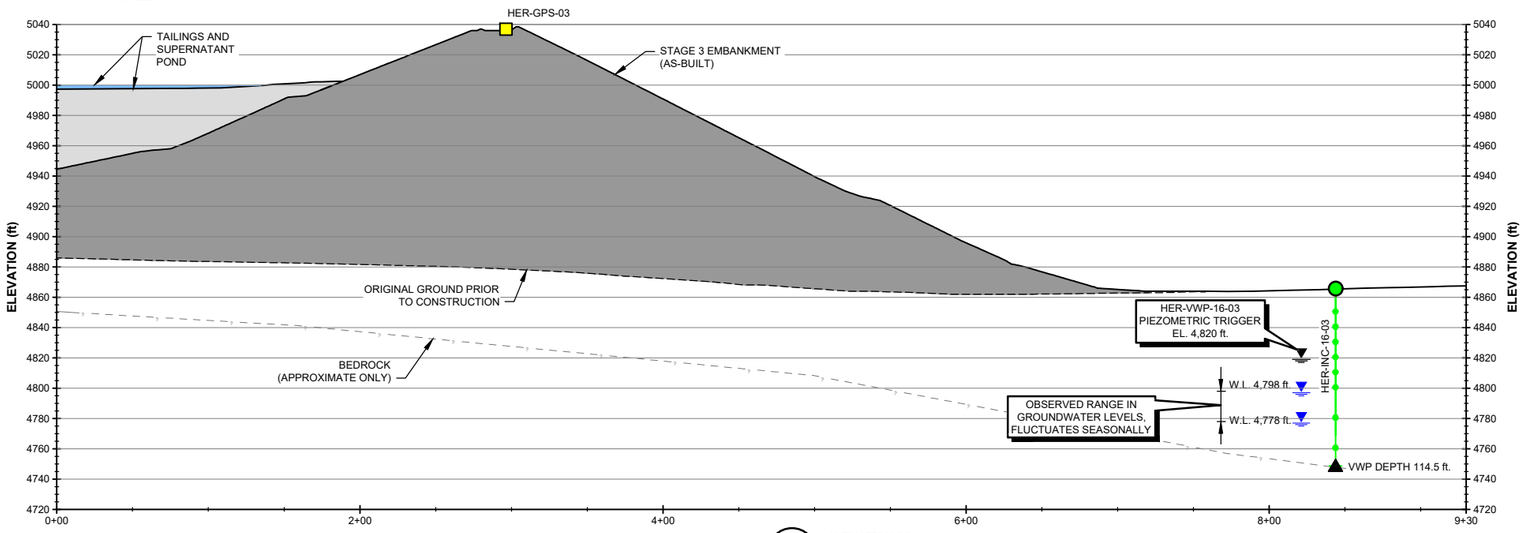
SAVED: I:\101\00\66\44\A\cad\FIGS\B11 R0, 12/21/2022 2:13:11 PM, MDEMERS PRINTED: 12/21/2022 2:13:29 PM, FIG A.1, MDEMERS
XREF FILE(S): CNTRL PNTS- SMO000 & MTRS-FT, X-C-TOPO-BASE-ASBLT-HERTZ-NAD83, X-C-TOPO-HERTZ-PIVOTS-BNDRY-NAD83 (IMAGE FILE(S))



1 FIG — **SECTION HER-INC-16-01**
SCALE A



2 FIG — **SECTION HER-INC-16-02**
SCALE A



3 FIG — **SECTION HER-INC-16-03**
SCALE A

LEGEND:

- WATER
- TAILINGS
- EMBANKMENT FILL
- BEDROCK (APPROXIMATE ONLY)
- SLOPE INCLINOMETER LOCATION
- INCLINOMETER SENSOR LOCATION
- MEASURED WATER LEVEL
- PHREATIC SURFACE TRIGGER LEVEL
- VIBRATING WIRE PIEZOMETER LOCATION
- STAGE 3 SURVEY MONUMENTS

NOTES:

1. SECTIONS BASED ON STAGE 3 AS-BUILT SURVEY DATA PROVIDED BY RED LODGE SURVEYING NOVEMBER 17, 2015. OTHER DETAILED TOPOGRAPHY PROVIDED BY HKM ENGINEERING INC. SEPTEMBER 24, 2004, FEBRUARY 10, 2000, AND SEPTEMBER 29, 2000.
2. DIMENSIONS AND ELEVATIONS ARE IN FEET UNLESS NOTED OTHERWISE.

SCALE A: 50 0 50 100 150 200 250 ft

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	22DEC'22	ISSUED FOR INFORMATION	CNH	MMD	KJB

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
SLOPE INCLINOMETER SECTIONS

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB101-66/44	NB22-01398

FIGURE A.2 REV 0

4.0 TAILINGS AND WATER MANAGEMENT

The TSF staging and filling schedule are illustrated in Figure A.2. If the supernatant pond level exceeds the maximum operating level, tailings deposition must cease and removal of water from tailings impoundment basin is required to commence immediately using the water reclaim system. There are no restrictions on the rate of filling or on the rate of drawdown for the supernatant pond, with respect to dam safety. The location of the tailings discharge and reclaim water pipework is shown in Figure A.1. The water balance flowsheet for the Tailings Impoundment is shown in Figure A.3.

Treated mine water is pumped to the LAD Storage Pond for storage prior to spray application at the irrigation pivots. The depth-area-capacity curves for the LAD Storage Pond are illustrated in Figure A.4. If the pond level exceeds the maximum operating level, surplus water must be removed from the pond using the irrigation system.

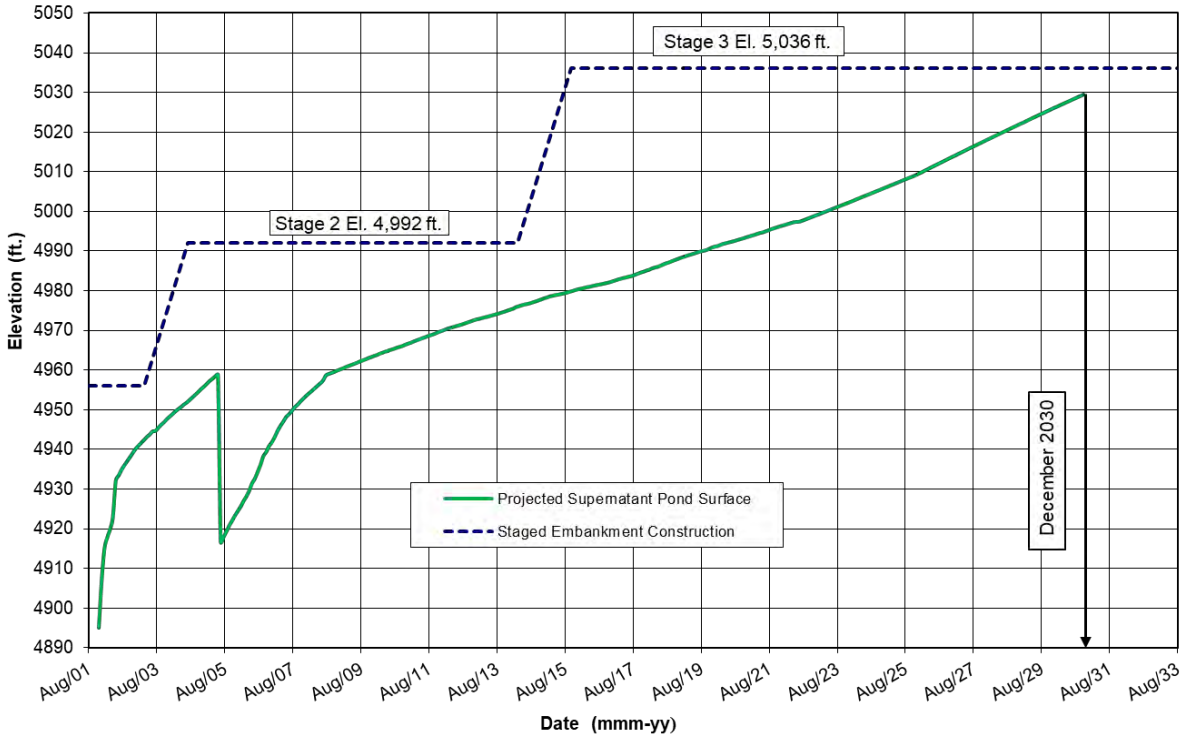


Figure A.3 TSF Filling Curve

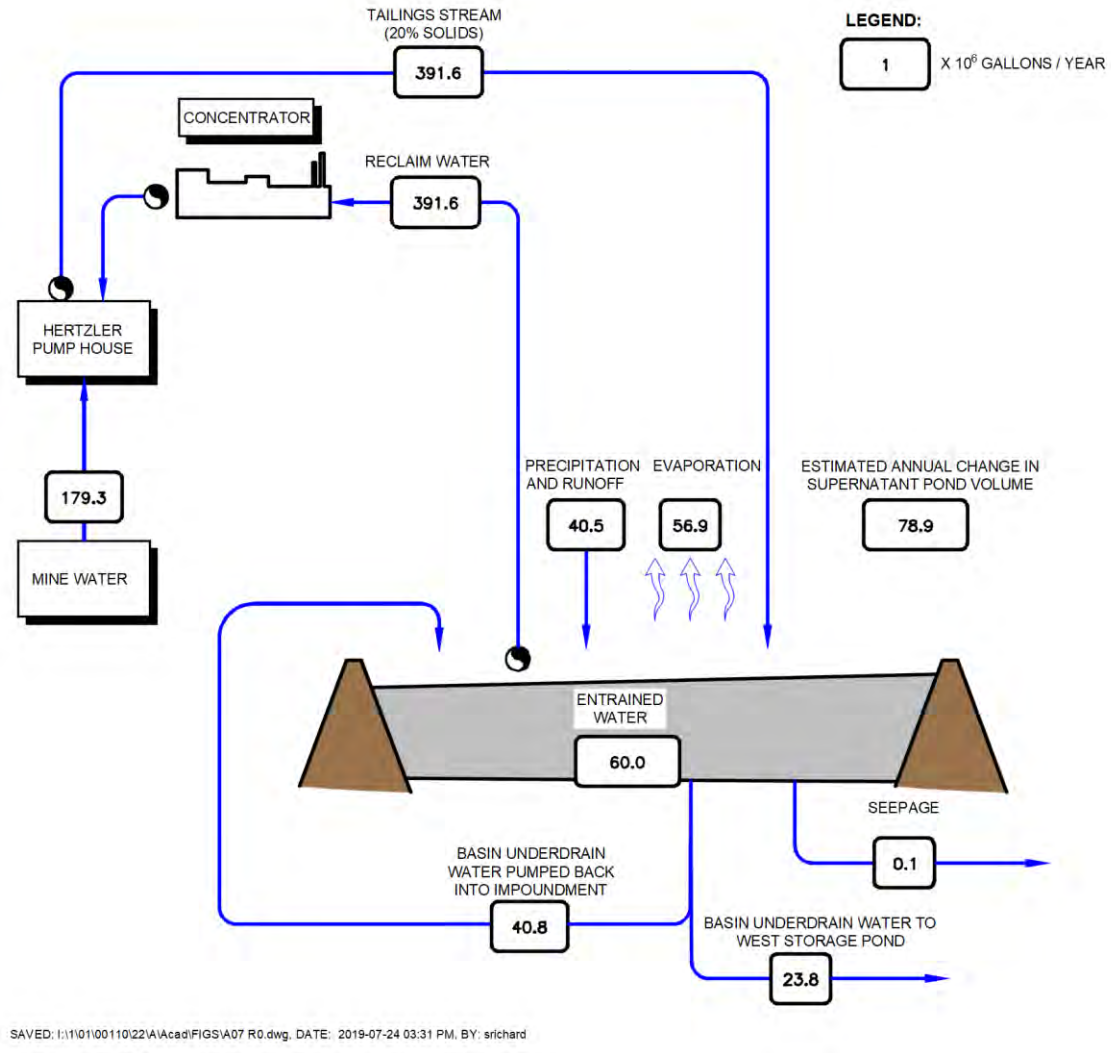


Figure A.4 Water Balance Flowsheet

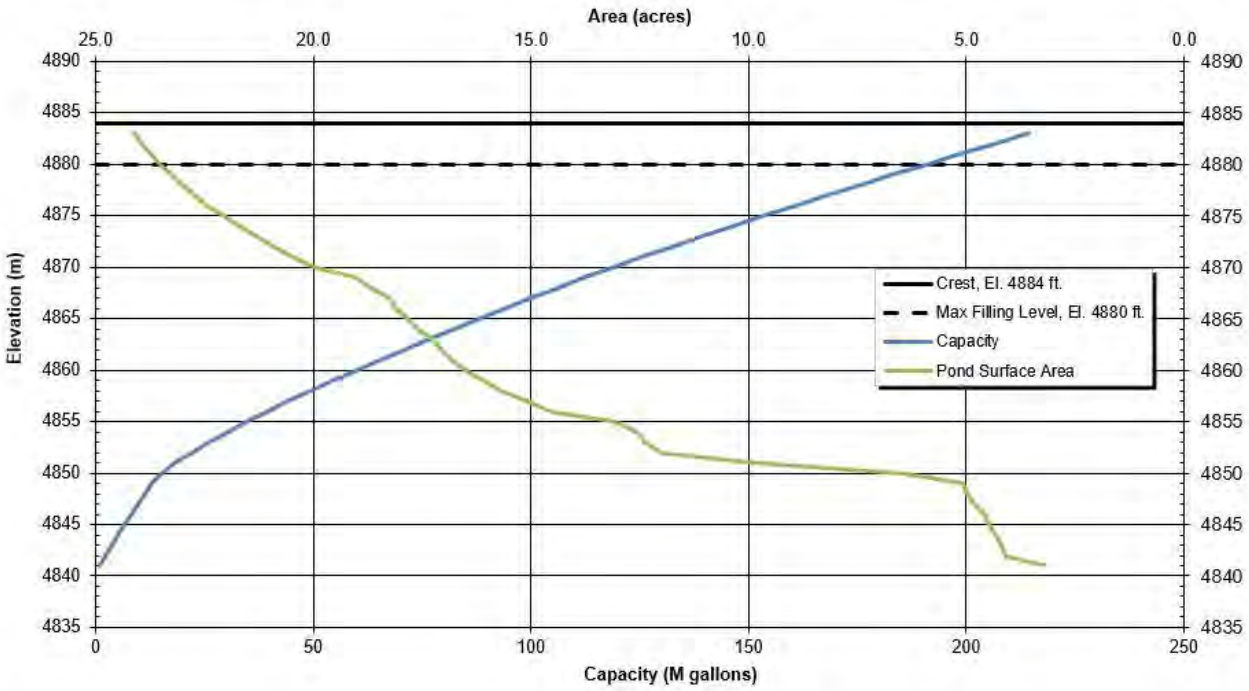


Figure A.5 LAD Storage Pond Depth-Area-Capacity Curves

Appendix B
References

(Page B-1)

APPENDIX B
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Stillwater Mining Company (SMC), 1996. Mine Waste Management Plan: Amendment to Permit #00118. April. Appendix I.

Stillwater Mining Company (SMC), 2013. Attachment to 2012 Annual Report for Operating Permit #00118.

Appendix C
Inspection and Surveillance

Appendix C1
Inspection and Surveillance Schedule

Appendix C2
Unusual Events and Occurrences Requiring Non-Routine Walkovers

Appendix C3
Inspection Forms

Appendix C1

Inspection and Surveillance Schedule

(Page C1-1)

TABLE C1.1

SIBANYE STILLWATER
STILLWATER MINE

HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
INSPECTION AND SURVEILLANCE SCHEDULE

Print Dec-22-22 9:21:27

Component	Description	Operations	Inspection and Surveillance	Responsible Parties
Tailings Embankment	Perimeter embankment around the impoundment.	Maintain access roads on the embankment crest.	Inspect the embankments **weekly** and look for evidence indicating instability or deformation. Inspect downstream face **weekly** for evidence of seepage, runoff, erosion or piping. Take photographs of the embankments **semi-annually**.	Surface Supervisor Surface Supervisor Environmental Supervisor, Concentrator Manager
Tailings Basin	Process water and tailings solids storage in an HDPE lined basin. Basin underdrain layer to reduce seepage and promote tailings consolidation.	Pond required to store 72 hr PMP event plus provide an additional 3 ft, of freeboard. Maximum operating pond level is 6 ft. below the crest elevation during normal operations. Compare pond levels with design filling schedules. Relocate spigots as necessary to develop the tailings beach around the perimeter of the impoundment.	Record Tailings throughput **daily**. Inspect the tailings discharge location **weekly** and note the approximate extent of beach development in the facility. Inspect the tailings beach **weekly**. Note any sinkholes or excessive beach erosion. Inspect the geomembrane **monthly**. Measure and monitor the pond water levels **weekly**. Take photographs of the pond **semi-annually**. Determine the volume of the supernatant pond annually (prior to winter freeze-up) by sounding the pond depths from a boat.	Surface Supervisor Surface Supervisor Surface Supervisor, Surface Crew Surface Supervisor Surface Supervisor Environmental Supervisor, Concentrator Manager Concentrator Superintendent
Tailings Delivery System	Consists of the tailings delivery pipeline and discharge spigots around perimeter of impoundment.	Ensure that the discharge pipeline is fully flushed prior to relocating any pipework. Ensure that there is always an open path for the tailings to exit during operations and discharge relocation. Keep spigot points downstream of active spigotting sections open to allow the unused pipeline to drain. Maintain non-erosive laminar flow over the tailings beaches.	Inspect the pipeline **weekly** for evidence indicating leakage. Conduct detailed inspections of the tailings pipeline during **pipeline maintenance**. Take photographs of the tailings delivery spigots **semi-annually**. Inspect and measure HDPE inner pipe wall thickness at each vault **every 5 years**.	Surface Supervisor, Surface Crew Concentrator Superintendent Environmental Supervisor, Concentrator Manager Surface Supervisor, Surface Crew
Reclaim Water Pipeline	Consists of the 3 inclined reclaim pumps and pipes, reclaim manifold from tailing impoundment to the mill, reclaim water pipeline and booster pump station adjacent to the mine site.	The inclined pumps and booster pump may be controlled from the Mill control room, or breather panel on the dam crest. Monitor the water and tailings elevation relative to the inclined pump location.	Inspect the pipeline **weekly** for evidence of leakage. Monitor and assess the inclined pump elevation **quarterly** and determine if pumps need to be raised. Conduct detailed inspections of the reclaim pipeline during **pipeline maintenance**. Take photographs of the reclaim pipeline semi-annually. Inspect and measure HDPE inner pipe wall thickness at each vault **every 5 years**.	Surface Supervisor, Surface Crew Surface Supervisor, Surface Crew Surface Supervisor Environmental Supervisor, Concentrator Manager Concentrator Manager, Surface Supervisor
LAD Storage Pond	Mine water, storage pond lined with HDPE geomembrane. Pumps and pipework to transfer water to irrigation pivots and/or percolation ponds.	Maximum operating pond level is 4 ft. below the crest elevation during normal operations.	Inspect the geomembrane **twice annually**. Measure and monitor the pond water levels **weekly**. Take photographs of the pond semi-annually.	Environmental Specialist Surface Supervisor, Surface Crew Environmental Supervisor, Concentrator Manager
Instrumentation	Includes vibrating wire piezometers, survey monuments, groundwater monitoring wells and slope inclinometers.	Piezometers and slope inclinometers connected to LoggerNet data collection system. Survey monuments transmit data to Navstar monitoring system. Instrumentation data plotted and reviewed on Navstar's GeoExplorer software, SMC's internal monitoring system for slope inclinometers and piezometers. Check condition of instrumentation and complete maintenance as required. Make note of any instrumentation that is not functioning. Follow manufacture's instructions for instrumentation operation. Notify EOR of any anomalous trends in the data.	Review instrumentation data **monthly**. Check condition of instrumentation as required Provide instrumentation data **quarterly** to the EOR for review. Monitor water levels in each groundwater monitoring well and obtain water quality samples as required by permits. Data is compiled by the Environmental Specialist and a reported to the appropriate agencies as required by the permit.	Environmental Specialist Environmental Specialist Environmental Specialist Environmental Specialist

I:\1\01\00066\44\A\Report\Hertzler TOMS Update\Hertzler TOMS Manual\App C - Inspection and Surveillance\[Table C1.1 - Inspect_Sched.xlsx]Table C1.1

Appendix C2

Unusual Events and Occurrences Requiring Non-Routine Walkovers

(Page C2-1)

TABLE C2.1

SIBANYE STILLWATER
STILLWATER MINE

HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
UNUSUAL EVENTS AND OCCURRENCES REQUIRING NON-ROUTINE WALKOVERS

Print Dec-22-22 9:28:19

Event/Observation	Recommended Action
Extreme rainfall	Monitor the TSF pond level. Confirm pond level is below the maximum operating level. Monitor the LAD Storage Pond. Confirm pond level is below the maximum operating level. Inspect the TSF embankments for signs of concentrated runoff and erosion. Inspect the TSF embankments for indications of localized slumping or instability. Note areas of saturated or soft ground. Inspect surface water management ditches and sediment ponds along access roads.
Water levels rising in the TSF more than expected and within 2 ft. of the maximum operating level	Monitor pond levels Weekly. Develop plan to slow or stop the water level rise (stop tailings deposition, transfer water to the LAD Storage Pond and/or underground mine). Contact the EOR.
Water levels rising in the TSF more than expected and within 1 ft. of the maximum operating level	Monitor pond levels daily. Initiate plan to slow or stop the water level rise (stop tailings deposition, transfer water to the LAD Storage Pond and/or underground mine). Contact the EOR.
Significant earthquake event (See Note 1.)	Read all instrumentation. Follow inspection and reporting procedures if instrumentation readings exceed trigger levels.
Rupture of tailings delivery, reclaim water or evaporator water supply pipelines	Stop pumping tailings to the TSF and stop reclaiming water to the mill. Check the upstream slope and crest for erosion. Take photographs and make notes of exact location and cause (if known) of leak. Contact the EOR.
Significant, rapid erosion of embankment slopes; Sudden seepage on embankment slope or downstream of embankment in form of continuous seepage or boils	Estimate seepage flow rate. Estimate size of area. Take photographs and make notes of exact location (if known) of erosion. Contact the EOR.
Minor surface erosion on embankment crest and/or slopes	Repair as necessary. Determine the cause of the erosion.
Soft toe condition or minor seepage at the downstream slope or toe	Conduct embankment walkovers daily until the problem is understood and addressed. Monitor seepage development (e.g. clarity, content/quality, extent etc.). Prepare to carry out corrective repairs. Contact the EOR if appropriate.
High turbidity in Basin Underdrain flow	Reduce or suspend underdrain pumping. Collect sample for suspended solids determination. Prepare to carry out corrective repairs. Contact the EOR if appropriate.
Extended power failure	Drain the reclaim water and tailings delivery pipelines if power failure occurs during extreme freezing temperatures. Flush the tailings delivery pipelines prior to restarting tailings deposition.
Exceedance of Level 2 instrumentation trigger levels	Refer to trigger levels in QRFG. Re-check the readings. Continue monitoring daily until readings return to normal. Contact the EOR if appropriate.
Failure of tailings delivery, reclaim water, or evaporator water supply pipelines resulting in erosion of the embankment crest	Document and repair as necessary. Monitor water levels daily. Ensure backup pumps are available. Repair or replace failed pumps ASAP.
Tailings Delivery Pipeline blocked	Stop tailings discharge. Flush pipeline with water to clear obstruction. Inspect the pipeline for damages or leaks. Determine the cause or reason for blockage.
Minor cracks developing at the embankment crest or slope	Conduct embankment walkovers daily until the problem is understood and addressed. Monitor crack development (e.g. crack size, extent, etc.). Prepare to carry out corrective repairs. Contact the EOR if appropriate.
Geomembrane damage due to unusual environmental occurrences (ice, wind, erosion damages, etc.)	Document the extent of the geomembrane damage. Identify a repair plan. Contact the Geomembrane Installer to complete the repairs.
Other events/observations	Use judgement, consult your peers.

I:\1\01\00066\44\A\Report\Hertzler TOMS Update\Hertzler TOMS Manual\App C - Inspection and Surveillance\[Table C2.1 - Hertzler Unusual Events.xlsx]Table C2.1

NOTE:

1. A SIGNIFICANT EARTHQUAKE IS DEFINED AS AN EARTHQUAKE THAT COULD POTENTIALLY DISPLACE, DAMAGE OR CAUSE AN EMBANKMENT TO CRACK OR SETTLE, RESULTING IN A LOSS OF STRUCTURAL INTEGRITY OR FREEBOARD. THE OCCURRENCE OF AN EARTHQUAKE GREATER THAN MAGNITUDE 5.0 ON THE RICHTER SCALE WITHIN 60 MILES (100 KILOMETERS) OF THE FACILITY WILL AUTOMATICALLY TRIGGER A LEVEL 1 OR HIGHER CONDITION. ASSESSING AND REPORTING POTENTIAL DAMAGE CAUSED BY AN EARTHQUAKE WILL BE THE REQUIRED REMEDIAL ACTION.

Appendix C3
Inspection Forms

TABLE C3.1

SIBANYE STILLWATER
STILLWATER MINE

HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
WEEKLY TSF INSPECTION
(Surface Supervisor or Surface Crew)

Print Dec-22-22 9:41:49

Inspectors:		Inspection Date:	Inspection Time:
Name:	Title:	Signature:	
Name:	Title:	Signature:	
Weather Conditions	Precipitation (24hr):	Wind Speed:	
	Temperature °F:	Sky: Clear Partly Cloudy Cloudy Overcast	
Samples Collected:	Yes No		

TAILINGS EMBANKMENT			
Crest of Dam	Condition/Issue/Defect Present (circle one)		Comments
Cracking	Yes	No	
Subsidence, Depressions	Yes	No	
Lateral Deformation	Yes	No	
Standing Water or Wet Areas	Yes	No	
Upstream Slope			
Liner Trampoline (due to potential displacement of underlying subgrade)	Yes	No	
Liner Bulging (due to potential displacement of underlying subgrade)	Yes	No	
Excessive Ice Build-up and/or Snow Accumulation	Yes	No	
Ice Rafting on Geomembrane			
Downstream Slope			
Cracking	Yes	No	
Subsidence	Yes	No	
Bulging, Sliding or Sloughing	Yes	No	
Erosion	Yes	No	
Animal Burrows	Yes	No	
Damp Areas	Yes	No	
Seeps, Soft Areas	Yes	No	

TAILINGS BASIN			
Basin Filling	Condition/Issue/Defect Present (circle one)		Comments
Tailings Beach Location (sinkholes or excessive erosion)	Yes	No	
Pond Elevation (estimated from marked location (ft.))			
Tailings Beach Development (approx. area)			
Tailings Discharge Location (Spigot No.)			

TAILINGS DELIVERY SYSTEM			
Pipelines	Condition/Issue/Defect Present (circle one)		Comments
Pipeline Leakage (external inspection)	Yes	No	
Pipeline Damage (external inspection)	Yes	No	
Valves - Conditions/Issues Identified (external inspection)	Yes	No	
Maintenance Activities (repairs and replacements)			

WATER RECLAIM SYSTEM			
Pipelines and Pumps	Condition/Issue/Defect Present (circle one)		Comments
Pipeline Leakage (external inspection)	Yes	No	
Pipeline Damage (external inspection)	Yes	No	
Valves - Conditions/Issues Identified (external inspection)	Yes	No	
Maintenance Activities (repairs and replacements)			

OTHER	
Other Issues or Observations Identified	Comments

I:\1\01\00066\44\A\Report\Hertzler TOMS Update\Hertzler TOMS Manual\App C - Inspection and Surveillance\[Table C3.1 to C3.4- Hertzler Inspection Log Templates.xlsx]Mill Wkly TSF Inspection_Hertz

TABLE C3.2

SIBANYE STILLWATER
STILLWATER MINE

HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
MONTHLY TSF INSPECTION
(Surface Supervisor)

Print Dec-22-22 9:42:45

Inspectors:			Inspection Date:	Inspection Time:	
Name:		Title:		Signature:	
Name:		Title:		Signature:	
Weather Conditions		Precipitation (24hr):		Wind Speed:	
		Temperature °F:		Sky: Clear Partly Cloudy Cloudy Overcast	
NOTE: Photograph all conditions, issues or defects identified.					
Photos Taken:	Yes No			Instrumentation Data Collected:	Yes No
Samples Collected:	Yes No			Data Collection Sheets Completed:	Yes No

TAILINGS EMBANKMENT			
Crest of Dam	Condition/Issue/Defect Present (circle one)		Comments
Cracking	Yes	No	
Subsidence, Depressions	Yes	No	
Lateral Deformation	Yes	No	
Standing Water or Wet Areas	Yes	No	
Excessive Ice Build-up and/or Snow Accumulation	Yes	No	
Upstream Slope			
Liner Trampoline (due to potential displacement of underlying subgrade)	Yes	No	
Liner Bulging (due to potential displacement of underlying subgrade)	Yes	No	
Excessive Ice Build-up and/or Snow Accumulation	Yes	No	
Ice Rafting on Geomembrane			
Downstream Slope			
Cracking	Yes	No	
Subsidence	Yes	No	
Bulging, Sliding or Sloughing	Yes	No	
Erosion	Yes	No	
Animal Burrows	Yes	No	
Damp Areas	Yes	No	
Seeps, Soft Areas	Yes	No	

TAILINGS BASIN			
Basin Filling	Condition/Issue/Defect Present/Observation (circle one)		Comments
Tailings Beach Location (sinkholes or excessive erosion)	Yes	No	
Freeboard minimum of 6 feet below crest required	Yes	No	
Pond Elevation (estimated from marked location (ft.))			
Tailings Beach Development (approx. area)			
Tailings Discharge Location (Spigot No.)			
Geomembrane			
Defects (holes, tears, ice, wind, uv degradation, etc.)	Yes	No	
Tension/Trampoline	Yes	No	
Areas of Previous Repair			
Concerns or Issues with Conditions	Yes	No	
Basin Underdrain			
Pump Operating	Yes	No	
Sump and Pumphouse (concerns or issues with conditions)	Yes	No	
Clarity of Discharge Water (WTP Sample Port)	Clear Cloudy Dirty		
Excessive Ice Buildup during Freezing Conditions	Yes	No	

TAILINGS DELIVERY SYSTEM			
Pipelines	Condition/Issue/Defect Present/Observation (circle one)		Comments
Pipeline Leakage (external inspection)	Yes	No	
Pipeline Damage (external inspection)	Yes	No	
Valves - Conditions/Issues Identified (external inspection)	Yes	No	
Spigot Inspection (issue identified)	Yes	No	
Record Spigot Locations (Spigot No.)			
Excessive Ice Buildup during Freezing Conditions	Yes	No	

WATER RECLAIM SYSTEM			
Pipelines and Pumps	Condition/Issue/Defect Present/Observation (circle one)		Comments
Pipeline Leakage (external inspection)	Yes	No	
Pipeline Damage (external inspection)	Yes	No	
Valves - Conditions/Issues Identified (external inspection)	Yes	No	
Pumps - Conditions/Issues Identified (external inspection)	Yes	No	
Excessive Ice Buildup during Freezing Conditions	Yes	No	

OTHER	
Other Issues or Observations Identified	Comments

I:\1\01\00066\44\A\Report\Hertzler TOMS Update\Hertzler TOMS Manual\App C - Inspection and Surveillance\[Table C3.1 to C3.4- Hertzler Inspection Log Templates.xlsx]Mill Monthly TSF Inspection

TABLE C3.3

SIBANYE STILLWATER
STILLWATER MINE

HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
QUARTERLY TSF INSPECTION
(Environmental Compliance Supervisor or Concentrator Manager)

Print Dec-22-22 9:44:37

Inspectors:		Inspection Date:	Inspection Time:	
Name:	Title:		Signature:	
Name:	Title:		Signature:	
Weather Conditions	Precipitation (24hr):		Wind Speed:	
	Temperature °F:		Sky: Clear Partly Cloudy Cloudy Overcast	
Photos Taken:	Yes No		Instrumentation Data Collected:	Yes No
Samples Collected:	Yes No		Data Collection Sheets Completed:	Yes No

TAILINGS EMBANKMENT				
Crest of Dam	Condition/Issue/Defect Present (circle one)		Comments	Photos Taken
Cracking	Yes	No		
Subsidence, Depressions	Yes	No		
Lateral Deformation	Yes	No		
Standing Water or Wet Areas	Yes	No		
Excessive Ice Build-up and/or Snow Accumulation	Yes	No		
Upstream Slope				
Liner Trampoline (due to potential displacement of underlying subgrade)	Yes	No		
Liner Bulging (due to potential displacement of underlying subgrade)	Yes	No		
Excessive Ice Build-up and/or Snow Accumulation	Yes	No		
Excessive Ice Build-up and/or Snow Accumulation				
Downstream Slope				
Cracking	Yes	No		
Subsidence	Yes	No		
Bulging, Sliding or Sloughing	Yes	No		
Erosion	Yes	No		
Animal Burrows	Yes	No		
Damp Areas	Yes	No		
Seeps, Soft Areas	Yes	No		
Vegetation (Reclamation)				
Wet Ground Vegetation	Yes	No		
Poor Growth	Yes	No		
Destroyed by Erosion	Yes	No		
Instrumentation				
Survey Monuments - Inspect Condition (damaged or maint needed)	Yes	No		
Piezometers - Inspect Condition (damaged or maint needed)	Yes	No		
Slope Inclinometers - Inspect Condition (damaged or maint needed)	Yes	No		
Areas of Previous Repair				
Concerns or Issues with Conditions	Yes	No		
TAILINGS BASIN				
Basin Filling	Condition/Issue/Defect Present/ Observation (circle one)		Comments	Photos Taken
Tailings Beach Location (sinkholes or excessive erosion)	Yes	No		
Freeboard Minimum of 6 feet below Crest Required	Yes	No		
Pond Elevation (estimated from marked location (ft.)				
Tailings Beach Development (approx. area (ft.))				
Tailings Discharge Location (Spigot No.)				
Geomembrane				
Defects (holes, tears, ice, wind, uv degradation, etc.)	Yes	No		
Tension/Trampoline	Yes	No		
Areas of Previous Repair				
Concerns or Issues with Conditions	Yes	No		
Basin Underdrain				
Pump Operating	Yes	No		
Sump and Pumphouse (concerns or issues with conditions)	Yes	No		
Clarity of Discharge Water (WTP Sample Port)	Clear Cloudy Dirty			
Excessive Ice Buildup during Freezing Conditions	Yes	No		
TAILINGS DELIVERY SYSTEM				
Pipelines	Condition/Issue/Defect Present/Observation (circle one)		Comments	Photos Taken
Pipeline Leakage (external inspection)	Yes	No		
Pipeline Damage (external inspection)	Yes	No		
Valves - Conditions/Issues Identified (external inspection)	Yes	No		
Spigot Inspection (issue identified)	Yes	No		
Record Spigot Locations (Spigot No.)				
Excessive Ice Buildup during Freezing Conditions	Yes	No		
WATER RECLAIM SYSTEM				
Pipelines and Pumps	Condition/Issue/Defect Present (circle one)		Comments	Photos Taken
Pipeline Leakage (external inspection)	Yes	No		
Pipeline Damage (external inspection)	Yes	No		
Valves - Conditions/Issues Identified (external inspection)	Yes	No		
Pumps - Conditions/Issues Identified (external inspection)	Yes	No		
Inclined Pump Elevation (set elevation acceptable)	Yes	No		
Excessive Ice Buildup during Freezing Conditions	Yes	No		
SURFACE WATER MANAGEMENT (COMPLETED AS PART OF THE SWPPP)				
Ditches, Sediment Collection	Condition/Issue/Defect Present (circle one)		Comments	Photos Taken
Blockages	Yes	No		
Flowing Water, Boils or Seeps	Yes	No		
Signs of Erosion	Yes	No		
FENCING				
Fencing	Yes	No		
OTHER				
Other Issues or Observations Identified	Comments			Photos Taken

I:\1\01\00066\44\A\Report\Hertzler TOMS Update\Hertzler TOMS Manual\App C - Inspection and Surveillance\[Table C3.1 to C3.4- Hertzler Inspection Log Templates.xlsx]Env. or Mill Quarterly Insp.

TABLE C3.4

SIBANYE STILLWATER
STILLWATER MINE

HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
TSF INSPECTION - UNUSUAL EVENT INSPECTION
(Environmental Compliance Supervisor or Concentrator Manager)

Print Dec-22-22 9:47:01

Inspectors:		Inspection Date:	Inspection Time:
Name:		Title:	Signature:
Name:		Title:	Signature:
Weather Conditions	Precipitation (24hr):	Wind Speed:	
	Temperature °F:	Sky: Clear Partly Cloudy Cloudy Overcast	
Photos Taken:	Yes No	Instrumentation Data Reviewed:	Yes No
Samples Collected:	Yes No		

Event	Comments	Photo
EXTREME RAINFALL EVENT (2 inches in 24 hours)		
Monitor TSF Pond Level. Confirm Pond Level is below Maximum Operating Level		
Inspect Embankments for Signs of Concentrated Runoff and Erosion		
Inspect Embankments for Indications of Localized Slumping or Instability		
Note Areas of Saturated or Soft Ground		
Inspect Surface Water Management Ditches and Sediment Ponds along Access Roads		
TSF POND LEVEL WITHIN 2 ft. MAXIMUM OPERATING LEVEL		
Monitor Pond Level Weekly		
Develop Plan to Reduce Pond Level		
TSF POND LEVEL WITHIN 1 ft. MAXIMUM OPERATING LEVEL		
Monitor Pond Level Daily		
Initiate Plan to Reduce Pond Level		
SIGNIFICANT EARTHQUAKE EVENT (Magnitude greater than 5 within 60 miles)		
Review Instrumentation Readings		
Carry Out Detailed Walkover of TSF, Pipelines and Associated Structures if Instrumentation Trigger Levels are Exceeded		
Investigate Downstream and Upstream (visible) Slopes for Cracks, Bulging Settlement or Deformation		
Look for and note any Seepage, particularly the Rate of Seepage Flow at the Embankment Toe and Clarity		
Review all Surface Monument and Slope Inclinometer Readings		
Inspect Downstream Embankment slope for Sand Boils and Sinkholes		
Inspect Tailings Beach for Whirlpools		
Discuss findings with Engineer of Record		
Check and ensure that the Basin Underdrain Sumps and Pumps are Functioning		
RUPTURE OF PIPELINE AT THE EMBANKMENT		
Stop Pumping Tails to the TSF and Stop Reclaiming Water to Mill		
Check Upstream Slope and Crest for Erosion		
Take Photographs and make Notes of Exact Location and Cause of Erosion (if known), Contact EOR		
SIGNIFICANT EROSION OF THE EMBANKMENT SLOPES; SEEPAGE ON THE EMBANKMENT SLOPE OR DOWNSTREAM OF THE EMBANKMENT TOE		
Estimate Seepage Flow Rate. Estimate Size of Area.		
Take Photographs and make Notes of Exact Location and Cause (if known) of Erosion		
Contact the EOR		
SIGNIFICANT TEAR OR DEFECT IN GEOMEMBRANE		
Document Location and Extent of Tear/Defect		
Develop Repair Plan		
EXCEEDANCE OF INSTRUMENTATION TRIGGER LEVEL		
Embankment Inspection Observations		
OTHER OBSERVATIONS		

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Appendix D
Selected Site Photos

(Pages D-1 to D-10)

PHOTO 1 – Overview of Hertzler TSF (2022).

PHOTO 2 – Overview of LAD Storage Pond (2022).

PHOTO 3 – North end of Hertzler TSF (2022).

PHOTO 4 – East Embankment upstream slope (2022).

PHOTO 5 – Southwest Embankment upstream slope (2022).

PHOTO 6 – Example survey monument (2022).

PHOTO 7 – West Embankment upstream slope with evaporators installed (2022).

PHOTO 8 – Stage 3 vibrating wire piezometer readout location (2022).

PHOTO 9 – Floating tailings discharge spigot (2022).

PHOTO 10 – Cell 1 Basin Underdrain Collection Sump and pumphouse (2015).

PHOTO 11 – Cell 2 Basin Underdrain Collection Sump (2015).

PHOTO 12 – East embankment downstream slope (2022).

PHOTO 13 – West Embankment downstream (2021).

PHOTO 14 – Tailings delivery pipeline on embankment crest (2022).

PHOTO 15 – Evaporator installation on West Embankment Crest (2022).

PHOTO 16 – Water reclaim manifold and pipework (2022).

PHOTO 17 – North end of LAD Storage Pond (2022).

PHOTO 18 – South end of LAD Storage Pond (2022).

PHOTO 19 – Mine water supply pipeline, north end of LAD Storage Pond (2022).

PHOTO 20 – LAD Storage Pond reclaim pipework and pumps (2022).

Appendix E

Tailings Deposition Plan

(Pages E-1 to E-8)

Knight Piésold CONSULTING

TABLE E.1

SIBANYE STILLWATER
STILLWATER MINE

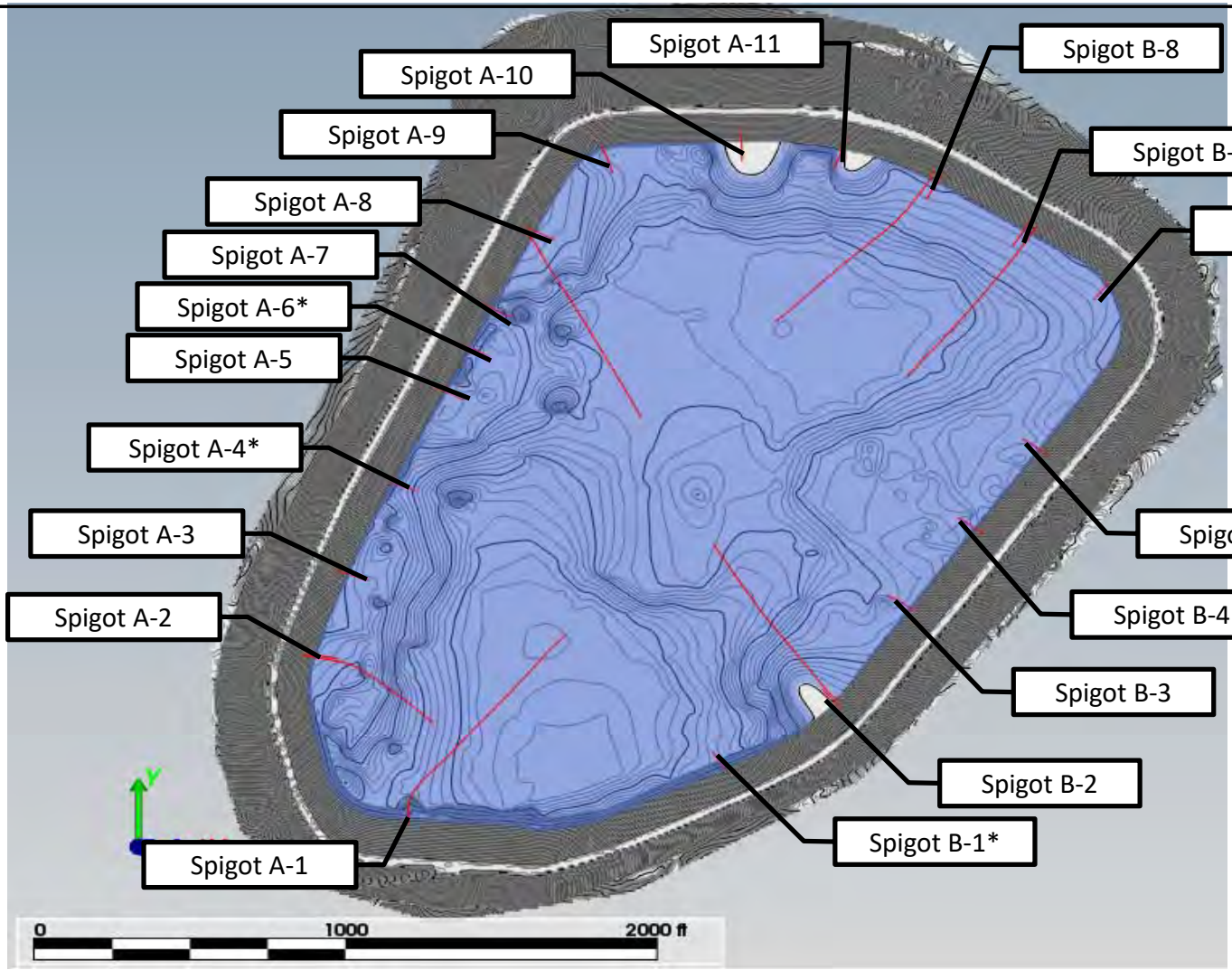
HERTZLER TAILINGS OPERATIONS, MAINTENANCE AND SURVEILLANCE (TOMS) MANUAL
2022 TO 2024 DEPOSITION SUMMARY

Print Dec-22-22 10:25:25

Month	Tailings Deposited (tons)	Spigot #'s	Pond Volume (M gal)	Pond Volume (cu.ft.)	Pond Area (sq.ft.)	Beach Area (acres)
Sep-22	50,355	A4, B7, A2	190	25,399,306	4,321,633	1.2
Oct-22	52,034	A8, B8	187.5	25,065,104	4,343,077	0.7
Nov-22	50,355	A11, B8, A10	185	24,730,903	4,170,388	4.6
Dec-22	52,034	A9, B7, A8, B6	185	24,730,903	4,017,450	8.4
Jan-23	58,907	A7, B5, A4, B4	185	24,730,903	4,012,868	8.2
Feb-23	53,207	A3, B3, A2, B1	185	24,730,903	4,133,282	5.9
Mar-23	58,907	A5, B1, A11, B2	185	24,730,903	4,139,101	6.0
Apr-23	57,007	A1, B7	185	24,730,903	4,314,743	2.0
May-23	58,907	A1, B8	182.5	24,396,701	4,366,877	0.8
Jun-23	57,007	A8, B2	180.0	24,062,500	4,398,966	0.1
Jul-23	58,907	A2, B7	177.5	23,728,299	4,406,633	0.2
Aug-23	58,907	A1, B8	175.0	23,394,097	4,413,739	0.1
Sep-23	57,007	A8, B2	172.5	23,059,896	4,420,338	0.1
Oct-23	58,907	A1, B8, B7	170	22,725,694	4,426,926	0.4
Nov-23	57,007	A11, B8, A10, B7	167.5	22,391,493	4,107,473	7.7
Dec-23	58,907	A9, B6, A8, B5	167.5	22,391,493	3,975,135	11.3
Jan-24	60,791	A7, B4, A5, B3	167.5	22,391,493	4,071,863	9.5
Feb-24	56,869	A4, B2, A2, B1	167.5	22,391,493	4,308,950	4.1
Mar-24	60,791	A10, B7, A3, B1	167.5	22,391,493	4,226,136	6.5
Apr-24	58,830	A2, B7	167.5	22,391,493	4,359,549	3.4
May-24	60,791	A1, B8	165.0	22,057,292	4,432,575	1.7
Jun-24	58,830	A8, B2	162.5	21,723,090	4,483,313	0.6

I:\1\01\00066\44\A\Report\Hertzler TOMS Update\Hertzler TOMS Manual\App E - Tailings Deposition Plan\[App E_Hertzler Tailings Deposition Plan Table and Figures.xlsm]E1 2022 Deposition Summary

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	22DEC'22	ISSUED FOR INFORMATION (NB22-01392)	MJT	CNH



NOTES:

1. SPIGOTS A-4, A-6, AND B-1 WERE NOT INSTALLED AS OF MAY 2022.
2. POND ELEVATION SHOWN AT 4997.5 ft AS MEASURED IN WEEKLY INSPECTION REPORT BY SMC (2021).
3. BASE SURFACE DISPLAYS BATHYMETRIC SURVEY COMPLETE IN JULY 2021 PROVIDED BY SMC.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	22DEC'22	ISSUED FOR INFORMATION	MJT	CNH

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
TAILINGS DEPOSITION MODELLING
SPIGOT LOCATIONS

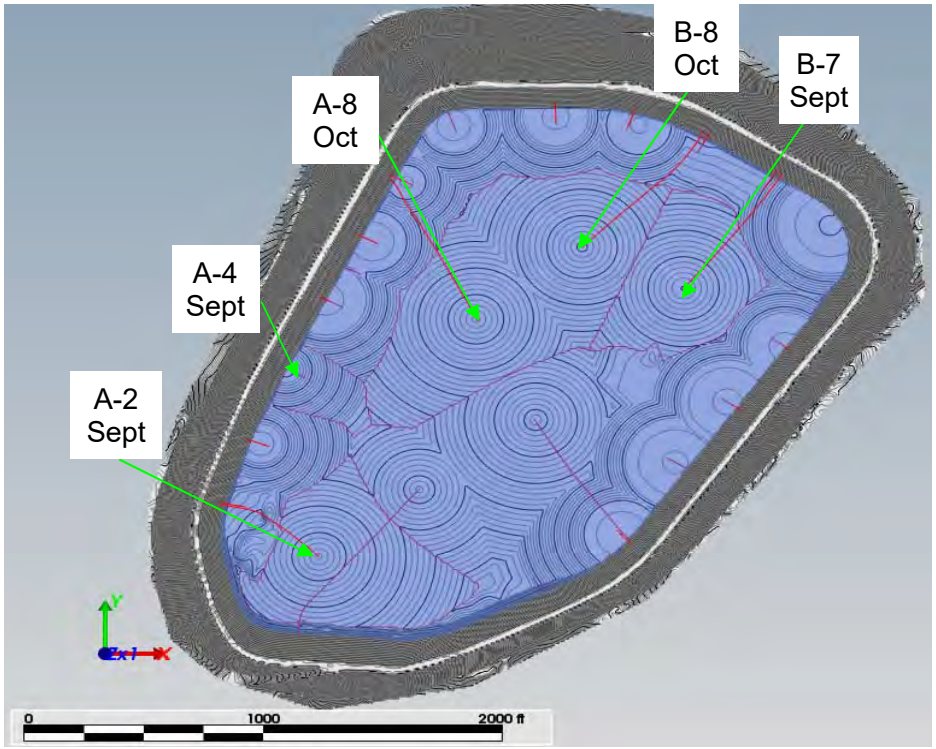
Knight Piésold CONSULTING

P/A NO. NB101-66/44

REF. NO. NB22-01392

FIGURE E.1

REV 0



September – October 2022
Pond Volume = 187.5 M gal
Pond Elevation = 5000.2 ft.
Beach Surface Area = 0.7 acres
Total Tonnage Deposited = 102,389 tons

NOTES:

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	22DEC'22	ISSUED FOR INFORMATION	MJT	CNH

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
TAILINGS DEPOSITION MODELLING
SEPTEMBER TO OCTOBER 2022

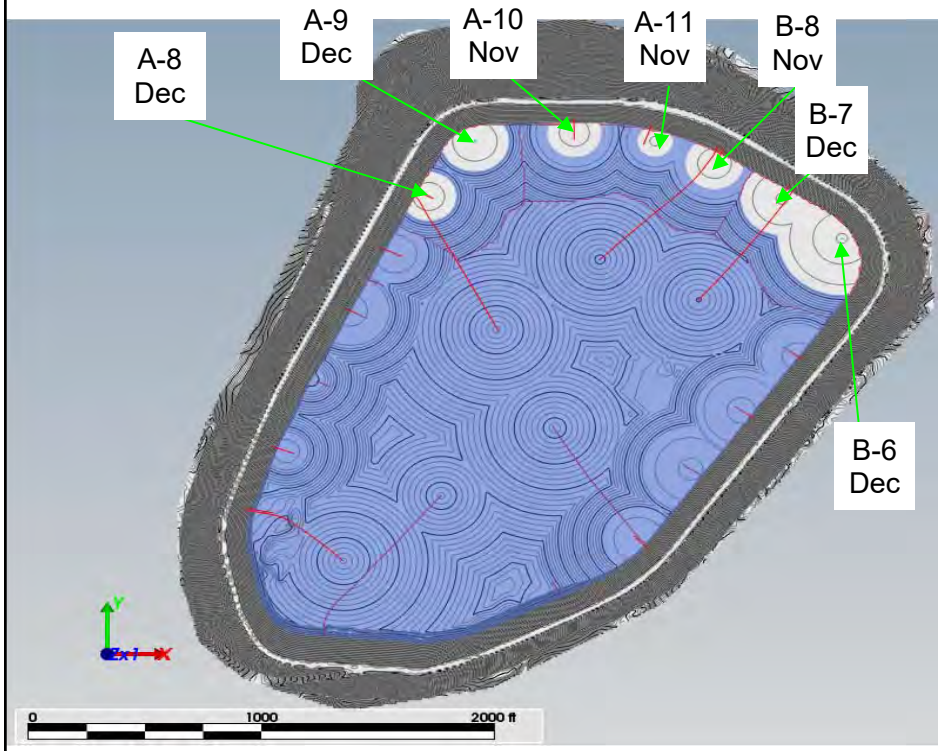
Knight Piésold CONSULTING

P/A NO. NB101-66/44

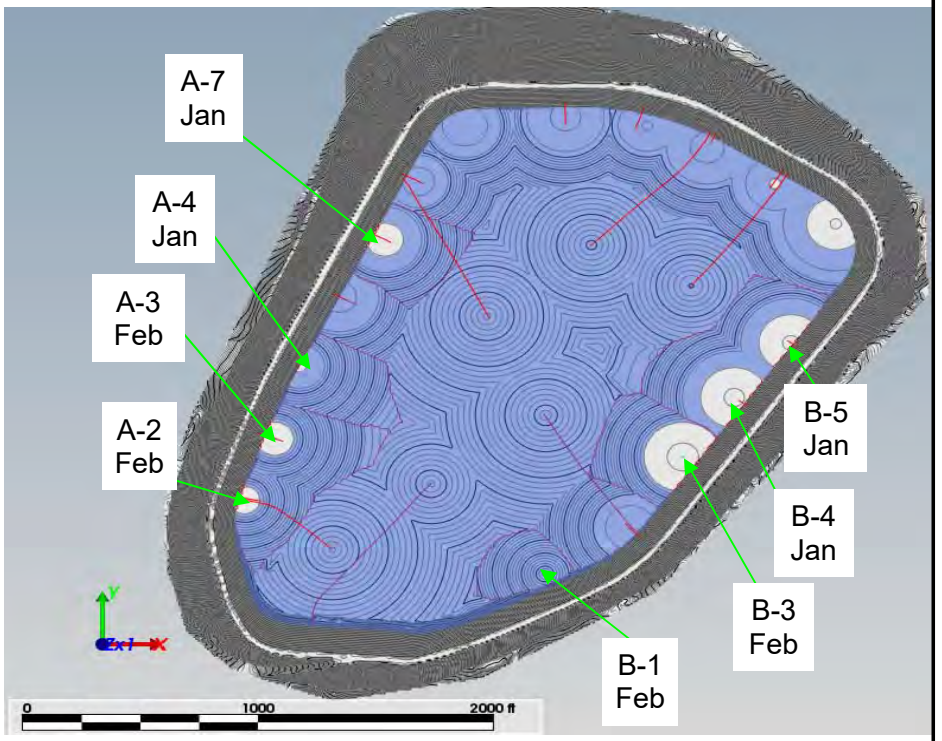
REF. NO. NB22-01392

FIGURE E.2

REV 0



November – December 2022
Pond Volume = 185 M gal
Pond Elevation = 5000.7 ft.
Beach Surface Area = 8.4 acres
Total Tonnage Deposited = 102,389 tons



January – February 2023
Pond Volume = 185 M gal
Pond Elevation = 5001.5 ft.
Beach Surface Area = 5.9 acres
Total Tonnage Deposited = 112,114 tons

NOTES:

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	22DEC'22	ISSUED FOR INFORMATION	MJT	CNH

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
TAILINGS DEPOSITION MODELLING
NOVEMBER 2022 TO FEBRUARY 2023

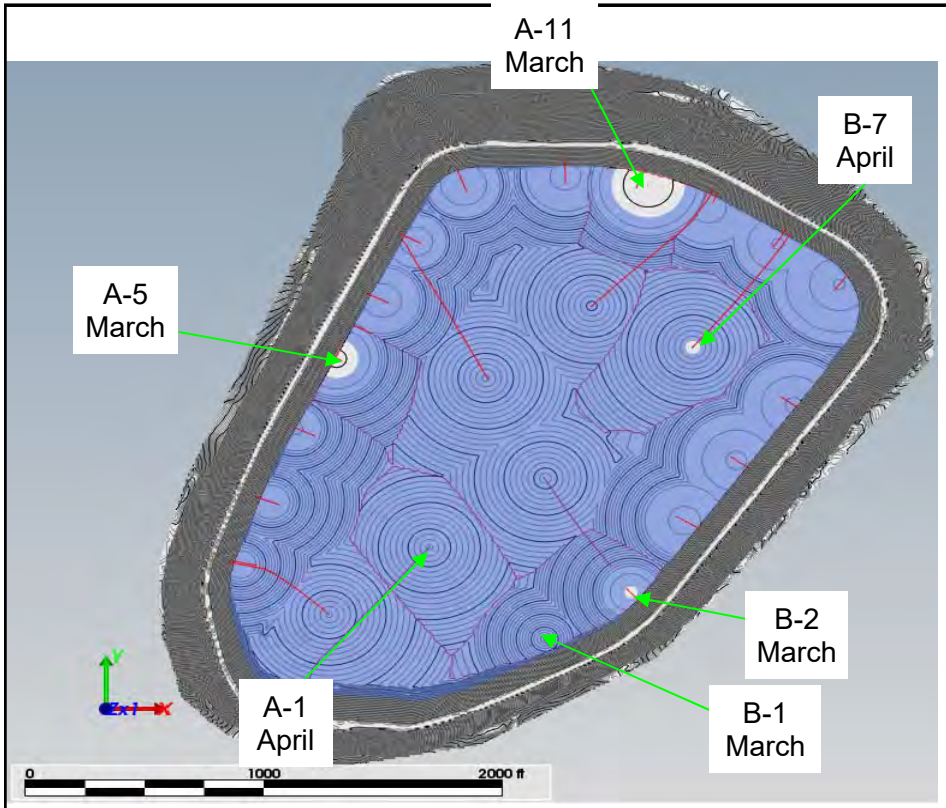
Knight Piésold CONSULTING

P/A NO. NB101-66/44

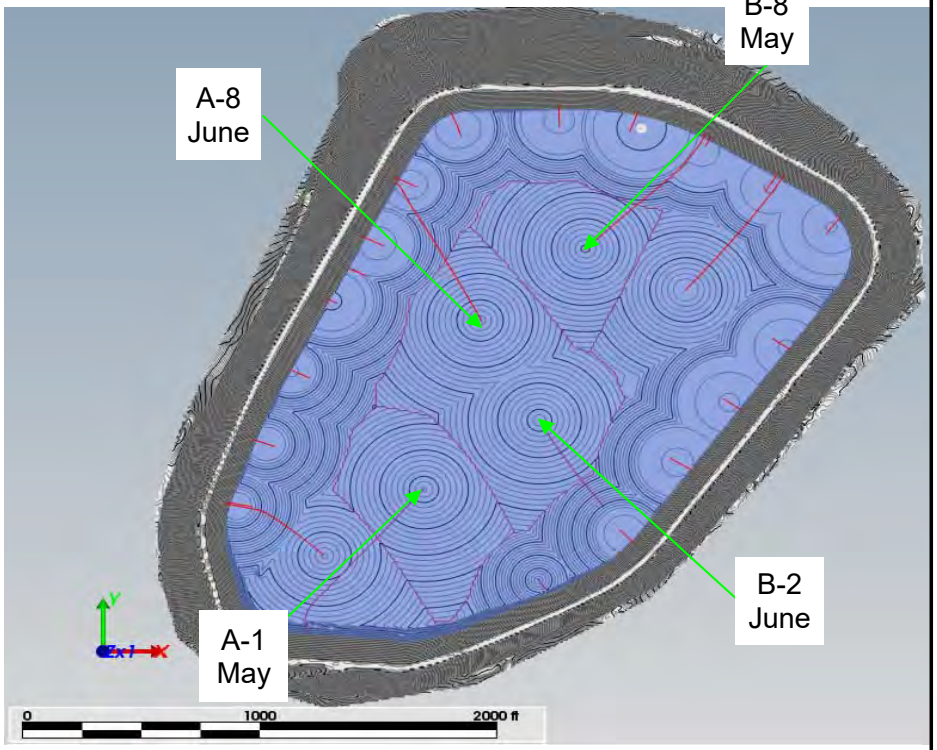
REF. NO. NB22-01392

FIGURE E.3

REV 0



March – April 2023
Pond Volume = 185 M gal
Pond Elevation = 5002.3 ft.
Beach Surface Area = 2.0 acres
Total Tonnage Deposited = 115,915 tons



May – June 2023
Pond Volume = 180 M gal
Pond Elevation = 5002.9 ft.
Beach Surface Area = 0.1 acres
Total Tonnage Deposited = 115,915 tons

NOTES:

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	22DEC'22	ISSUED FOR INFORMATION	MJT	CNH

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
TAILINGS DEPOSITION MODELLING
MARCH TO JUNE 2023

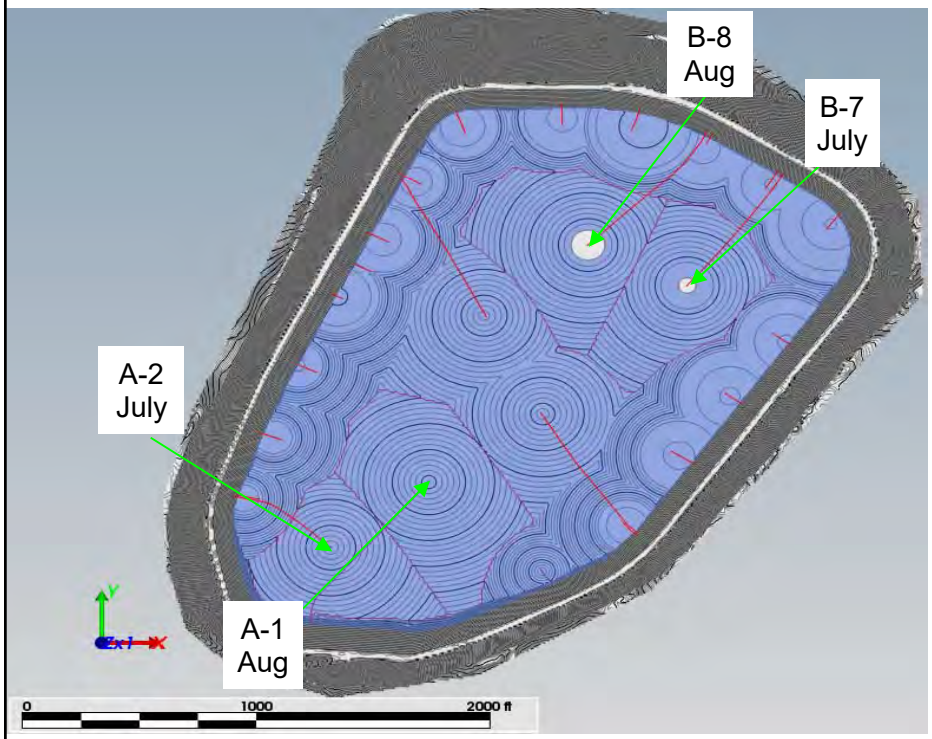
Knight Piésold CONSULTING

P/A NO. NB101-66/44

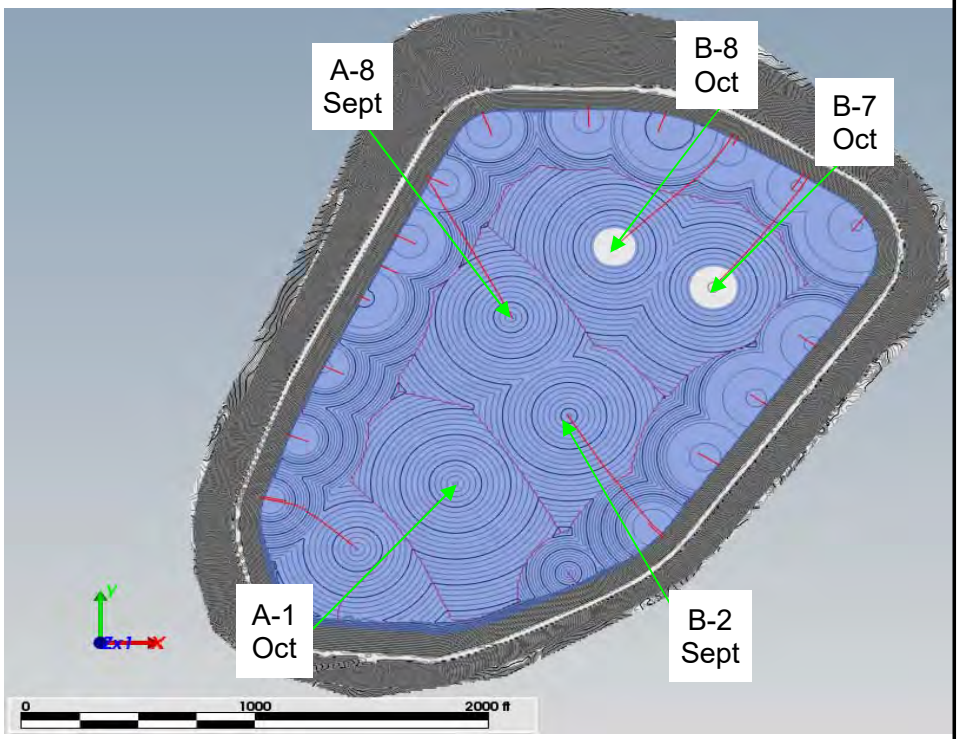
REF. NO. NB22-01392

FIGURE E.4

REV 0



July – August 2023
Pond Volume = 175 M gal
Pond Elevation = 5003.5 ft.
Beach Surface Area = 0.1 acres
Total Tonnage Deposited = 117,815 tons



September – October 2023
Pond Volume = 170 M gal
Pond Elevation = 5004.1 ft.
Beach Surface Area = 0.4 acres
Total Tonnage Deposited = 115,915 tons

NOTES:

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	22DEC'22	ISSUED FOR INFORMATION	MJT	CNH

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
TAILINGS DEPOSITION MODELLING
JULY TO OCTOBER 2023

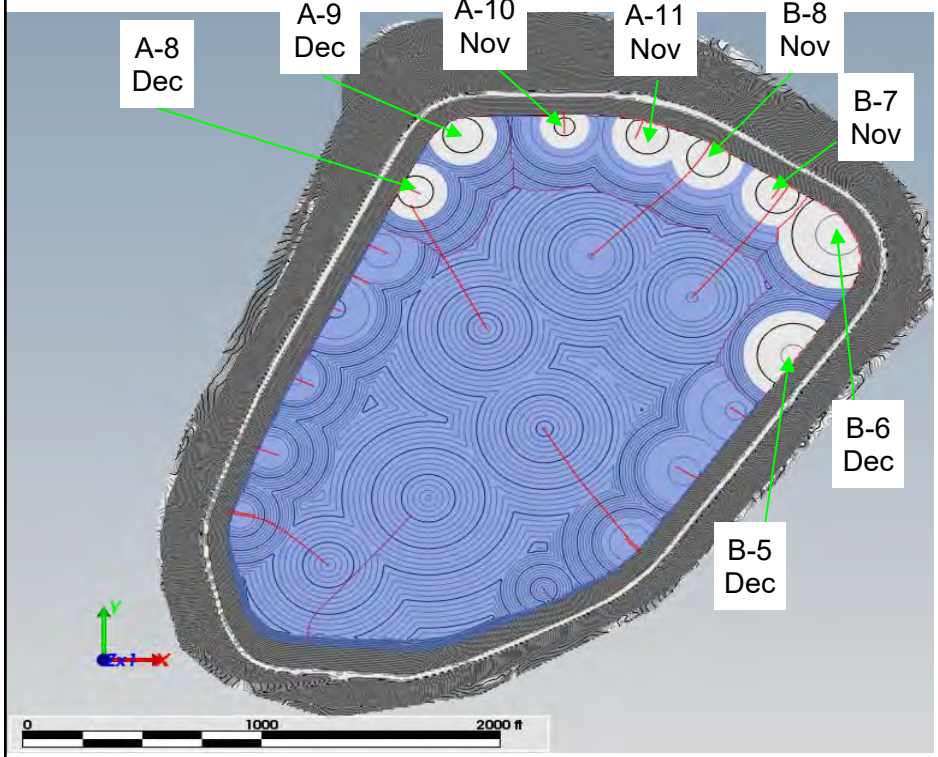
Knight Piésold CONSULTING

P/A NO. NB101-66/44

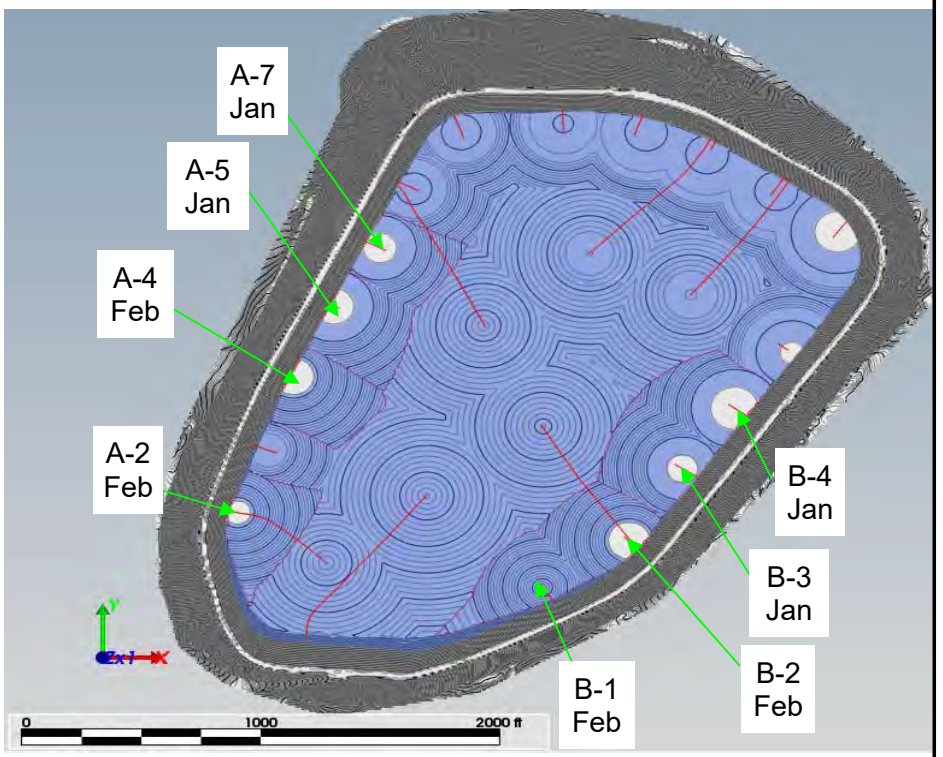
REF. NO. NB22-01392

FIGURE E.5

REV 0



November – December 2023
Pond Volume = 167.5 M gal
Pond Elevation = 5004.7 ft.
Beach Surface Area = 11.3 acres
Total Tonnage Deposited = 115,915 tons



January – February 2024
Pond Volume = 167.5 M gal
Pond Elevation = 5005.5 ft.
Beach Surface Area = 4.1 acres
Total Tonnage Deposited = 117,660 tons

NOTES:

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	22DEC'22	ISSUED FOR INFORMATION	MJT	CNH

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
TAILINGS DEPOSITION MODELLING
NOVEMBER 2023 TO FEBRUARY 2024

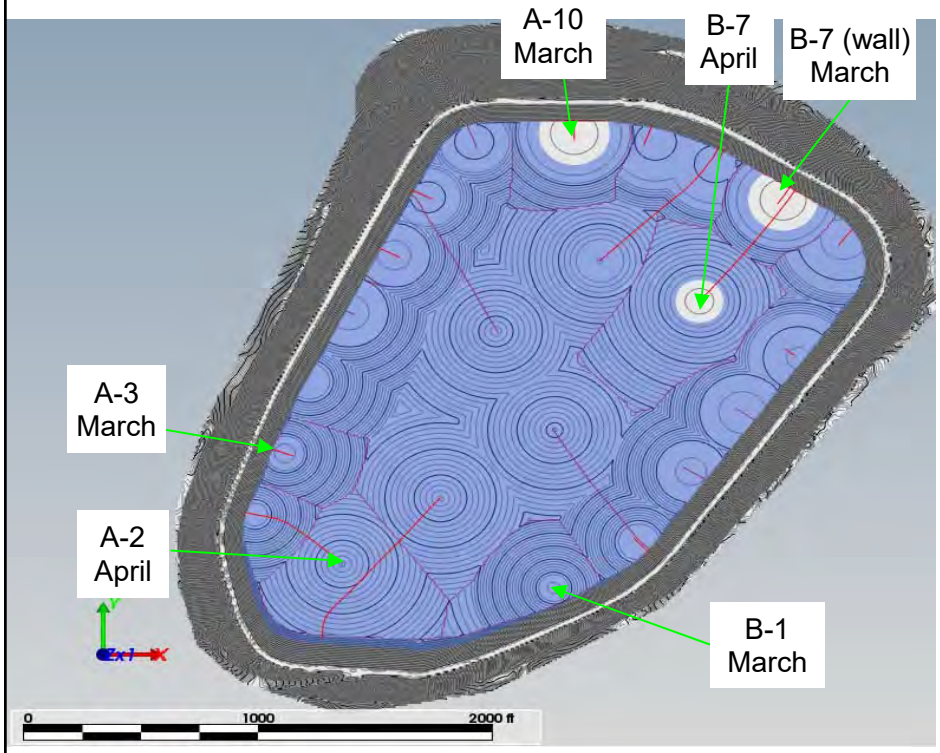
Knight Piésold CONSULTING

P/A NO. NB101-66/44

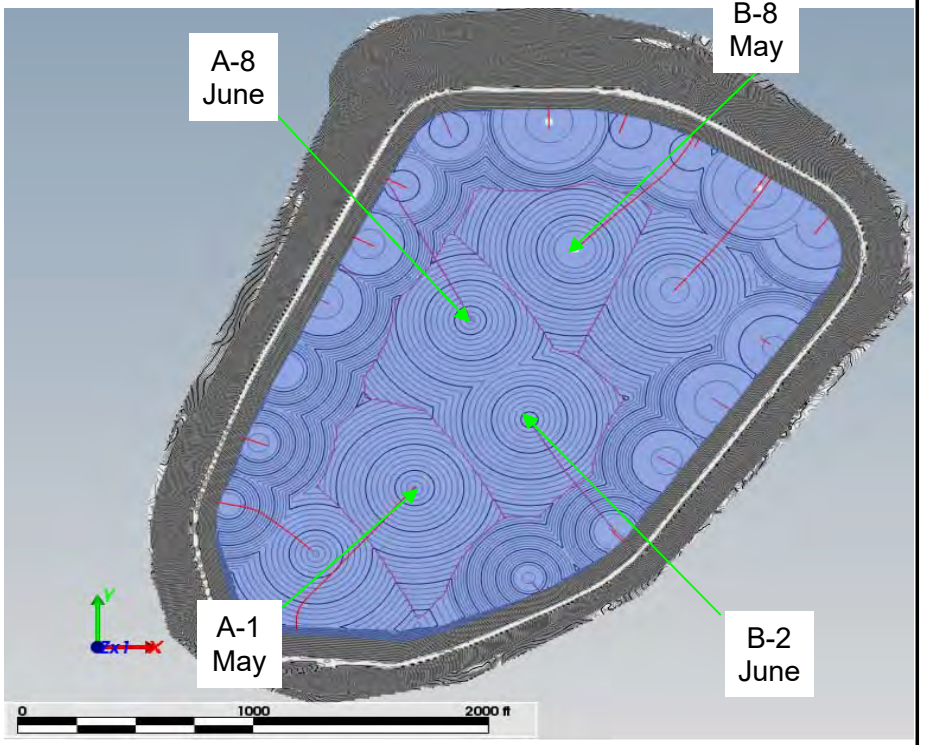
REF. NO. NB22-01392

FIGURE E.6

REV 0



March – April 2024
Pond Volume = 167.5 M gal
Pond Elevation = 5006.3 ft.
Beach Surface Area = 3.4 acres
Total Tonnage Deposited = 119,621 tons



May – June 2024
Pond Volume = 162.5 M gal
Pond Elevation = 5006.9 ft.
Beach Surface Area = 0.6 acres
Total Tonnage Deposited = 119,621 tons

NOTES:

1. SPIGOT DEPOSITION LOCATIONS SELECTED TO OPTIMIZE TSF CAPACITY.
2. MONTHLY TAILINGS TONS DEPOSITED BASED ON MILL PRODUCTION PROJECTIONS.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	22DEC'22	ISSUED FOR INFORMATION	MJT	CNH

SIBANYE STILLWATER

STILLWATER MINE

HERTZLER TSF
TAILINGS DEPOSITION MODELLING
MARCH TO JUNE 2024

Knight Piésold CONSULTING

P/A NO. NB101-66/44

REF. NO. NB22-01392

FIGURE E.7

REV 0