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	WSP Response to IGTRB Review of CDF Design Report
	IGTRB letter response to WSP responses

Pre-Feasibility Design Update Report Co-Disposal Facility

Springpole Project

First Mining Gold Corp.

OMGM2215

Prepared by:
WSP Canada Inc.

October 2024

Pre-Feasibility Design Update Report
Co-Disposal Facility
Springpole Project

Red Lake District, Northwest Ontario
Project #OMGM2215

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LIST OF ATTACHMENTS

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LIST OF ACRONYMS AND ABBREVIATIONS

CDF	co-disposal facility
°C	degrees Celsius
EA	Environmental Assessment
EDF	Environmental Design Flood
EIS	Environmental Impact Statement
FMG	First Mining Gold Corp.
FVT	field vane test
GCL	geosynthetic clay liner
IDF	Inflow Design Flood
IGTRB	Independent Geotechnical and Tailings Review Board
km	kilometres
kPa	kilopascals
LOM	life of mine
m/s	metres per second
m^3/day/m	cubic metres per day per metre
mm	millimetres
Mt	million tonnes
NAG	non-acid generating
NBCC	National Building Code of Canada
PAG	potentially acid generating
PFS	Prefeasibility Study
PGA	Peak horizontal ground acceleration
PMF	Probable Maxmium Flood
PMP	Probable Maximum Precipitation
PMP	Probable Maximum Precipitation
RQD	Rock Quality Designation
SPT	Standard Penetration Test
t/m^3	tonnes per cubic metre
WSP	WSP Canada Inc.

1.0 INTRODUCTION

First Mining Gold (FMG) proposes to develop, operate and eventually decommission and close an open pit gold and silver mine and ore process plant with supporting infrastructure known as the Springpole Project (Project). The Project has an estimated mineral resource of 4.6 million ounces of gold and 24.3 million ounces of silver (AGP 2021) with a planned mine life of approximately 10 years while providing significant benefits to the local, regional and Indigenous economies of northwestern Ontario. The Project is located approximately 110 kilometres (km) northeast of the Municipality of Red Lake, Ontario, 150 km northwest of the Municipality of Sioux Lookout, Ontario. Based on the current mine plan, approximately 101 million tonnes (Mt) of ore will be extracted from the open pit. Tailings, both potentially acid generating (PAG) and non-acid generating (NAG), will be co-disposed with mine rock in the CDF located west of the proposed open pit. The CDF will cover an area of approximately 380 ha and will be located on land west of the open pit.

FMG has retained WSP Canada Inc. (WSP) to provide engineering services for the proposed co-disposal facility (CDF) Project. As part of this service, WSP has completed a review and optimizations of the CDF Prefeasibility Study (PFS) design previously prepared by Knight Piésold (March 2012, and September 2021). WSP developed this CDF design incorporating the design optimizations identified through the environmental assessment (EA) process. This report provides the design update of the CDF together with material take-offs and recommended investigations and studies required to advance next steps for the CDF design.

As this is a design optimization and update of previously prepared PFS Design, this report should be read in conjunction with the relevant previous PFS study and design reports (Knight Piésold March 2021 and Sept 2021).

2.0 PROJECT BACKGROUND

2.1 Regional Geology

The information provided here is based on the Project Hydrogeology Baseline Study (WSP 2023c) . The Project area was glaciated by south-southwest flowing ice during the last major glaciation referred to as the "Late Wisconsinan" glaciation. This glaciation appears to have removed all evidence of older glacial and non-glacial material and to have deposited glaciated material (silty sand till) over the bedrock formations. As the last ice sheet retreated from the region, glacial Lake Agassiz formed covering much of the area, including the Springpole Project area. Deposition of clay and silt size materials took place in deep water. As Lake Agassiz retreated from the region, innumerable depressions remained water filled. The deeper of these remain as lakes today in which organic sediments accumulated. The shallow depressions were soon partly infilled with alluvium and with an ever-increasing amount of organic material (e.g., peat). Overburden deposits in this region are relatively thin and primarily consist of glacial till, glaciofluvial deposits, glaciolacustrine sediments and organic deposits.

The bedrock at the Project site consists of metavolcanic and metasedimentary rock units. As shown in Figure 2-3, the bedrock at the site includes mainly mafic to intermediate metavolcanic rock at the southwest zone, a narrow zone of mafic to ultramafic rock near the open pit area, and felsic to intermediate metavolcanic rocks at the northeast zone of the Project site.

2.2 Seismicity

The Springpole Project site is located approximately at Latitude 51° 23' N and Longitude 92° 17' W within a Stable Seismic Zone incorporated in the National Building Code of Canada (Kolaj M. et. al. 2020). The Stable Craton is a source zone of relatively low to moderate seismicity with average maximum credible earthquake of magnitude 7.0.

The Geological Survey of Canada provides ground motion parameters (peak ground acceleration and spectral accelerations for various return periods) for locations within Canada. The first edition of ground motion parameters was published in the 1985/1995 National Building Code of Canada (NBCC). These ground motion parameters were subsequently revised in 2005, 2010, 2015 and 2020. The latest ground motion parameters corresponding to 2020 NBCC are made available by Earthquakes Canada through an online seismic hazard calculator tool at https://www.seismescanada.rncan.gc.ca/hazard-alea/interpolat/nbc2020-cnb2020-en.php.

The peak horizontal ground acceleration (PGA) values obtained from the online calculator for 1:475, 1:1,000 and 1:2,475-year return periods for the Springpole Project site are summarized below in Table 2-1. The PGA value corresponding to the 1 in 10,000-year event was obtained by extrapolation.

2.3 Climate and Hydrology

The climate and hydrology information provided here is based on the detailed Hydrology Baseline Study (Wood 2021, and WSP 2024). The average annual precipitation of 677 millimetres (mm) to 777 mm is based on Environment and Climate Change Canada stations in the region, with approximately 516 mm falling as rain and the remainder falling as snow. Most of the rainfall occurs in the summer and fall months, with peak rainfall occurring during June and July. Snow normally starts in late September and ends in early June, with peak snowfall in December. The average annual lake evaporation was estimated to be 460 mm. The coldest month is January with average temperature of -18.3 degrees Celsius (°C) and the warmest months is July with average temperature of 18.1 °C. Temperatures fall below freezing from November through March. The 72-hr Probable Maximum Precipitation (PMP) was calculated to be about 400 mm by Knight Piésold (March 2021).

2.4 Mine Waste Schedule

The Project mine plan and waste production (including separated PAG, NAG and low Rock Quality Designation (RQD) NAG mine rock tonnages) are summarized in Table 2-2. It is understood that approximately 20% of tailings (20.2 Mt) will be PAG tailings and remaining 80% will be NAG tailings (Knight Piesold 2021). Properties of tailings were determined based on test work and literature and provided in Section 4.1.

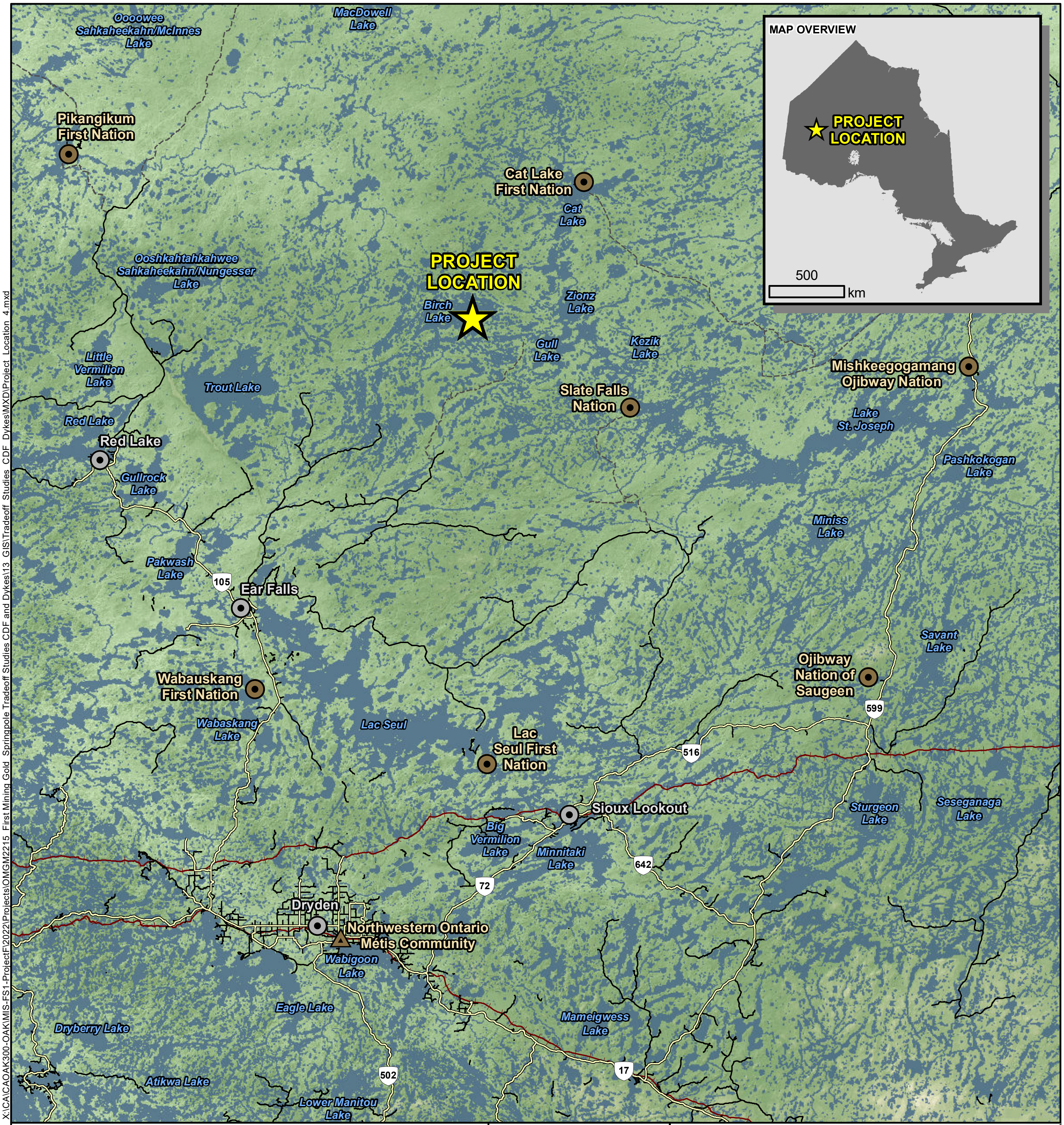
Table 2-1: Peak Ground Accelerations for Springpole Project Site (NBCC 2020)

Probability	10% / 50 Year	5% / 50 Year	2% / 50 Year	0.5% / 50 Year
Return period (years)	1:475	1:1,000	1:2,475	1:10,000
PGA (g), mean values – Site Class C (V_{s-30} = 760 m/s)	0.01	0.02	0.04	0.13*

*Extrapolated value.

Table 2-2: Annual Mine Waste Production Schedule

Year	PAG Mine Rock (Mt)	NAG Mine Rock (Mt)	Low RQD NAG Mine Rock (Mt)	Tailings (Mt)
Pre-production Year 1	8.8	4.2	0.4	0
Year 1	14.9	12.6	2.9	10.95
Year 2	14.8	12.1	3.6	10.95
Year3	18.4	9.2	1.5	10.95
Year 4	18.4	17.6	9.3	10.95
Year 5	20.3	15.2	12.0	10.95
Year 6	18.1	11.0	11.5	10.95
Year 7	23.9	11.8	9.1	10.95
Year 8	7.4	1.4	1.3	10.95
Year 9	0.6	0.0	0.0	10.95
Year 10	0.0	0.0	0.0	2.45
Totals	145.5	95.2	51.7	101



X:\CA\CAOAK300-OAK\MIS-FS1-Project\2022\Projects\OMGM2215 First Mining Gold Springpole Tradeoff Studies CDF and Dykes\13 GIS\Tradeoff Studies CDF Dykes\MXD\Project Location 4.mxd

LEGEND

- ★ Project Location
- Railway
- Town
- First Nation Reserve
- Northwestern Ontario Métis Community
- Highway
- Secondary Road
- Resource / Winter Road

0 12.5 25 50 75 100 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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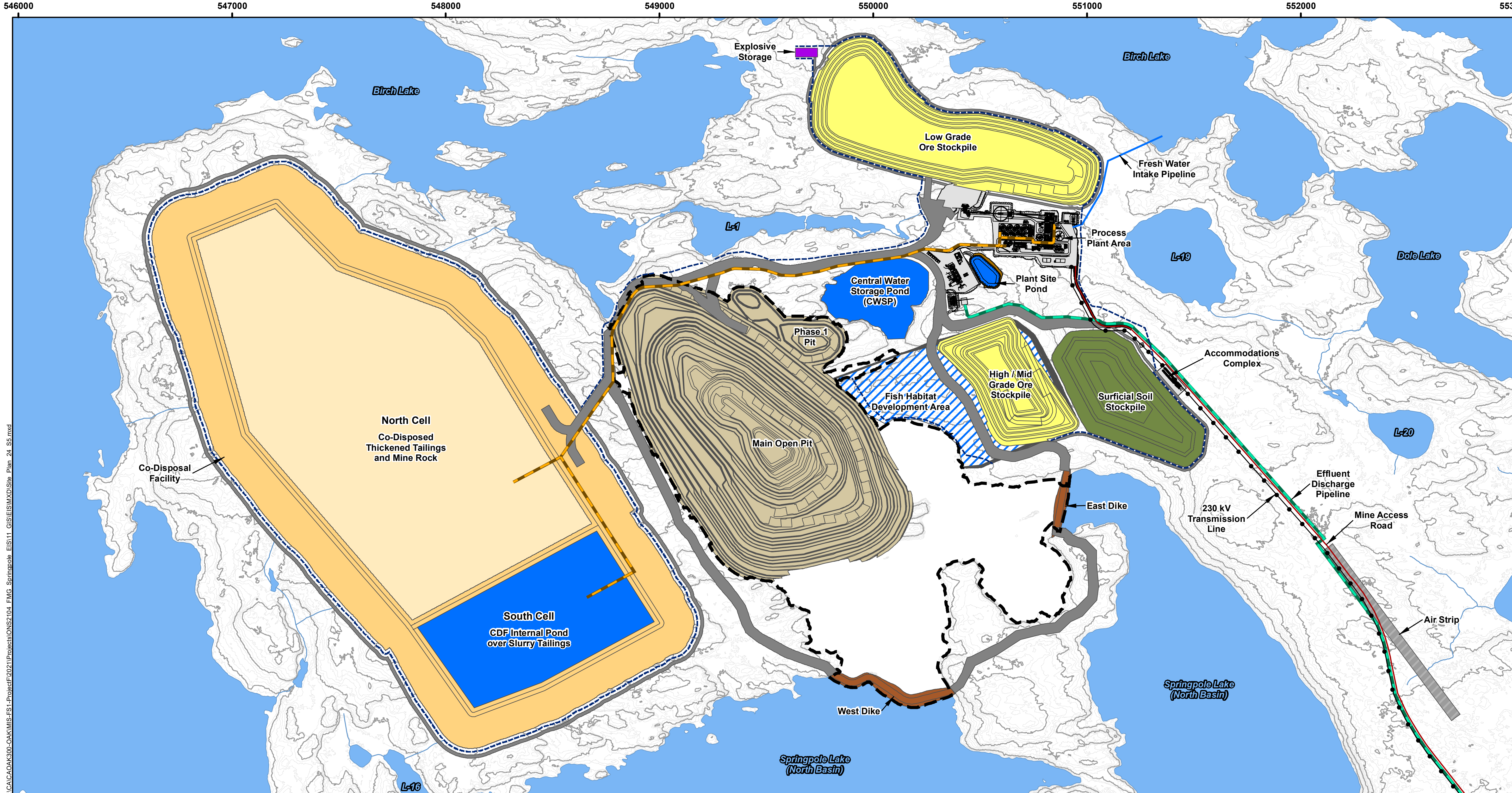
SPRINGPOLE GOLD PROJECT

Project Location

PROJECT N°: OMGM2215	**FIGURE: 2-1**
SCALE: 1:1,500,000	DATE: October 2024



LEGEND

- Watercourse
- Waterbody
- Major Contours (5 m interval)
- Minor Contours (1 m interval)

Proposed Mine Features

- Open Pit
- Open Pit Basin
- Ore Stockpile
- Surficial Soil Stockpile
- Co-Disposal Facility
- Co-Disposed Thickened Tailings and Mine Rock
- Process Plant Area
- Dike
- Pond
- Haul / Access Road
- Explosives Storage
- Air Strip
- Mine Access Road
- Seepage / Runoff Collection System
- 230 kV Transmission Line
- Fresh Water Intake Pipeline
- Effluent Discharge Pipeline
- Tailings Pipeline Corridor
- Fish Habitat Development Area

NOTES:
- Contours extracted from 2020 LiDAR survey.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

N E S W

0 0.5 1 2 3 4 5 Kilometres

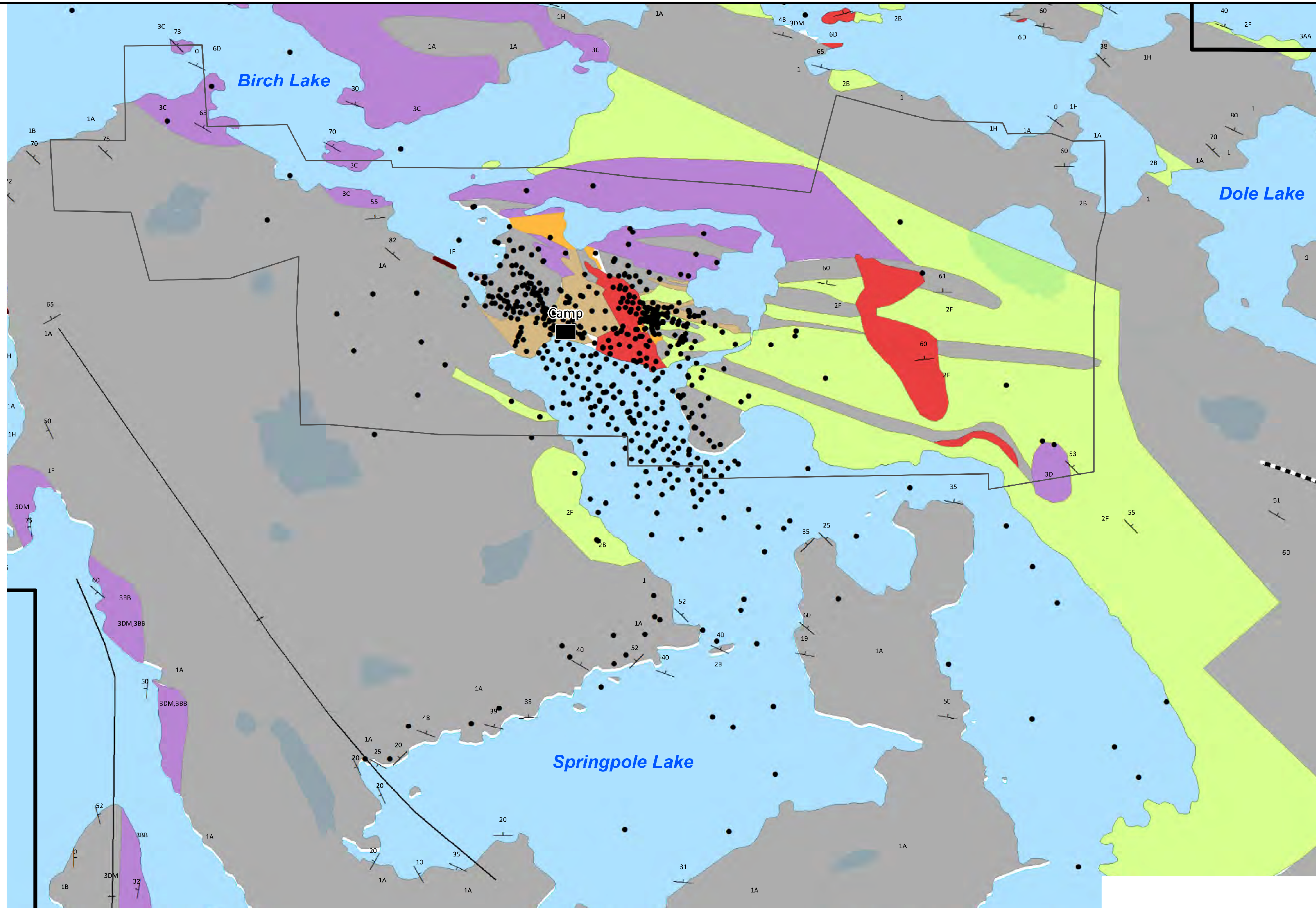
FIRST MINING GOLD

WSP

SPRINGPOLE GOLD PROJECT

EIS / EA Site Plan

PROJECT Nº: ONS2104	FIGURE: 2-2
SCALE: 1:17,000	DATE: April 2024



LEGEND

- Drillhole Collar
- Camp
- Property Outline
- Patents Outline

Geology Mapping 20k Scale

- 1-Mafic to Intermediate Metavolanics; 1A-Massive Lava
- 2-Intermediate to Felsic Metavolcanics; 2B-Intermediate to Felsic Tuff
- 2A-Rhyolite
- 3AA-Clastic Sediment; 3C-Conglomerate; 3DM-Metasediments; 3BB-Siltstone and Greywacke; 3
- 6B-Quatz Porphyry
- 6D-Feldspar Porphyry
- B
- O
- Lithology Observation
- Structure Strike/Dip
- BIF
- Shear
- Anticline
- Syncline

NOTES:
- Site bedrock geology provided by FracFlow Consultants Inc., Hydrogeology Baseline Report 19 February 2021.

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SPRINGPOLE GOLD PROJECT

Local Geologic Setting

Datum: NAD83
Projection: UTM Zone 15N

PROJECT N°: ONS2104	**FIGURE: 2-3**
SCALE: 1:21,000	DATE: October 2023

0 0.5 1 2 3 4 5 Kilometres

X:\CA\CAOAK300-OAK\MIS-FS1-ProjectF\2021\Projects\ONS2104_FMG_Springpole_EIS\11_GIS\HydroGeo\Baseline_Report_2022\MXD\Site_Bedrock_Geology_1.mxd

3.0 SITE INVESTIGATIONS

Geotechnical site investigation programs carried out at the CDF and the surroundings include the following:

- 2020 geotechnical investigation program by Fracflow (Fracflow 2020):

  This site investigation program was carried out to support the Prefeasibility Study. It focussed on the mine rock storage area (CDF area) west of the proposed open pit, the plant site area, and the ore stockpiles area on the east side of the open pit. The scope of work included a total of 14 geotechnical boreholes, and investigation of overburden at 32 locations using 21 test pits and nine hand auger holes and diamond drilling in lieu of test pit excavation (2 locations). Six boreholes and 13 test pits were located at the proposed CDF area.

- 2021 geotechnical investigation program by Ausenco (Ausenco 2022):

  This program consisted of 62 test pits and 23 geotechnical boreholes. Four boreholes and 17 test pits were located at the proposed CDF area.

- 2022 geotechnical investigation program by Knight Piésold (KP 2022):

  This program consisted of 11 geotechnical boreholes and 39 test pits at the CDF area.

- 2022 Supplemental Geotechnical Investigation (WSP 2023b):

  This geotechnical investigation program consisted of the seven (7) boreholes and 15 monitoring wells. Seven (7) boreholes and four (4) monitoring wells were located at the proposed CDF area.

Figure 3-1 shows a location plan of the boreholes, monitoring wells and test pits completed at the CDF area. Measured hydraulic conductivities for the shallow bedrock at the CDF area are shown in Figure 3-2. Further details and discussion on the shallow and deep bedrock hydraulic conductivity data can be found in the 2023 Baseline Hydrogeologic Conditions (WSP 2023c) and 2023 Hydrogeologic Modelling Report (WSP 2023d).

3.1 Subsurface Conditions

The following sections summarize the subsurface conditions encountered at the CDF area during the geotechnical site investigations.

Overburden at the CDF area generally consists of peat, sand to silt, silt to clay and sand and gravel deposits. Overburden thickness at the CDF dam footprint area is generally 2.5 m and less, except for the limited zone at the southwest corner of the CDF footprint and limited localized low-lying areas. Bedrock at the CDF footprint is generally consistent and composed of mafic to intermediate metavolcanics (see Figure 2-3) with average (geometric mean) shallow bedrock permeability of $5.7x10^{-8}$ m/sec and deep bedrock permeability of $1.6x10^{-8}$ m/sec. In general, subsurface conditions at the CDF area are favourable with limited thickness of overburden and low permeability bedrock.

To better reference areas of the CDF subsurface condition across the site, subsurface conditions are summarized by west, north, east and south segments.

3.1.1 West CDF

The interpreted stratigraphy along the west side of CDF was inferred from 17 test-pits (TP22-AD, TP22-AB, TP22-BM, TP22-BH, TP22-BE, TP22-BD, TP22-AE, TP22-AC, TP22-AA, TP22-BC, TP22-BB, TP22-BA, TP-TMF 09, TP-TMF-10, TP-TMF-02, TP-TMF-14, and TP-TMF-27) and nine (9) boreholes/drillholes (DH22-AM, SG22-034, BH-TMF-37, DH22-BB, SG22-033, DH22-AK, BHWSF2-14, DH22-AX, and SH22-MW-005A). Groundwater was generally encountered near surface at the low-lying areas.

Peat

A layer of organics with an average thickness of approximately 1.4 metres (m), but generally less than a meter, was typically encountered at surface. Thicker deposits of organics were encountered towards the south-west with thickness extended up to 5.3 m (DH22-AK), but generally within the range of 2 m to 3 m thick. Some thicker deposits of organics were also encountered in two test-pits in the north-west (TP22-BA & TP22-BD) which encountered a thickness of 2.6 m.

Sand to Silty Sand

Sand to silty sand was encountered underlying the organics layer with thickness ranging from 0.6 m to 1.5 m, with the exception of borehole DH22-AK which encountered a 2.9 m thick deposit of sandy silt to silt underlying the organics layer. The deposit of sand to silty sand was generally encountered in the central portion of the west-side of the CDF. The Standard Penetration Test (SPT) N-values were 6 and 7 as reported in boreholes BHWSF2-14 and SG22-041, respectively, indicating a loose compactness.

Silt to Clay

Deposit of silt to clay was generally encountered underlying the organics in the south-west end of the facility with thickness ranging from 1 m to 2 m, except at south-west corner boreholes DH22-BB and DH22-AM which encountered 4.5 m and 7.2 m thick silty clay deposit respectively. The SPT N-values within the silt to clay deposit varied from 5 to 21 indicating firm to very stiff consistency. A total of 11 field-vane tests (FVT) were conducted within this soil unit (boreholes DH22-AM, DH22-BB, and DH22-AK). The FVTs within primarily clay deposit indicated peak undrained shear strength of 15 kilopascals (kPa) to 22 kPa with a remoulded shear strength of 4 kPa to 8 kPa. The FVTs within primarily silt deposit reported peak undrained shear strength ranging from 20 kPa to 60 kPa with remoulded shear strength ranging from 6 kPa to 50 kPa. One (1) direct simple shear test was completed on a clayey silt sample from borehole DH22-AK and indicated an undrained shear strength ratio (Su/σ_V') of 0.22.

Sand and Gravel

A deposit of sand and gravel (thicknesses of up to 0.8 m) was generally encountered underlying the deposits of sand to silty sand and silt to clay deposit. The sand and gravel layer was generally encountered overlying bedrock.

Bedrock

Bedrock was encountered (or inferred) at depths ranging from 0.7 m to 11.3 m depth, but was generally encountered within 2 m of surface. The deeper locations generally being near the south-west corner. Bedrock was encountered at shallow depths generally within the central portion of the west-side of the facility and generally found at deeper depths towards the south-west end of the facility. The bedrock hydraulic conductivity was measured at boreholes SG22-039 through SG22-041 and ranged from 8×10^{-9} metres per second (m/s) to 4×10^{-6} m/s (Wood 2022).

3.1.2 North CDF

Subsurface condition at the north side of CDF was Inferred from test-pit (TP22-AZ) and borehole/drillhole (BH-TMF-38).

Surficial gravelly sand deposit of up to 0.9 m thickness was encountered at this area. Bedrock was encountered beneath the gravelly sand deposit. Ground water was encountered below bedrock surface.

3.1.3 East CDF

Subsurface condition along the east side of CDF was inferred from 16 test-pits (TP-WSF2-24A, TP-TMF-01, TP22-AT, TP-TMF-06, TP-TMF-12, TP-B-55, TP-B-56, TP22-AR, TP-TMF-40, TP22-AX, TP22-AV, TP22-AU, TP-B-52, TP22-AS, TP22-AQ, and TP-TMF-15) and seven (7) boreholes/drillholes (DH22-AR, BH-TMF-36, DH22-AP, DH22-AS, BH-TMF-35, DH22-AQ, and DH22-AO). Ground water was encountered near ground surface at the low-lying area at the northeast side. Elsewhere, groundwater was encountered 1.9 m to 3.6 m below ground surface.

Peat

A surficial layer of organics with an average thickness of approximately 0.8 m was typically encountered along the east side of the facility. Thicker deposits of organics were encountered towards the north-east end of the facility with thicknesses extending up to 2.8 m.

Silt to Clay

Sandy silt to silt deposit was encountered at surface or underlying the organics in 11 test-hole locations. This deposit was generally encountered in the north-east and south-east ends of the facility generally with thickness ranging from 0.2 m to 1.4 m.

Silty clay to clay deposit was encountered underlying the organics at two test-hole locations in the north-east end of the facility (TP22-AX and TP22-AV) with thickness of 2.2 m. The SPT N-values generally ranged between 5 to 21 indicating a firm to very stiff consistency. One (1) direct simple shear test was completed on a “clay and silt” sample obtained from borehole DH22-AS and indicated undrained shear strength ratio (S_u/σ_v') ratio of 0.25.

Sand to Silty Sand

A deposit of sand to silty sand was encountered underlying the organics in nine (9) test-hole locations. The deposit of sand to silty sand was generally encountered in the central portion of the east-side of the facility ranging in thicknesses of 0.3 m to 1.9 m. The SPT N-values ranged between 6 and 17 generally indicating a loose to compact compactness.

Sand and Gravel

A deposit of sand and gravel was generally encountered underlying the deposits of silt to clay or sand to silty sand with thickness ranging up to 1 m.

Bedrock

Bedrock was generally encountered (or inferred) at depths ranging from 0.8 m to 5.8 m, but was generally encountered within 2 m of surface. Bedrock was encountered at deeper depths towards the north-east end of the facility. The bedrock hydraulic conductivity was measured at boreholes SG22-043 and SGH22-006 and ranged from 4×10^{-9} m/s to 8×10^{-6} m/s (Wood 2022).

3.1.4 South CDF

Subsurface condition along east side of CDF was inferred from seven (7) test-pits (TP22-AJ, TP22-AG, TP-TMF-16, TP22-AI, TP-WSF2-26, TP22-AH, and TP22-AF) and four (4) boreholes/drillholes (DH22-AN, SH22-MW-003A/B, DH22-AL, and SG22-035). Ground water was generally encountered 2.4 m to 4.2 m below ground surface.

Peat

A layer of organics with an average thickness of approximately 0.2 m was typically encountered at surface.

Sand to Silt

Deposit of sand to silty sand to sand and silt was encountered underlying the organics layer with thickness ranging from 0.4 m to 3.1 m, but typically less than 1 m. This layer was found to have generally loose compactness with SPT N-value of 7 measured at borehole DH22-AL.

Clayey Silt

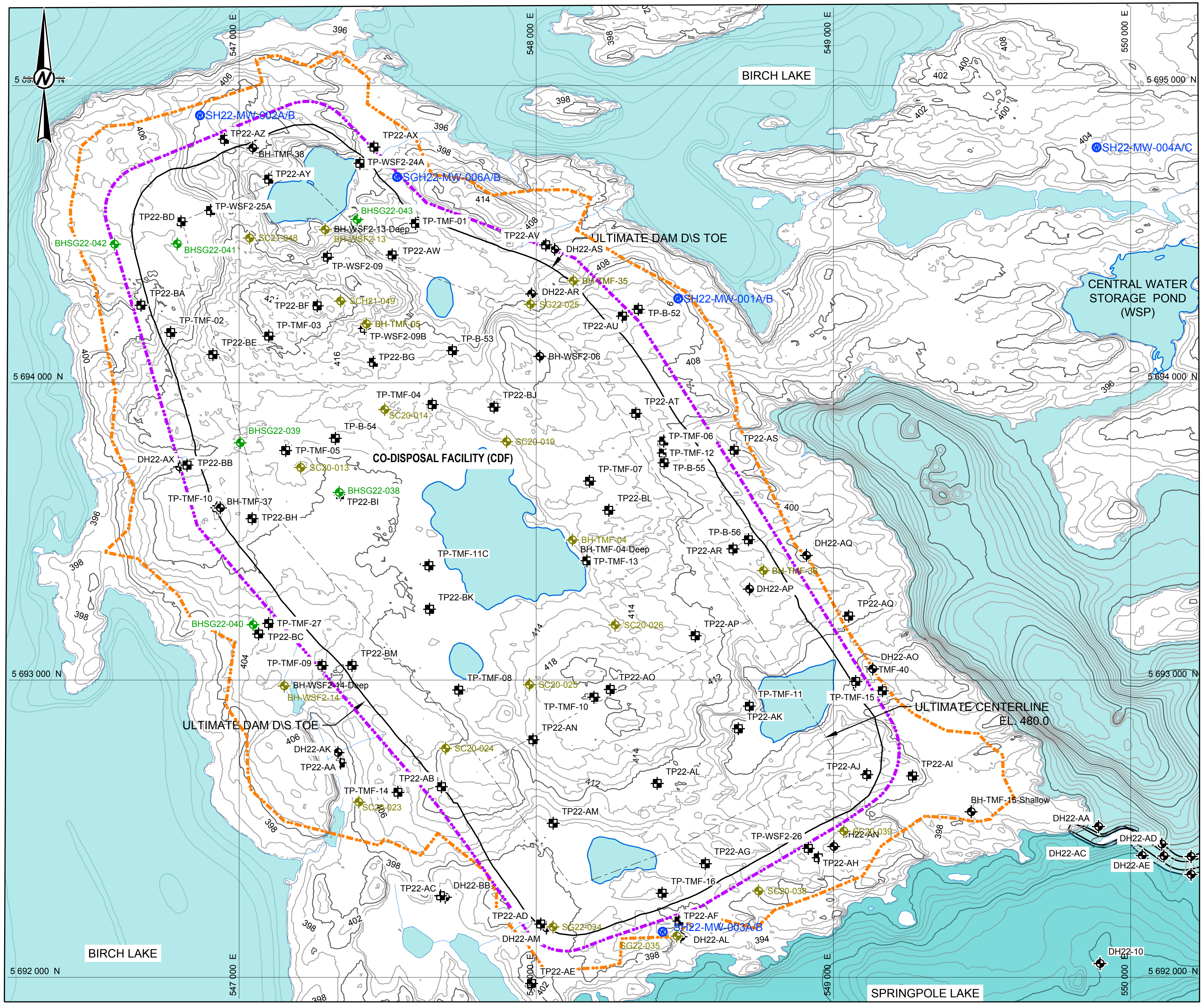
An isolated 1.1 m thick deposit of clayey silt was encountered underlying the sand to silt layer in test pit TP22-AF which is located towards the south-west area of the facility.

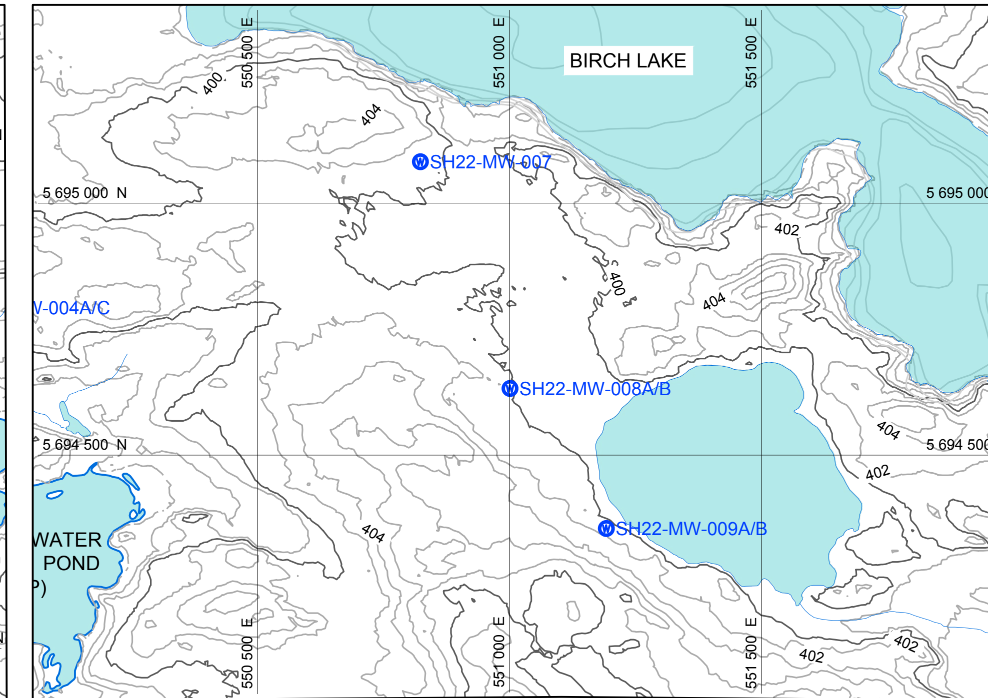
Sand and Gravel

A deposit of sand and gravel was generally encountered underlying the deposits of sand to silt with thicknesses ranging from 0.4 m to 1.6 m.

Bedrock

Bedrock was generally encountered (or inferred) at depths ranging from 1.4 m to 2.5 m depth.





NOTE(S)

1. THE TOPOGRAPHY SHOWN ON THIS DRAWING WAS OBTAINED FROM 2022-06-27 LIDAR CONTOURS & INDEX FOR KP AND SPRINGPOLE_LAKE_2019_BATHYMETRY.

BOREHOLES SETOUT TABLE

ID	NORTHING	EASTING
SG22-038	5,693,631	547,337
SG22-039	5,693,798	547,004
SG22-040	5,693,186	547,047
SG22-041	5,694,467	546,792
SG22-042	5,694,466	546,581
SG22-043	5,694,549	547,397

MONITORING WELL SETOUT TABLE

ID	NORTHING	EASTING
SGH22-MW-006A/B	5,694,692	547,532
SH22-MW-001A/B	5,694,283	548,477
SH22-MW-002A/B	5,694,900	546,868
SH22-MW-003A/B	5,692,153	548,425
SH22-MW-004A/C	5,694,792	549,885
SH22-MW-007	5,695,082	550,823
SH22-MW-008A/B	5,694,632	551,001
SH22-MW-009A/B	5,694,354	551,192

LEGEND

400	CONTOUR
	LAKE
	120m WATER BODY / OPEN PIT OFFSET
	OFFSET ALLOWANCE FOR PERIMETER DITCH AND ACCESS ROAD
	CDF PROPOSED DESIGN DOWNSTREAM TOE
TP-XX	TEST PIT FROM PREVIOUS INVESTIGATIONS
BH-XX	BOREHOLE FROM PREVIOUS INVESTIGATIONS
BH-XX	BOREHOLE FROM PREVIOUS INVESTIGATIONS (SAMPLED FOR GEOCHEMICAL TESTS)
BHSG22-042	BOREHOLE
SH22-MW-002A/B	MONITORING WELL

NOT FOR CONSTRUCTION

0 250 500
1:7,500 METRES

CLIENT
FIRST MINING GOLD

CONSULTANT

YYYY-MM-DD	2024-07-19
DESIGNED	GN
PREPARED	NR \ SC
REVIEWED	GN
APPROVED	GN

PROJECT
SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

TITLE
GEOTECHNICAL INVESTIGATION LOCATION MAP

PROJECT NO.	CONTROL	REV.	FIGURE
OMGM2215	0003	A	3-1

LEGEND

- Hydraulic Conductivity (m/s)*
- Watercourse
- Waterbody

*Data points with paired values indicate locations with two nested monitoring well installations

NOTES:
- Topographic information extracted from LIO, MNRF.
- Aerial imagery provided by First Mining Gold, August 2020.

Datum: NAD83
Projection: UTM Zone 15N

0 0.25 0.5 1 1.5 2 Kilometres

FIRST MINING GOLD

wsp

SPRINGPOLE GOLD PROJECT

Co-disposal Facility Area Shallow Bedrock Hydraulic Conductivity

PROJECT N°: OMGM2215	FIGURE: 3-2
SCALE: 1:15,000	DATE: October 2024

4.0 CDF PFS DESIGN UPDATES

The CDF design, as presented in the draft EIS/EA (Wood 2022; Knight Piésold 2021) involved a two-cell facility consisting of north cell and south cell. The NAG tailings was to be a filtered tailings co-disposed and co-managed with PAG mine rock in the north cell. PAG tailings was to be slurry deposited within south cell. The north cell embankments were to be centreline raised while the south cell embankments are raised by the downstream construction method. The base of the south cell and its perimeter embankments were to be lined with a low permeability material.

WSP identified several design optimizations for the tailings and mine waste rock management. The optimizations were presented to FMG and the Independent Geotechnical and Tailings Review Board (IGTRB). This section presents these optimizations in the form of a CDF PFS design update including design criteria, sizing, tailings and water management strategy, closure concept, perimeter and internal dams design, and material take-offs.

Based on the optimizations, the CDF will still consist of north and south cells, contained by perimeter dams and separated by an internal dam. PAG slurry tailings will be deposited within the south cell under water cover to limit oxygen ingress. NAG tailings and PAG mine rock will be co-disposed within the north cell. Potential volume gained from co-disposal of tailings and PAG mine rock (within the north cell) will be excluded from the design.

Non-metal leaching NAG mine rock will be used for CDF perimeter dam construction. Surplus NAG mine rock not used in construction will be stored within the CDF. PAG mine rock will be stored within the north cell of the CDF and may be used for the internal dam construction.

Adequate elevation difference will be maintained between the north and south cells so that all runoff and tailings water reports to south cell. Allowance for the operating pond and containment of the Environmental Design Flood (EDF) will be made within the south cell. Considering the yearly rate of rise of CDF, the spillway will be constructed at closure. During the operational phase, the CDF will be designed to contain the Inflow Design Flood (IDF).

The minimum design offset from waterways and waterbodies is to be 120 m as per environmental commitments. The minimum design offset from open pit is also assumed to be 120 m as this will be reclaimed at closure and reconnected to Springpole Lake. The 120 m offset from the open pit also follows current guidance from FMG for pit wall stability and will be further refined at the next design stage. An allowance of 60 m is considered for the seepage and runoff collection system and perimeter access road around the CDF. Collection Ponds are to be accommodated within the 60 m allowance and/or other available areas outside the waterways and water bodies offset. The proposed CDF layout with offset areas is shown in Figure 4-1. As shown in Figure 4-1, proposed CDF layout provides setback ranging from 120 m (minimum offset) to as much as 300 m from waterways providing additional allowance for environmental contingency measures.

Dam crest widths of 40 m will be maintained to allow for trucks to transport and place mine rock directly to CDF. Starter and ultimate dam crest width of 25 m may be adopted to reflect material availability both early and late in the Project. That is, the crest width of 40 m will be maintained for the staged dam raises until the final dam raise.

The south cell perimeter starter dams and subsequent raises will be designed as downstream raised. The upstream slope will be lined with low permeability liner (e.g., reinforced geosynthetic clay liner; GCL) and anchored to low permeability bedrock and/or overburden. Higher hydraulic conductivity bedrock zones along the GCL anchor will be grouted as required.

The north cell perimeter starter dams will be designed as downstream raised, with subsequent raises as centerline raises. The north cell perimeter dams will be designed as pervious dams without a low permeability liner. The lack of a permanent pond in the north cell and presence of wide tailings zone upstream of the dams will limit seepage losses. South cell perimeter dams (GCL lined) will be extended past the internal dam into north cell to limit seepage losses from the south cell pond. Perimeter and internal dam layout and configurations are presented in Section 5.0. Engineering analyses at later design stages are required to define the transition area extent.

4.1 Waste Storage Requirements

Based on the mine production plan provided by AGP, CDF waste storage volume requirements are calculated and summarized below.

Year	Annual Tailings (Mt)	PAG Tailings (Mm^3)		Annual NAG Tailings (Mm^3)	Annual PAG Mine Rock (Mt)	Annual PAG Mine Rock (Mm^3)	PAG Mine Rock + NAG Tailings (Mm^3)	
		Annual	Cumulative				Annual	Cumulative
PP1	0	-	-	-	8.8	4.0	4.0	4.0
Y1	10.95	1.7	1.7	6.7	14.9	6.8	13.5	17.5
Y2	10.95	1.7	3.4	6.7	14.8	6.7	13.5	31.0
Y3	10.95	1.7	5.1	6.7	18.4	8.3	15.1	46.0
Y4	10.95	1.7	6.7	6.7	18.4	8.3	15.1	61.1
Y5	10.95	1.7	8.4	6.7	20.3	9.2	16.0	77.1
Y6	10.95	1.7	10.1	6.7	18.1	8.2	15.0	92.1
Y7	10.95	1.7	11.8	6.7	23.9	10.9	17.6	109.7
Y8	10.95	1.7	13.5	6.7	7.4	3.4	10.1	119.8
Y9	10.95	1.7	15.2	6.7	0.6	0.3	7.0	126.8
Y10	2.45	0.4	15.5	1.5	0.0	0.0	1.5	128.3

Notes:

1. Nominal plant throughput: 30,000 tonnes per day (FMG).
2. PAG tailings is 20% and NAG tailings is 80% of total tailings production.
3. Specific gravity of tailings solids: 2.8 (FMG/FL Smith/SGS).
4. Settled dry density and void ratio of deposited tailings: 1.3 tonnes per cubic metre (t/m^3) and 1.1 (assumed).
5. Specific gravity of waste rock: 2.7 (assumed).
6. Average dry density of Mine Rock (PAG & NAG): 2.2 t/m^3 (assumed).

4.2 Design Standards

The following regulations, guidelines, and standards have been adopted for the CDF design and analyses:

- Dam Safety Guidelines 2007 (2013 Edition). Canadian Dam Association (CDA 2013);
- Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams (CDA 2019);
- Global Industry Standard on Tailings Management (GISTM 2020); and
- Technical Bulletins, Ontario Environment and Energy, Dam Management (Lakes and Rivers Improvement Act[1]).

[1] https://www.ontario.ca/page/dam-management#section-2, Accessed 2024

Applicable requirements from these guidelines have been adopted as the minimum design requirements. Design requirements of the Global Industry Standard on Tailings Management, being the global technical standard, has also been considered in developing the design criteria.

Considering the close proximity to water bodies and overall size, the CDF will be designed applying design criteria for the highest hazard classification with a design earthquake of 1 in 10,000-year event and IDF of Probable Maximum Precipitation (PMP) considered for the design analyses.

4.3 Summary of Design Criteria and Requirements

The key design requirement, criteria and assumptions are summarized below:

Production

- Ore resources: 101 Mt;
- Nominal plant throughput and life of mine (LOM): 30,000 tonnes per day, 9.5 years ; and
- Mine rock: 292.5 Mt.

Waste Management Requirements

- Tailings:
  - Potentially acid generating (PAG) tailings (20% of total): 20.2 Mt;
  - Non-acid generating (NAG) tailings (80% of total): 80.8 Mt;
  - Tailings disposal technology: south cell conventional slurry, north cell thickened slurry, centrifugal pumping/gravity discharge ; and
  - Average in-situ tailings settled dry density: 1.3 tonnes per cubic metre (t/m^3) (calculated, assuming void ratio of 1.1, Gs of 2.8).
- Mine rock:
  - PAG mine rock: 145.5 Mt;
  - NAG mine rock: 147.0 Mt; and
  - Dry density of mine rock (NAG & PAG): 2.2 t/m^3 (assumed).

Design Criteria and Assumptions

- Hazard Classification – Extreme, corresponding to design earthquake of 1 in 10,000-year event and IDF of Probable Maximum Precipitation (PMP);
- Static and seismic stability criteria for embankment dams:
  - Static Factor of Safety > 1.5;
  - Pseudo-static Factor of Safety > 1.0 or acceptable deformation; and
  - Post-earthquake Factor of Safety > 1.2.
- Allowance for operating pond and containment of IDF within the south cell during operation. Emergency spillway is to be constructed at closure;
- Minimum design offset from waterways and waterbodies to be 120 m as per environmental commitments;

- Minimum design offset from open pit is to be 120 m; and
- Allowance for CDF perimeter ditch (for seepage and runoff collection) and perimeter access road is 60 m.

4.4 CDF Ultimate Dam Sizing

The CDF footprint was established considering the offset requirements and is shown in Figure 4-1 with offset constraints. Height of the CDF north and south cells were established considering the following storage requirements:

- Storage requirements for the north cell:
  - Storage volume (NAG tailings and PAG mine rock): 125 Mm^3 (excluding PAG mine rock required for internal dam).
- Storage requirements for south cell:
  - Storage volume (PAG tailings): 15.5 Mm^3.
  - Allowance for subaqueous tailings deposition: 4 m.

    This allowance is made assuming a grid of tailings depositions from inside the pond forming tailings cones below the water pond surface. This ensures no PAG tailings above the water pond level.
  - Water cover and operating pond range: 3 m (see Section 4.6 for details).
  - Allowance to contain EDF & IDF within south cell during operations: 5 m (see Section 4.6 for details).

    As noted earlier, the PMF is to be contained within the CDF during operation. Knight Piésold (March 2021) considered the 72-hr PMP (400 mm) and an estimated allowance of 2 m was allowed to contain this event. For future design, a longer duration PMP will be considered which may require more than a 2 m allowance. Consequently 5 m is currently assumed. The 5 m allowance will be adjusted during the feasibility design when the longer duration PMP estimate has been prepared.
  - At closure an overflow spillway capable of passing the IDF (PMP) will be constructed.

The CDF with perimeter and internal dams were modelled using Muk3D software and struck-level storage curves were developed. The location of the Internal Dam was adjusted to achieve approximately 5 m elevation difference between north and south cell. Freeboard allowance of 2 m was considered for both north and south cells. Multiple Muk3D modelling iterations were performed optimizing the CDF height and location of the internal dam. Struck-level stage storage curves for the north and south cells are shown in Figure 4-2 and Figure 4-3, respectively. Based on the modelling, north and south cell perimeter dams were established at elevation 485 m and 480 m, which correspond to average dam heights of approximately 76 and 75 m respectively.

The CDF layout and typical dam sections are shown in Figure 5-1 through Figure 5-2. Dam design and analyses are discussed in Section 5.0.

The location of the internal dam can be adjusted (moved further north or south) at later design stages should the relative volumes of PAG and NAG tailings change with additional study.

4.4.1 Starter Dam Sizing

North and south cells starter dams were sized to contain 24 months of production. Struck-level stage storage curves of north and south cells were utilized to establish waste surface elevations within north and south cells and required starter dam crest elevations. Starter dam crest elevations are summarized below:

- South cell
  - PAG tailings: 3.4 Mm^3;
  - PAG tailings surface elevation: 428 m;
  - Allowance for water management (subaqueous deposition + operating pond + freeboard) = 9 m;
  - Dam crest elevation: 437 m; and
  - EDF and IDF is assumed to be managed between south and north cells during the initial CDF phase.
- North cell
  - Tailings + PAG mine rock: 30 Mm^3;
  - Co-disposed tailings + PAG mine rock surface elevation: 430 m; and
  - Dam crest elevation of 437 m (same as south cell) is adopted to allow for management of EDF and IDF utilizing both cells.

4.5 Tailings and Mine Rock Management

South Cell: The south cell will be contained by lined perimeter dams and the unlined internal dam. PAG tailings will be subaqueously deposited within the south cell maintaining a water cover to ensure saturated conditions and prevent acid generation. Due to steeper underwater deposition slope, it will be required to spigot tailings from around the south cell perimeter dams as well as from inside the tailings pond using floating pipeline or barge.

North Cell: The north cell will be contained by unlined perimeter dams and internal dam. NAG tailings and PAG mine rock will be co-disposed within the north cell. PAG mine rock will be trucked from the open pit and placed within the north cell developing a PAG mine rock stockpile generally in the middle of north cell and away from the perimeter dams (see Figure 4-5 and Figure 4-6). PAG mine rock trucking access to the north cell is to be developed via the internal dam.

NAG tailings will be spigotted from the perimeter dams to develop a low permeability zone of tailings against the perimeter dams and enclose the PAG mine rock with a low permeability NAG tailings zone to limit oxygen ingress (see Figure 4-5and Figure 4-6). Mine rock placement and tailings discharge need to be actively managed to achieve effective development of wide NAG tailings zone enclosing the PAG mine rock. Towards the end of LOM, NAG tailings will be deposited over the entire north cell covering the PAG mine rock.

Yearly NAG tailings and PAG mine rock deposition and management plan was developed using Muk3D and shown in Figure 4-5and Figure 4-6. As illustrated, the PAG mine rock footprint is optimized to allow for development of a wide zone of NAG tailings around the PAG mine rock in order to encapsulate the PAG mine rock and limit oxygen ingress. As mining operations and supply of PAG mine rock ceases in year 9 (see Section 4.1 for mine production), spigotted NAG tailings will flow over and cover PAG mine rock during years 9 and 10 forming a low permeability cover over the PAG mine rock.

As described above and illustrated in Figure 4-5 and Figure 4-6, the waste management plan includes developing the PAG mine rock stockpile and completely enclosing it with adequately thick NAG tailings limiting oxygen ingress into the PAG mine rock.

Regrading of the north cell NAG tailings surface may be required at end of LOM to effectively direct runoff to south cell and prepare CDF for closure. If required at closure, NAG tailings surface can be contoured to improve infiltration, maintain percent saturation levels within NAG tailings and limit oxygen ingress into PAG mine rock.

4.6 Water Management

All runoff from the surface of the CDF (both north and south cells) will be directed to and managed within the south cell. The surface of the north cell will be graded to sustain surface drainage from the north cell through the internal dam and to the south cell, as the facility expands and dams are raised throughout the course of operations. The primary method of water movement from the north cell to the south cell will be seepage through the internal dam. Additional conveyance in the form of a pipe or an internal spillway may be included in later designs to facilitate conveyance of higher runoff events. Runoff from the outside slopes of the perimeter dams, as well as interflow and seepage through and beneath the dams will be captured by perimeter collection system and ponds. Approximately 10 perimeter collection ponds will be strategically located in the topographic low points surrounding the CDF. The water collected in these ponds will be considered contact water and pumped back into the CDF. A schematic layout of the perimeter collection system and ponds are shown in Figure 4-4.

Water collected in the south cell pond will be reclaimed to the plant/mill, reducing the need for freshwater demands from Birch Lake. Excess water will be pumped to the central water storage pond for monitoring, treatment, and discharge to environment as needed.

Construction of the CDF perimeter dams will be advanced at the rate necessary to maintain sufficient storage above the tailing surface to accommodate an aggregate of the following storages throughout Operations (approximately 9.5 years):

- A minimum water cover required to deposit PAG tailings subaqueously and an operational volume to account for typical seasonal fluctuations;
- The EDF to prevent direct discharge to the environment;
- The IDF (PMF) to prevent over-topping of the perimeter dam; and
- Freeboard between the maximum IDF (PMF) water level and the perimeter dam crest.

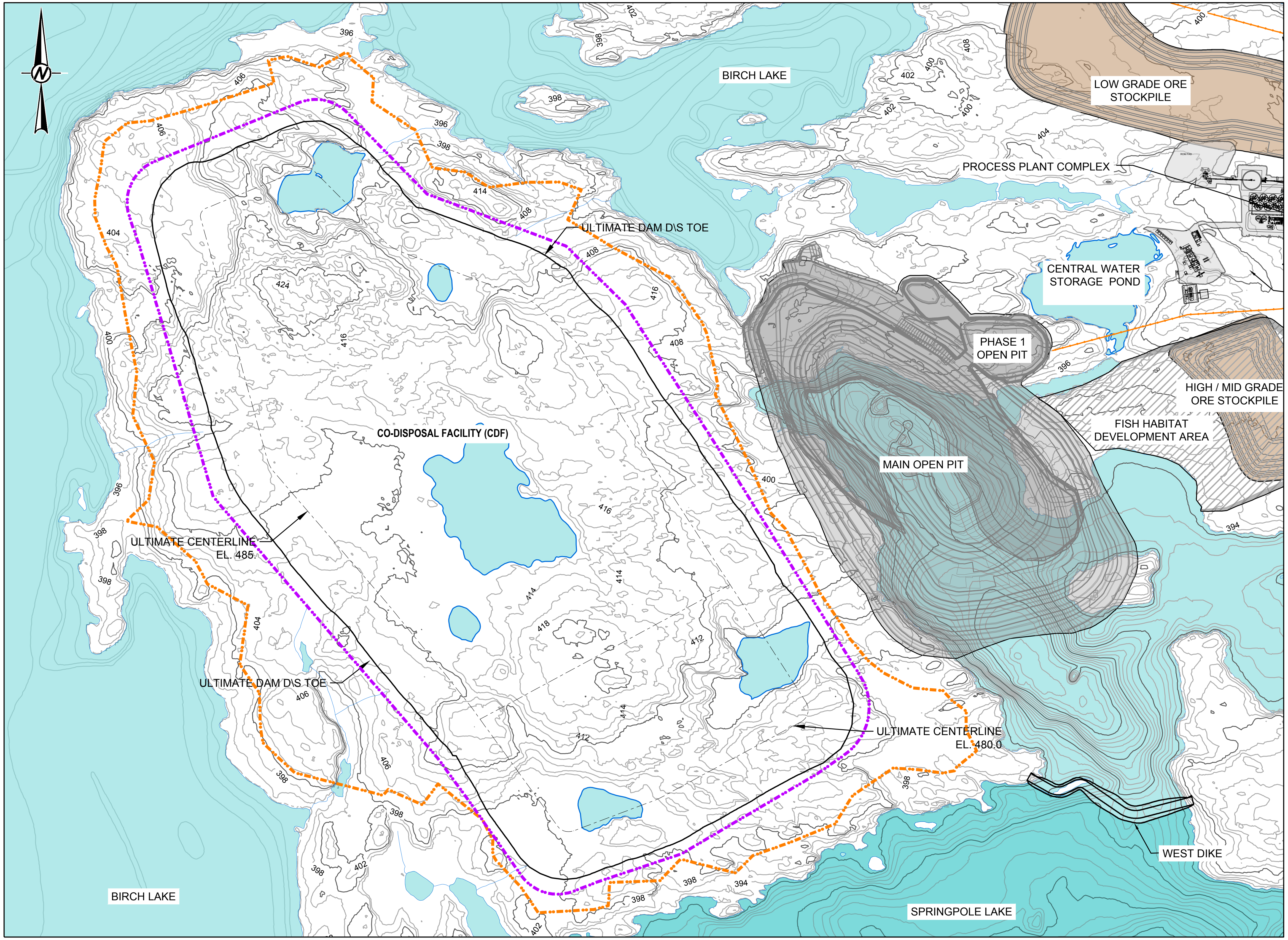
As the height of the CDF approaches its ultimate configuration in the later years of operation, a permanent overflow spillway will be constructed. The overflow spillway will have sufficient capacity to safely convey the IDF (PMF).

A site wide water balance has been prepared incorporating the CDF (WSP 2023f). The water balance is indicating a potential negative balance under the average condition for the CDF during operational phase. The potential negative balance is mainly due to the potential range of water losses (retention) into the co-disposed PAG mine rock and NAG tailings in the north cell. This will be refined at later design stages as additional detail for the mine plan and tailings and mine rock deposition plans are advanced.

4.7 Closure Concept

The CDF closure concept involves (a) continue directing run-off from the north cell to the south cell; (b) maintain a minimum pond (or no pond with thick coarse rockfill cover) to ensure saturated PAG tailings in south cell; and (c) implement an overflow spillway at the south cell to safely convey excess water (including EDF and IDF) to environment. Preparing the CDF for closure will involve the following:

- Construct overflow spillway at the south cell perimeter dam to safely pass the IDF (PMF) to the environment;
- Following completion of PAG mine rock disposal within the north cell, NAG tailings will be deposited over the entire north cell surface to fully cover the PAG mine rock and limit oxygen ingress;
- A vegetation cover will be established over the tailings or if necessary, erosion protection will be used to cover the entire north cell surface and direct all run-off to the south cell;
- Following completion of PAG tailings deposition within the south cell and upon final closure of the CDF, a deposit of NAG tailings or other suitable soil cover will be placed to remove excess pond capacity and provide a suitable vegetative or erosion protection cover over the PAG tailings; and
- Perimeter ditch collection system and ponds will be decommissioned to allow runoff and seepage water to report to environment once water quality requirements are met.



SITE PLAN
SCALE 7.500 m

NOTE(S)

1. THIS DRAWING ILLUSTRATES THE CO-DISPOSAL FACILITY BUFFER BOUNDARIES .
2. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS. GRID COORDINATES ARE IN NAD 1983 UTM ZONE 15N.
3. .THE DIGITAL FILES FOR THE BASE MAP WERE PRODUCED FROM DRAWING 105877-0000-G-001, PROVIDED BY AUSENCO.
4. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT.

LEGEND

- 400 — CONTOUR
- LAKE
- 120m WATER BODY / OPEN PIT OFFSET
- OFFSET ALLOWANCE FOR PERIMETER DITCH AND ACCESS ROAD
- CDF PROPOSED DESIGN DOWNSTREAM TOE

NOT FOR CONSTRUCTION

0 250 500
1:7,500 METRES

CLIENT
FIRST MINING GOLD

CONSULTANT
wsp

YYYY-MM-DD	2024-07-19
DESIGNED	GN
PREPARED	NR \ SC
REVIEWED	GN
APPROVED	GN

PROJECT
SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

TITLE
BUFFER BOUNDARY

PROJECT NO.	CONTROL	REV.	FIGURE
OMGM2215	0003	A	4-1

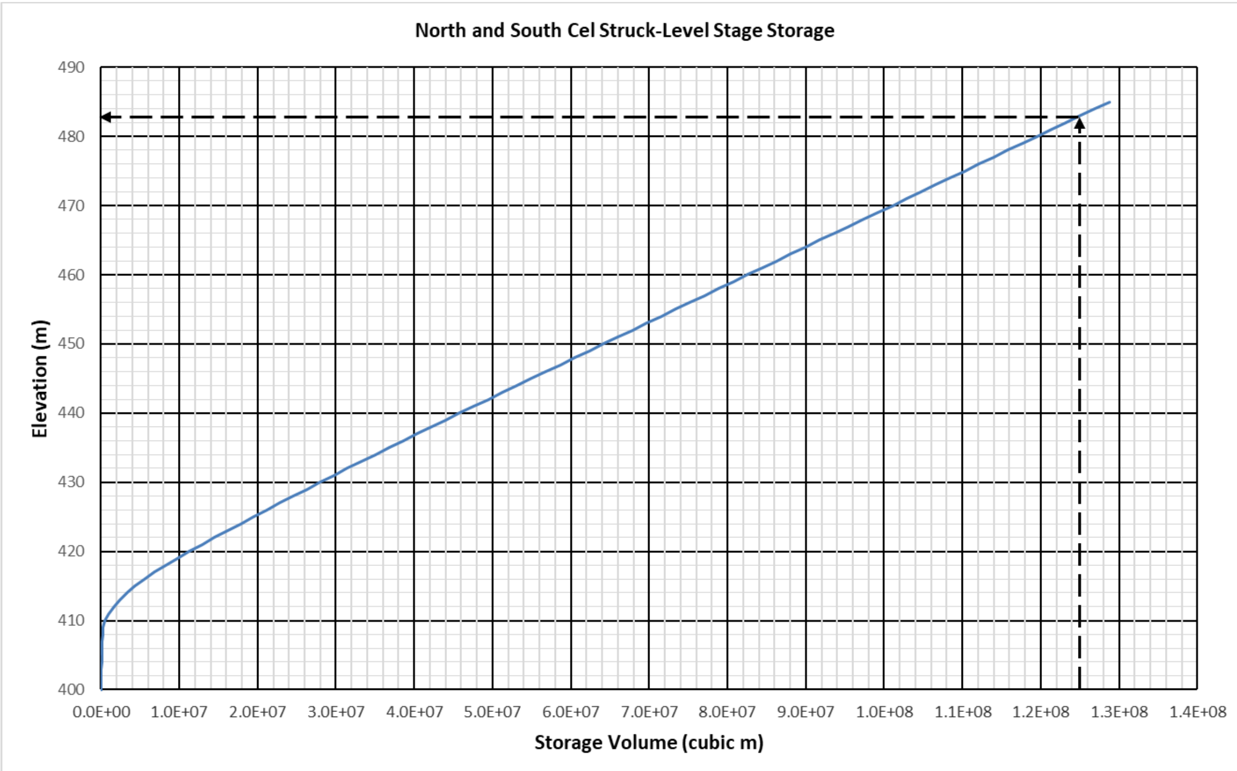


Figure 4-2: CDF North Cell Struck-Level Cell Stage-Storage Curve

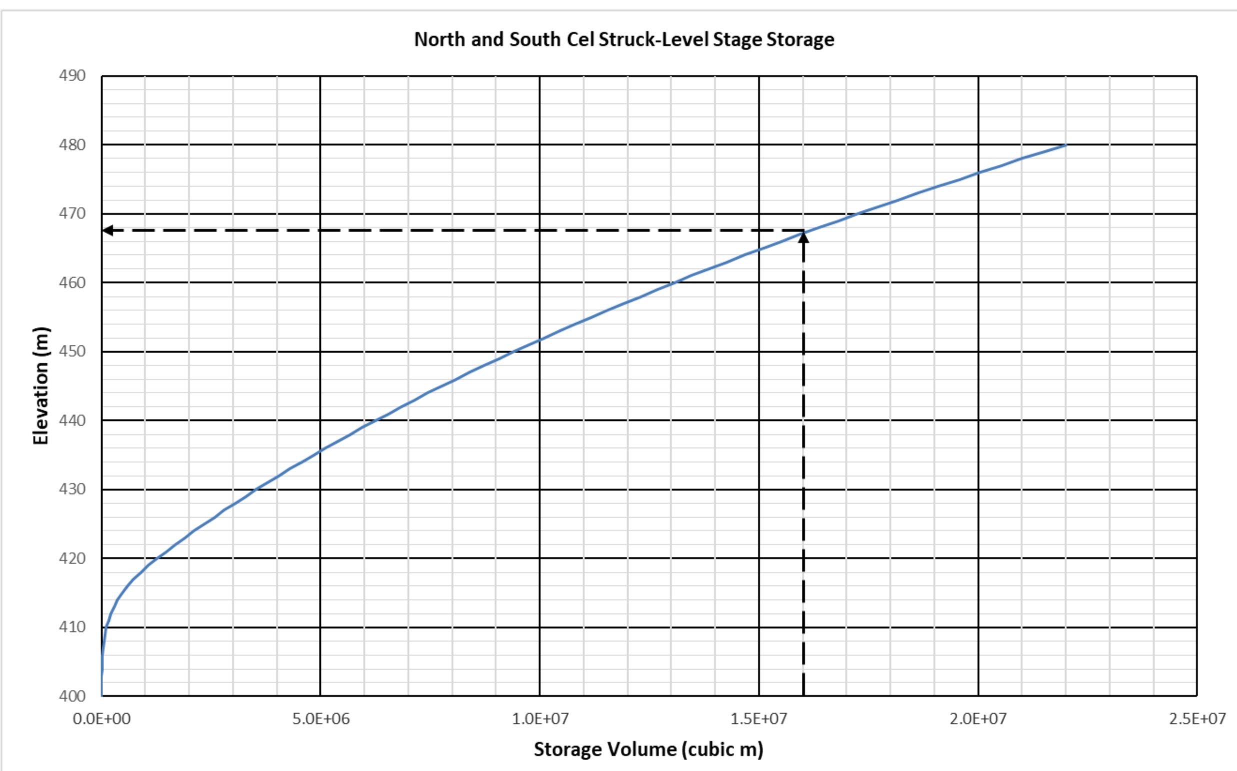
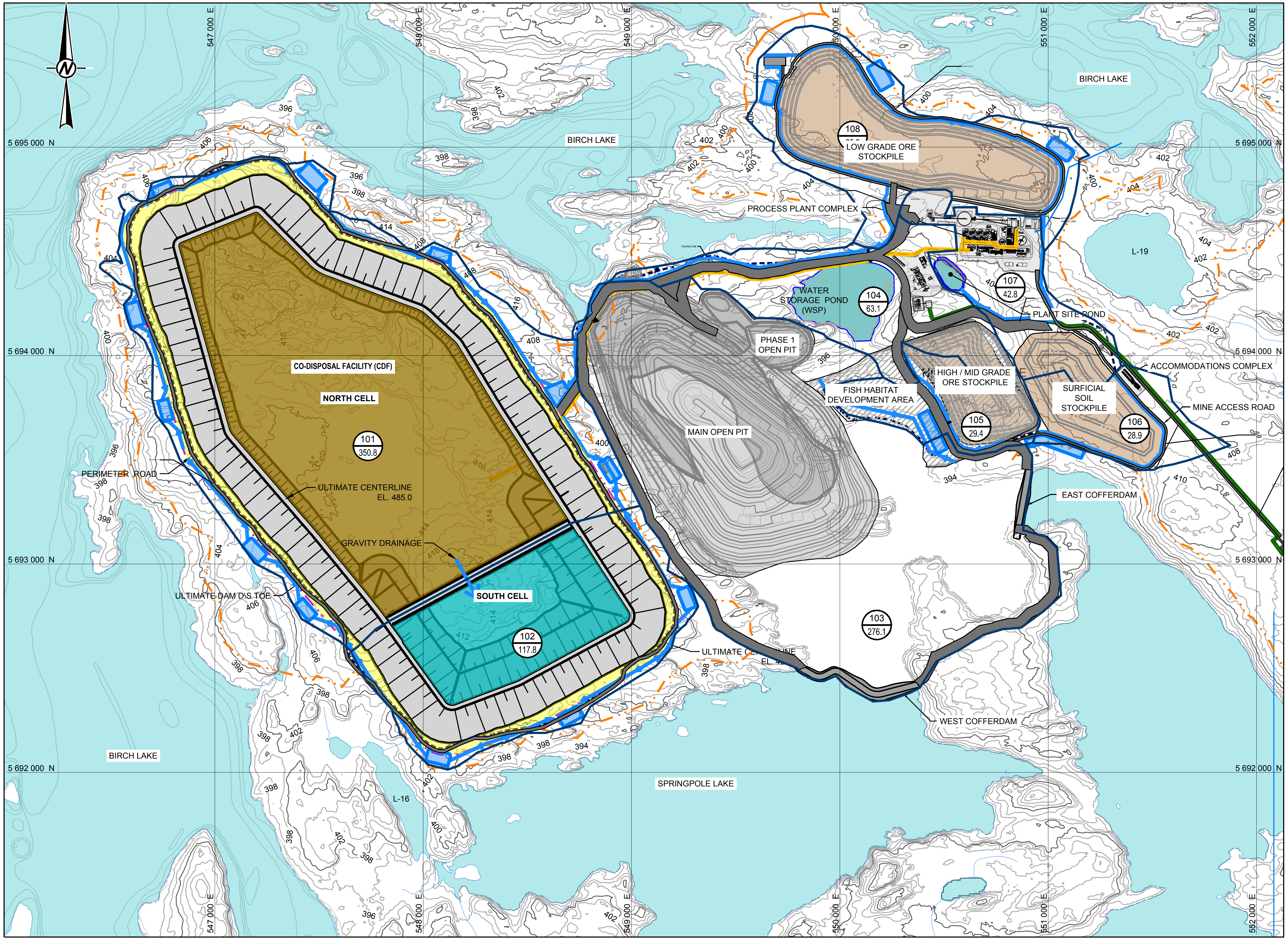


Figure 4-3: CDF South Cell Struck-Level Cell Stage-Storage Curve



SITE PLAN
SCALE 1:10,000 m

NOTE(S)

1. .ALL DIMENSIONS AND ELEVATIONS ARE IN METERS. GRID COORDINATES ARE IN NAD 1983 UTM ZONE 15N.

REFERENCE(S)

1. THE DIGITAL FILES FOR THE BASE MAP WERE PRODUCED FROM DRAWING SP-0000-GX-LYD-0003-1.dwg, PROVIDED BY AUSENCO.

LEGEND

- ROAD
- 400 CONTOUR
- LAKE
- SUMP
- TAILINGS BEACH
- POND OVER SLURRY TAILINGS
- CO-DISPOSAL DAM
- 120m WATER BODY / OPEN PIT OFFSET
- OFFSET ALLOWANCE FOR PERIMETER DITCH AND ACCESS ROAD
- DRAINAGE COLLECTION DITCH
- WATERSHED
- CDF PROPOSED DESIGN DOWNSTREAM TOE
- CDF PROPOSED ULTIMATE CENTERLINE
- 101 WATERSHED ID
- 350.8 WATERSHED AREA (ha)

WATERSHED AREAS SUMMARY TABLE

CATCHMENT ID	CATCHMENT AREA (ha)
101	350.8
102	117.8
103	276.1
104	63.1
105	29.4
106	28.9
107	42.8
108	85.9
TOTAL:	994.8

NOT FOR CONSTRUCTION

DRAFT

0 500 1,000
1:10,000 METRES

CLIENT
FIRST MINING GOLD

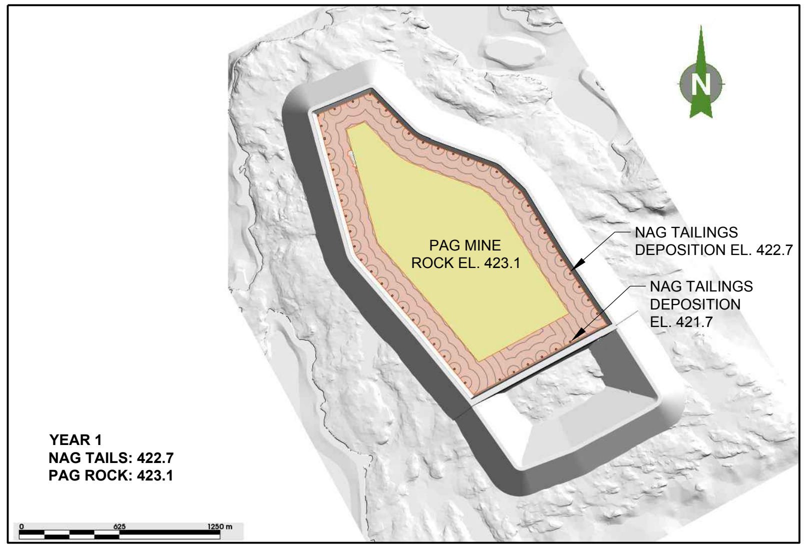
CONSULTANT
wsp

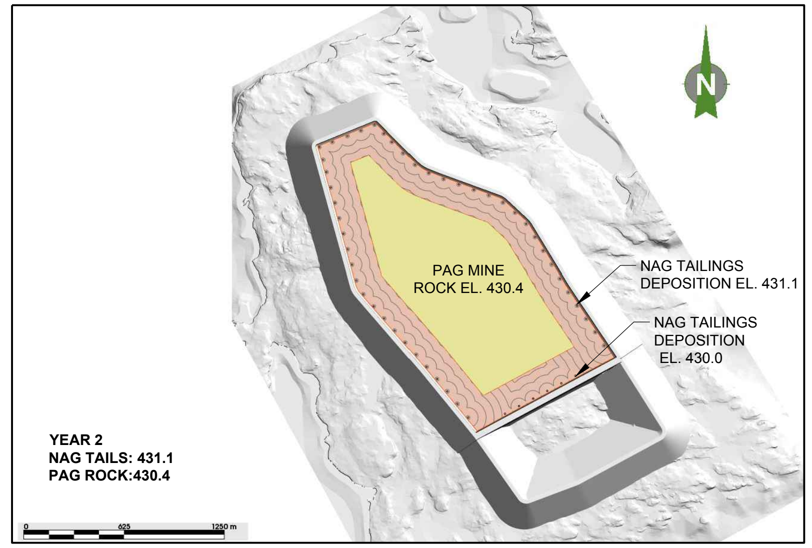
YYYY-MM-DD	2024-07-19
DESIGNED	GN
PREPARED	NR \ SC
REVIEWED	GN
APPROVED	GN

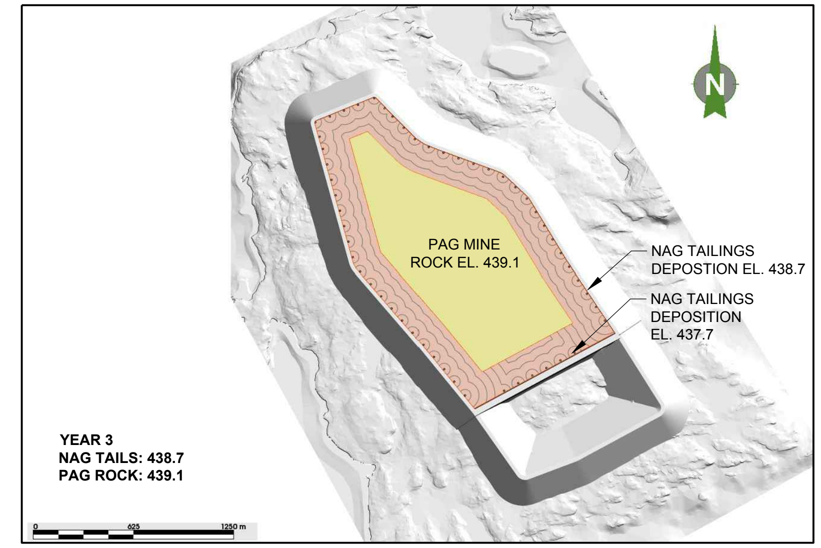
PROJECT
SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

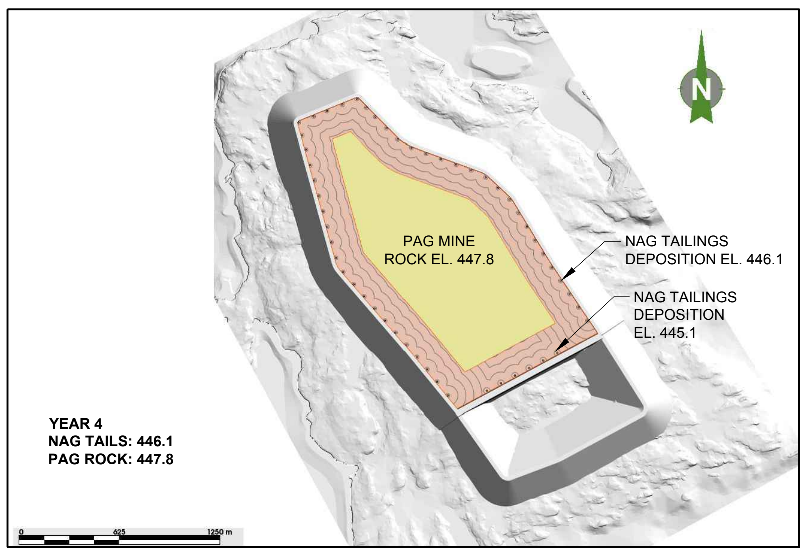
TITLE
ULTIMATE OPERATION SITE PLAN WITH CONCEPTUAL WATER MANAGEMENT PLAN

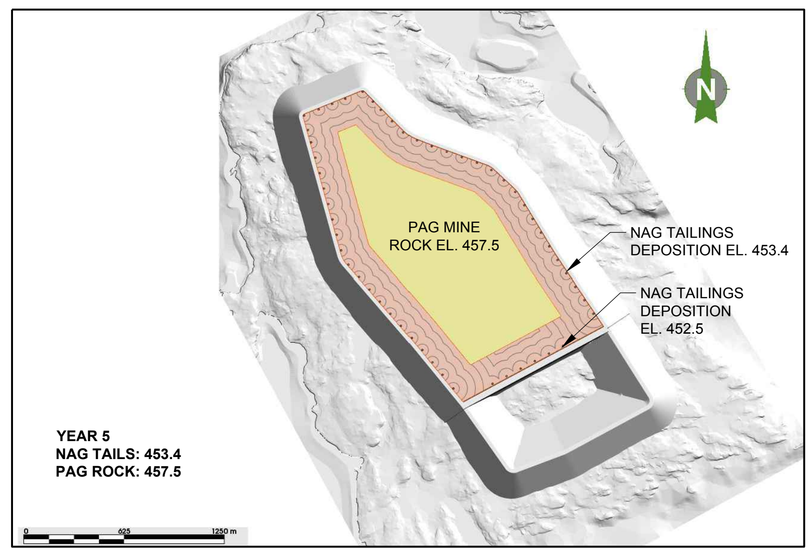
PROJECT NO.	CONTROL	REV.	FIGURE
OMGM2215	0003	B	4.4











NOTE(S)

1. THIS FIGURE ILLUSTRATES THE CO-DISPOSAL FACILITY ANNUAL PAG MINE ROCK AND NAG TAILINGS DEPOSITION PLAN FOR THE NORTH CELL.
2. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS. GRID COORDINATES ARE IN NAD 1983 UTM ZONE 15N.
3. THE DIGITAL FILES FOR THE BASE MAP WERE PRODUCED FROM DRAWING 105877-0000-G-001, PROVIDED BY AUSENCO.
4. NORTH AND SOUTH CELLS STARTER DAMS WERE SIZED TO CONTAIN 2 YEAR OF COMMERCIAL PRODUCTION.
5. CONSIDERING PERIMETER LENGTH OF ABOUT 5,000 M AND SIGNIFICANT ANNUAL RAISE OF ABOUT 7 m, NEAR CONTINUOUS DAM RAISE CONSTRUCTION (YEAR AROUND CONSTRUCTION) IS PROPOSED. SEE FIGURES 5-1 THROUGH 5-4 FOR DAM SECTION DETAILS.
6. PAG MINE ROCK IS TO BE TRUCKED FROM THE OPEN PIT AND PLACED GENERALLY IN THE MIDDLE OF THE NORTH CELL DEVELOPING PAG MINE ROCK STOCKPILE AS SHOWN.
7. NAG TAILINGS IS TO BE SPIGOTTED FROM PERIMETER DAMS DEVELOPING NAG TAILINGS ZONE ENCLOSING PAG MINE ROCK.
8. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING DESIGN REPORT.

NOT FOR CONSTRUCTION

FIRST MINING GOLD

2024-07-19
GN
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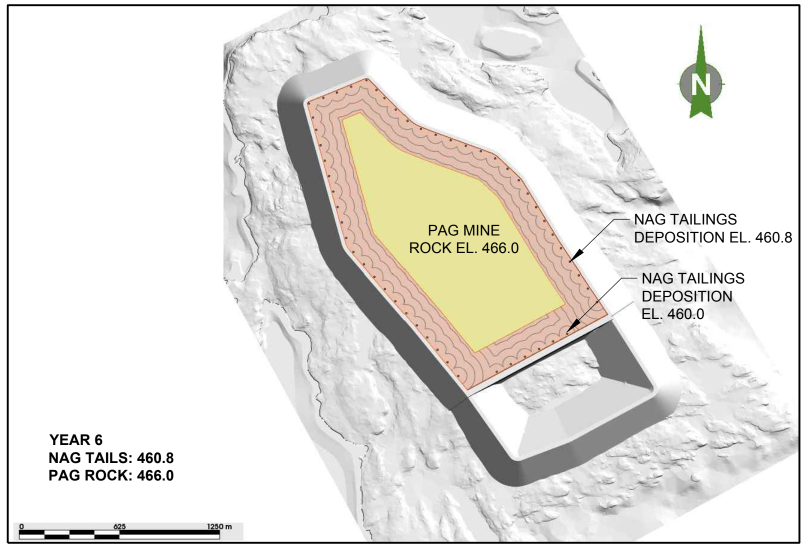
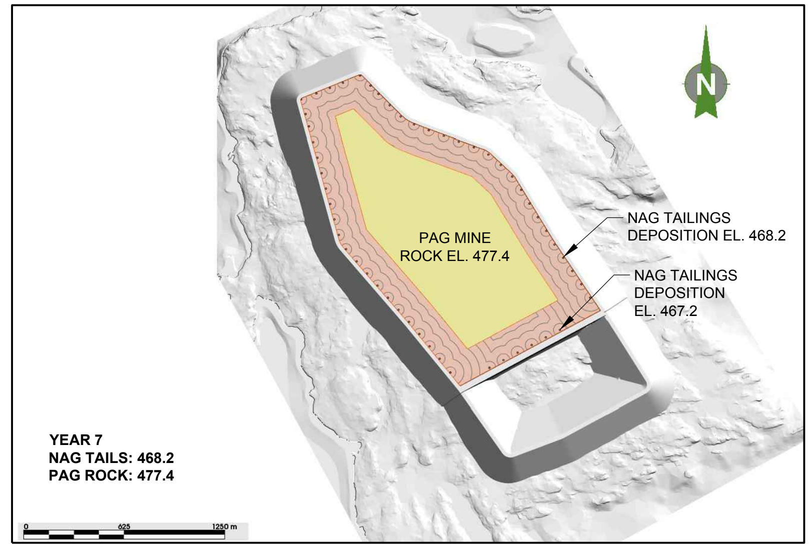
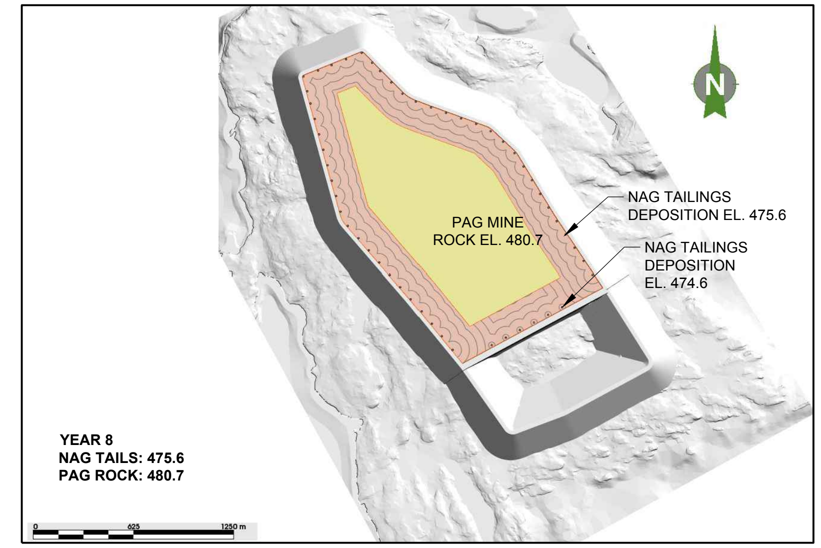
SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

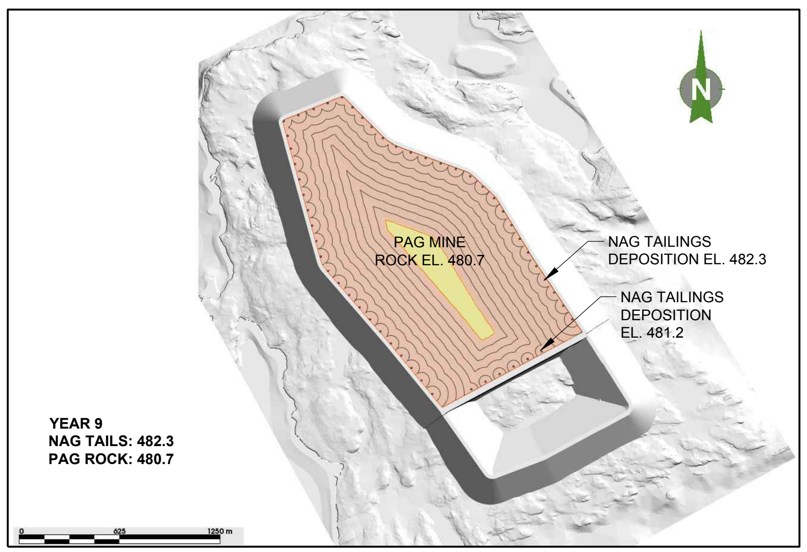
NORTH CELL
PAG MINE ROCK AND NAG TAILINGS DEPOSITION PLAN
(YEARS 1 THROUGH 5)

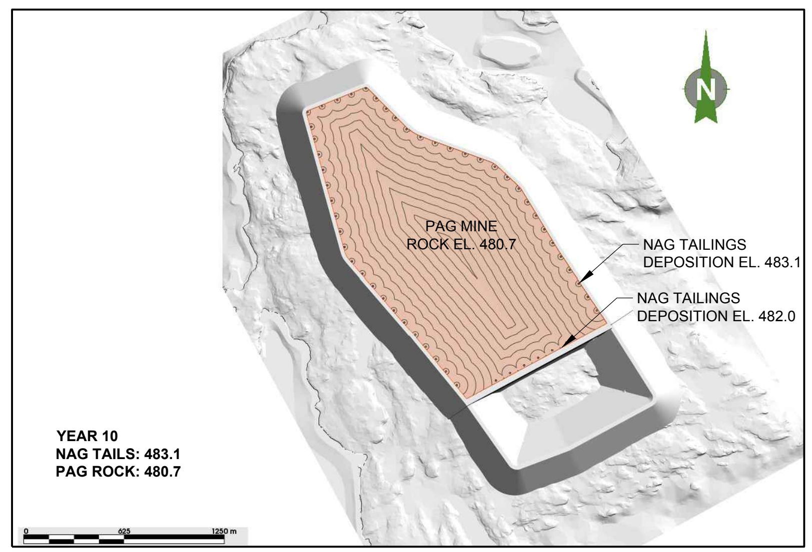
	CONTROL		FIGURE
OMGM2215	0002	A	4-5











NOTE(S)

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4. NORTH AND SOUTH CELLS STARTER DAMS WERE SIZED TO CONTAIN 2 YEAR OF COMMERCIAL PRODUCTION.
5. CONSIDERING PERIMETER LENGTH OF ABOUT 5,000 M AND SIGNIFICANT ANNUAL RAISE OF ABOUT 7 m, NEAR CONTINUOUS DAM RAISE CONSTRUCTION (YEAR AROUND CONSTRUCTION) IS PROPOSED. SEE FIGURES 5-1 THROUGH 5-4 FOR DAM SECTION DETAILS.
6. PAG MINE ROCK IS TO BE TRUCKED FROM THE OPEN PIT AND PLACED GENERALLY IN THE MIDDLE OF THE NORTH CELL DEVELOPING PAG MINE ROCK STOCKPILE AS SHOWN.
7. NAG TAILINGS IS TO BE SPIGOTTED FROM PERIMETER DAMS DEVELOPING NAG TAILINGS ZONE ENCLOSING PAG MINE ROCK.
8. AS MINING OPERATION AND SUPPLY OF PAG MINE ROCK CEASES IN YEAR 9, NAG TAILINGS IS TO FLOW OVER AND COVER PAG MINE ROCK DURING YEARS 9 AND 10 FORMING A COVER OVER THE PAG MINE ROCK.
9. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING DESIGN REPORT.

NOT FOR CONSTRUCTION

FIRST MINING GOLD

	2024-07-19
	GN
	NR \ SC
	GN
	GN

SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

NORTH CELL
PAG MINE ROCK AND NAG TAILINGS DEPOSITION PLAN
(YEARS 6 THROUGH 10)

	CONTROL		FIGURE
OMGM2215	0002	A	4-6

5.0 CDF DAM DESIGN AND ANALYSES

The CDF perimeter dam and internal dam design configuration, stability and seepage analyses are presented in the following sections. The CDF layout and typical sections of the perimeter and internal dams are provided in Figure 5-1 through Figure 5-4.

5.1 South Cell Perimeter Dam

The south cell perimeter dam is designed as a downstream raised rockfill dam with an upstream low-permeability reinforced GCL. The liner is to be anchored to a concrete plinth constructed on bedrock along the upstream toe or anchored into suitable low-permeability overburden. Bedrock grouting is to be implemented as required to reduce bedrock permeability. The dam fill material includes coarse to fine rock fill materials (Zones 4, 3 and 2) and bedding materials (Zone 1B) for the liner. A protection layer (Zone 1A) over the GCL is also included. It is expected that the downstream dam raise construction of coarse to fine rockfill zones (Zones 4, 3 and 2) can be implemented year around. Construction of filter (Zone 1B), GCL and protection layer (Zone 1A) can be implemented during the summer months.

The designed dam is founded directly on bedrock or competent sand and gravel overburden, except for the southwest corner. The southwest corner of the CDF contains thick silt to clay overburden which will require excavation or ground improvement. For the purpose of material take-offs, ground improvement is assumed. Additional investigation of this area is planned at the next stage of design to confirm the optimum design solution.

The proposed typical section of the south cell perimeter dam is provided in Figure 5-2.

5.1.1 Seepage and Stability Analyses

Steady state seepage analysis of the typical section was performed considering the ultimate dam closure configuration. Hydraulic conductivity parameters for various material zones were based on available site investigation data, and literature. These hydraulic conductivity parameters are provided with the seepage analyses results figures in Attachment A.

The seepage analyses show that seepage losses across the south cell perimeter dam would be limited to approximately 0.34 cubic metres per day per metre (m^3/day/m). Analyses also indicate that on the order of 90% of seepage would be captured with a perimeter seepage collection system.

Stability analyses were performed for long-term and 1 in 10,000-year design earthquake loading conditions. Material parameters for various zones were assumed based on available site investigation data, and literature. These parameters are provided with the stability analyses results figures in Attachment B. The stability analyses determined that the required factors of safety criteria are met or exceeded as required by CDA (2013).

5.2 North Cell Perimeter Dam

The north cell perimeter dam is designed as a centreline raised rockfill dam with suitable transition and filter zones. The designed dam is founded directly on bedrock or competent sand and gravel overburden. The proposed typical section of the north cell perimeter dam is provided in Figure 5-2.

Based on the starter and ultimate dam crest elevations and LOM of about 9.5 years, the north cell perimeter dam needs to be raised by approximately 6 m annually. Considering the north cell total perimeter length of about 5,000 m and significant annual raise of about 6 m, limiting the dam raise construction to only summer months may not be feasible even with downstream coarse rockfill zone being constructed year around. That is, year around dam raise construction may be required and low permeability dam fill zones may not be incorporated into dam raise construction. As such, to allow for year around construction, proposed dam raise configuration includes coarse to fine rockfill zones (Zones 4, 3, and 2) with a filter zone (Zone 1B) incorporated in the middle of a wide transition rockfill zone (Zone 2) as shown in Figure 5-2. The filter zone (Zone 1B) is proposed to be constructed by excavating a trench into the transition rockfill (Zone 2) and placement of Zone 1B filter materials. Assuming near continuous dam raise construction (year around construction), average monthly dam raise would be approximately 0.5 m and require temporary construction stockpiles. Therefore, it is poposed that Zone 1B filter material placement can be performed approximately every two months by excavating approximately 1 m deep trench into Zone 2 transition rockfill material. It will be critical to maintain as-built surveys of Zone 1B placements to accurately align subsequent excavation and placement of Zone 1B materials.

As discussed later in Section 6.1, approximately 23 Mm^3 of Low RQD NAG mine rock material is expected from the open pit mining operation. Considering estimated total volume of Zones 2 and 1B of about 5 Mm^3 (both north and south cell perimeter dams) it expected that transition rockfill (Zone 2) and filter material (Zone 1B) can be sourced from the Low RQD material by screening and crushing.

5.2.1 Stability and Seepage Analyses

Steady state seepage analysis of the typical section was performed considering the ultimate dam closure configuration. Hydraulic conductivity parameters for various material zones were based on available site investigation data, and literature.These hydraulic conductivity parameters are provided with the seepage analyses results figures in Attachment A. As shown in Figure 5.2 and Attachment A, the co-disposed PAG mine rock zone is modelled in the center of the cell surrounded by NAG tailings.

The seepage analyses indicate that seepage losses across the north cell perimeter dam would be limited to approximately 0.30 – 0.40 m^3/day/m. Analyses also indicate that on the order 90% of seepage would be captured with a perimeter seepage collection system. Seepage analyses results indicate that saturation of the PAG mine rock zone can generally be maintained by ensuring wide tailings beach zone, except for a limited zone at top (see Appendix A). It is noted that phreatic surface across north cell will be dependant on the tailings' hydraulic conductivity and beach width. As the Project progress to feasibility and detailed design stages, additional laboratory testing will be performed on tailings to refine the potential range of hydraulic conductivities and anisotropies. Further, as part of future studies, transient and steady state seepage analyses will be performed to establish potential range of phreatic / saturation levels within the PAG rock zone. The required extent of tailings zone (oxygen barrier) around the PAG mine rock will be established to limit the oxygen influx into the PAG mine rock.

Stability analyses were performed for long-term and 1 in 10,000-year design earthquake loading conditions. Material parameters for various zones were based on available site investigation data, literature and design criteria. These parameters are provided with the stability analyses results figures in Attachment B. The stability analyses results indicate that required minimum factors of safety criteria are met or exceeded as required by CDA (2013).

5.3 Internal Dam

The internal dam between the north and south cell is designed as a centreline raised rockfill dam. Considering the presence of tailings and/or mine rock buttressing on both sides of the dam, stability analyses were not performed for this design update. The internal dam is to allow seepage across from north cell to south cell. It may be required to incorporate a low permeability zone within the internal dam initial lift to contain south cell pond until adequate tailings deposited on either side of the internal dam.

The internal dam may have an internal spillway or pipe culvert to allow surface run-off from north cell to freely flow into the south cell. The internal spillway or pipe culvert will also allow flow back into north cell during EDF and IDF events.

5.4 Perimeter Dam Transition Segment

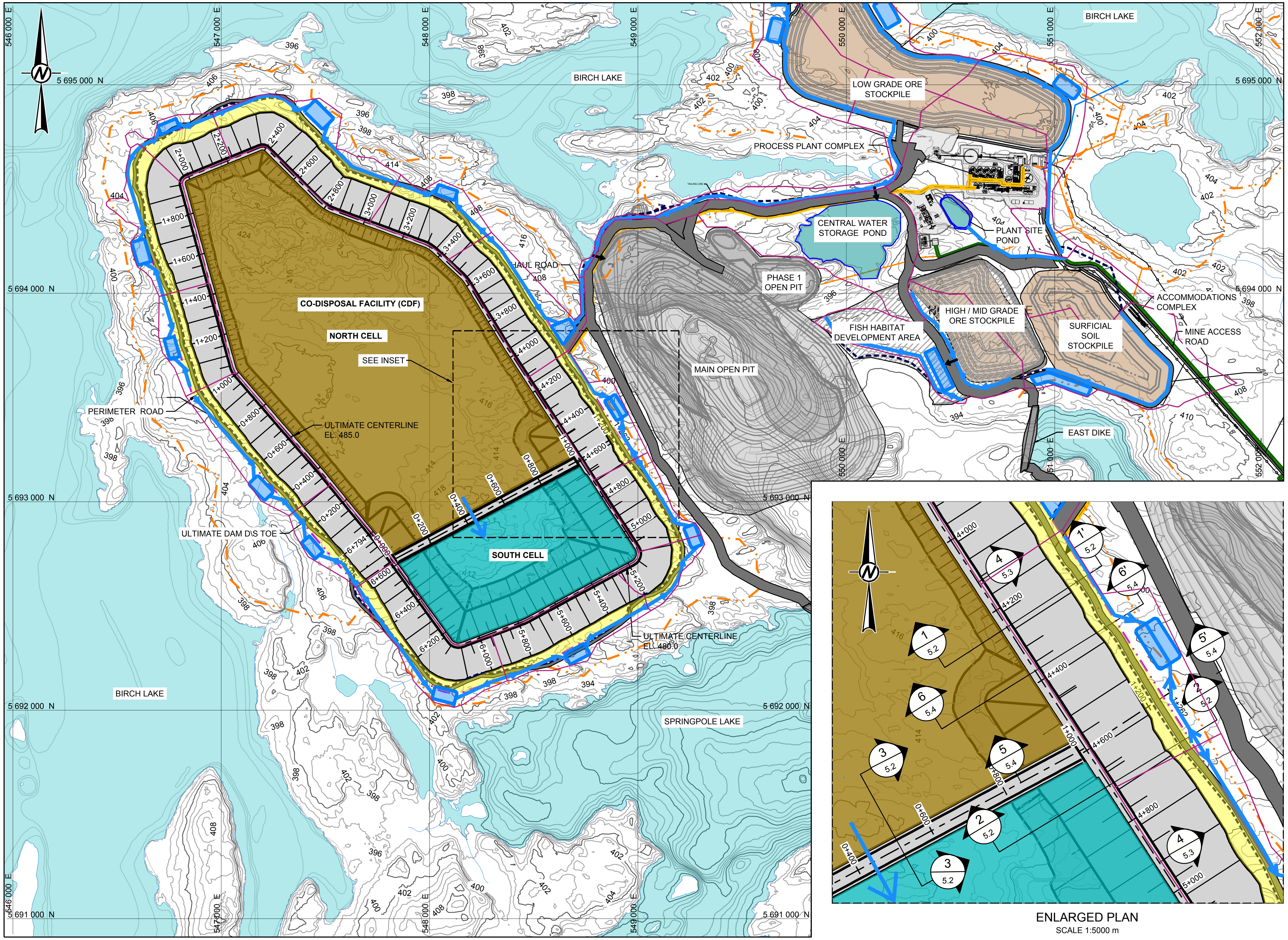
The GCL lined south cell perimeter dam is to be extended past the internal dam into the north cell to limit seepage losses from south cell pond. The details of the proposed perimeter dam transition from the south cell to north cell are illustrated in Figure 5-1 through Figure 5-4. The NAG tailings zone along the north side of the internal dam will provide the required low permeability zone to limit seepage losses from the south cell. As part of detailed design, three-dimensional seepage analyses will be performed to determine the required extension of GCL lined south cell perimeter dam into the north cell.

5.5 Instrumentation and Monitoring

Instrumentation and monitoring will be required to ensure performance of the CDF. Slope inclinometers and survey monuments will be installed to monitor the CDF perimeter dam deformations. Vibrating wire piezometers (VWPs) will be installed to monitor pore pressure conditions within the CDF dams' foundation and ensure phreatic conditions within the dams. Estimated instrumentation quantities are included in the Material Take-Offs.

In addition to geotechnical instrumentation, the following would be included to monitor the performance with respect to preventing acidification of the PAG tailings and PAG mine rock:

- VWPs in the NAG tailings in the north cell, and the PAG tailings and NAG tailings cover in the south cell, to monitor the phreatic surface;
- Tensiometers (or other suitable instrument) in the NAG tailings and co-disposed PAG mine rock (above phreatic surface) in the north cell to monitor degree of saturation; and
- Water quality, temperature, and gas monitors at multi-levels within the NAG tailings and co-disposed PAG mine rock in the north cell, and the PAG tailings and NAG tailings cover in the south cell, to monitor the progression of oxidation in the tailings and PAG rock.



ENLARGED PLAN
SCALE 1:5000 m

SITE PLAN
SCALE 1:10,000 m

NOTE(S)

1. THIS FIGURE ILLUSTRATES THE CO-DISPOSAL FACILITY DESIGN PLAN VIEW OF ULTIMATE CONFIGURATION.
2. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS. GRID COORDINATES ARE IN NAD 1983 UTM ZONE 15N.
3. THE DIGITAL FILES FOR THE BASE MAP WERE PRODUCED FROM DRAWING 105877-0000-G-001, PROVIDED BY AUSENCO.
4. NORTH AND SOUTH CELLS STARTER DAMS WERE SIZED TO CONTAIN 2 YEARS OF COMMERCIAL PRODUCTION.
5. DAMS ARE TO BE FOUNDED ON PREPARED FOUNDATION (DENSE OVERBURDEN OR BEDROCK).
6. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING DESIGN REPORT.

LEGEND

- ROAD
- 400 CONTOUR
- POND
- SUMP
- LAKE
- TAILINGS BEACH
- POND OVER SLURRY TAILINGS
- CO-DISPOSAL DAM
- INTAKE WATER LINE
- DRAINAGE COLLECTION DITCHES
- CLEAN WATER LINE
- TAILINGS LINE
- 230 KV TRANSMISSION LINE
- 25 KV TRANSMISSION LINE
- 120m WATER BODY / OPEN PIT OFFSET
- OFFSET ALLOWANCE FOR PERIMETER DITCH AND ACCESS ROAD

NOT FOR CONSTRUCTION

0 500 1,000
1:10,000 METRES

0 200 400
1:5,000 METRES

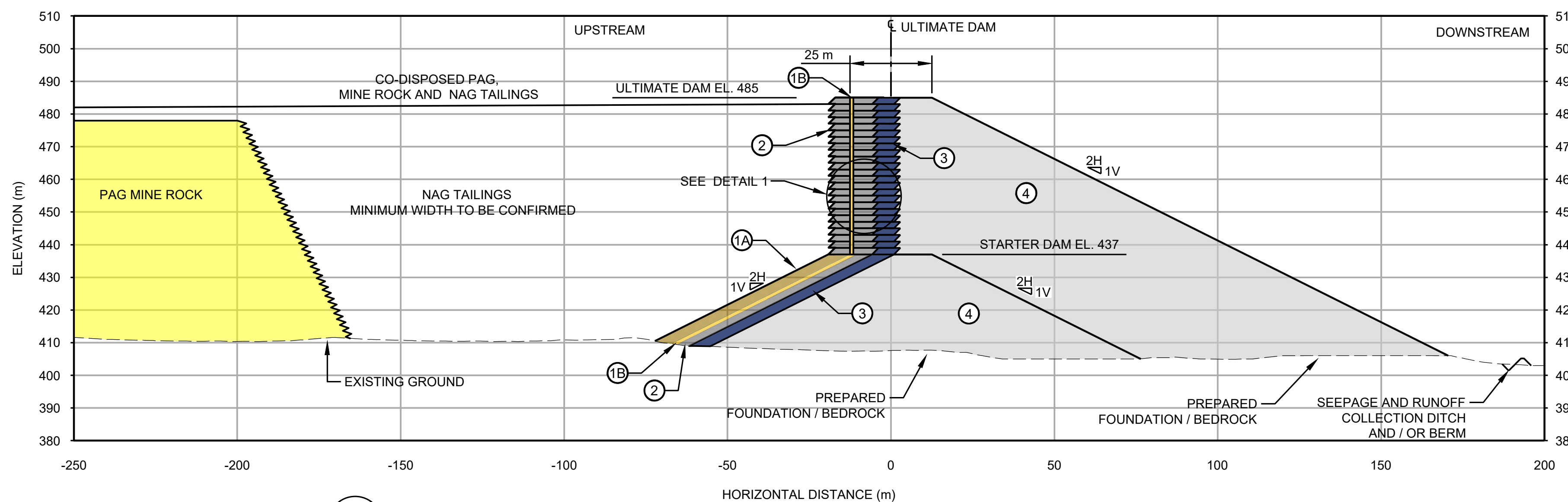
CLIENT	FIRST MINING GOLD
CONSULTANT	WSP
YYYY-MM-DD	2024-07-19
DESIGNED	GN
PREPARED	NR \ SC
REVIEWED	GN
APPROVED	GN

PROJECT
SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

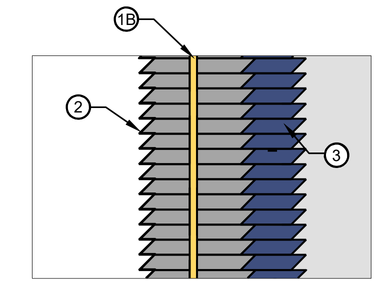
TITLE
ULTIMATE CONFIGURATION DESIGN ARRANGEMENT PLAN VIEW

PROJECT NO.	CONTROL	REV.	FIGURE
OMGM2215	0001	B	5.1

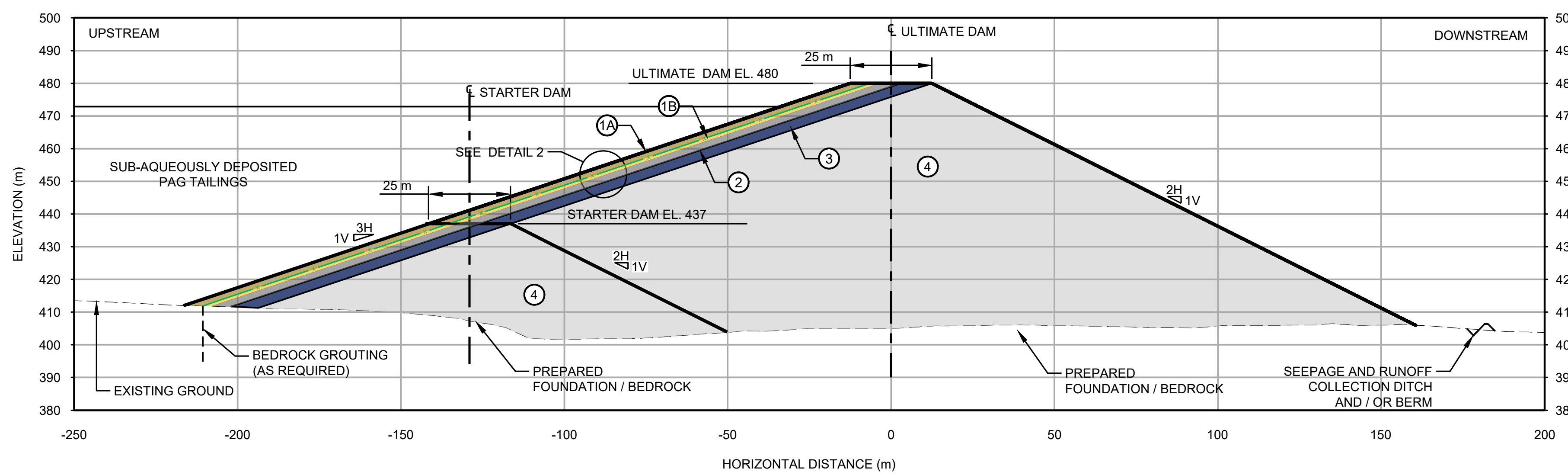
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
25 mm



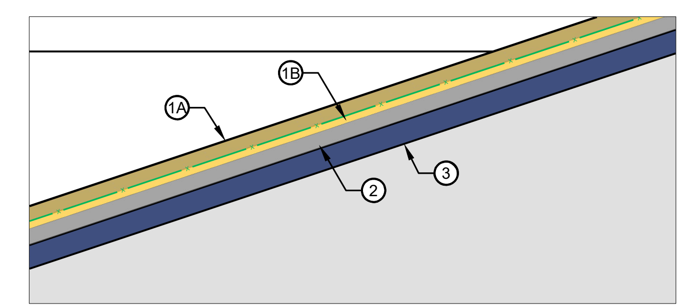
SCALE 1:1000 (1 / 5.1) SECTION A-A'



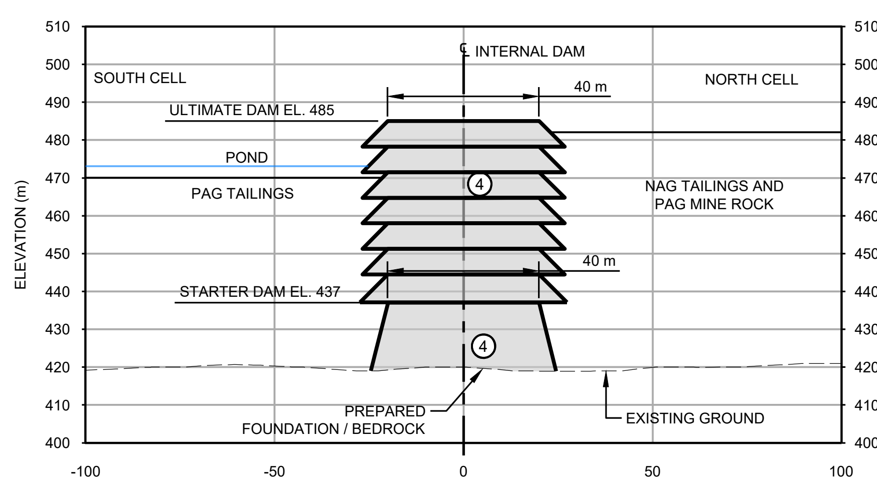
SCALE 1:500 m (1 / 5.2) DETAIL 1



SCALE 1:1000 (2 / 5.1) SOUTH CELL PERIMETER DAM - TYPICAL SECTION



SCALE 1:500 m (2 / 5.2) DETAIL 2



SCALE 1:1000 (3 / 5.1) INTERNAL DAM TYPICAL SECTION

NOTE(S)

1. THIS FIGURE ILLUSTRATES THE CO-DISPOSAL FACILITY PERIMETER DAMS TYPICAL SECTIONS AND DETAILS.
2. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS. GRID COORDINATES ARE IN NAD 1983 UTM ZONE 15N.
3. THE DIGITAL FILES FOR THE BASE MAP WERE PRODUCED FROM DRAWING 105877-0000-G-001, PROVIDED BY AUSENCO.
4. NORTH AND SOUTH CELLS STARTER DAMS WERE SIZED TO CONTAIN 2 YEAR OF COMMERCIAL PRODUCTION.
5. THE GCL LINED SOUTH CELL DAMS ARE EXTENDED INTO NORTH CELL TO MINIMIZE SEEPAGE LOSSES FROM SOUTH CELL.
6. DAMS ARE TO BE FOUNDED ON PREPARED FOUNDATION (DENSE OVERBURDEN OR BEDROCK).
7. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING DESIGN REPORT.

LEGEND

CONSTRUCTION MATERIALS:

1A	ZONE 1A (MIN 2.0 m THICK): OVERBURDEN FILL, PROTECTION LAYER OVER GCL
1B	ZONE 1B (MIN 1.0 m THICK): BEDDING/FILTER - SAND & GRAVEL
2	ZONE 2 (MIN 2.0 m THICK): TRANSITION ZONE (150 MM MINUS)
3	ZONE 3 (MIN 5.0 m THICK): ROCKFILL (600 MM MINUS)
4	ZONE 4: COARSE ROCKFILL (900MM MINUS)
	GCL (PROVIDE GEOTEXTILE UNDERNEATH)

NOT FOR CONSTRUCTION

CLIENT	FIRST MINING GOLD
CONSULTANT	WSP
YYYY-MM-DD	2024-07-19
DESIGNED	GN
PREPARED	NR \ SC
REVIEWED	GN
APPROVED	GN

PROJECT

SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

TITLE

ULTIMATE CONFIGURATION DESIGN ARRANGEMENT PROFILES AND SECTIONS

PROJECT NO.	CONTROL	REV.	FIGURE
OMGM2215	0001	A	5-2

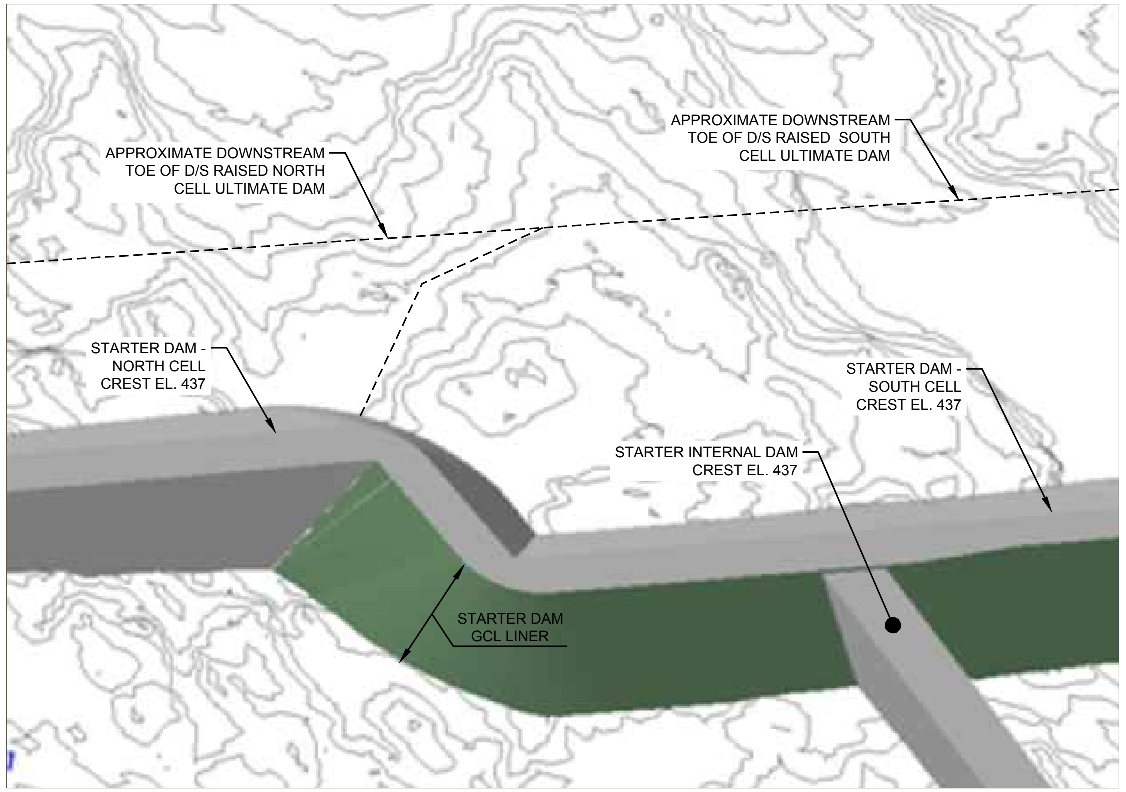
NOTE(S)

1. THIS FIGURE ILLUSTRATES THE CO-DISPOSAL FACILITY PERIMETER DAMS TYPICAL SECTIONS AND DETAILS.
2. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS. GRID COORDINATES ARE IN NAD 1983 UTM ZONE 15N.
3. THE DIGITAL FILES FOR THE BASE MAP WERE PRODUCED FROM DRAWING 105877-0000-G-001, PROVIDED BY AUSENCO.
4. NORTH AND SOUTH CELLS STARTER DAMS WERE SIZED TO CONTAIN 2 YEAR OF COMMERCIAL PRODUCTION.
5. THE GCL LINED SOUTH CELL DAMS ARE EXTENDED INTO NORTH CELL TO MINIMIZE SEEPAGE LOSSES FROM SOUTH CELL. REQUIRED DISTANCE TO BE CONFIRMED.
6. PERIMETER DAMS ARE TO BE FOUNDED ON PREPARED FOUNDATION (DENSE OVERBURDEN OR BEDROCK).
7. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING DESIGN REPORT.

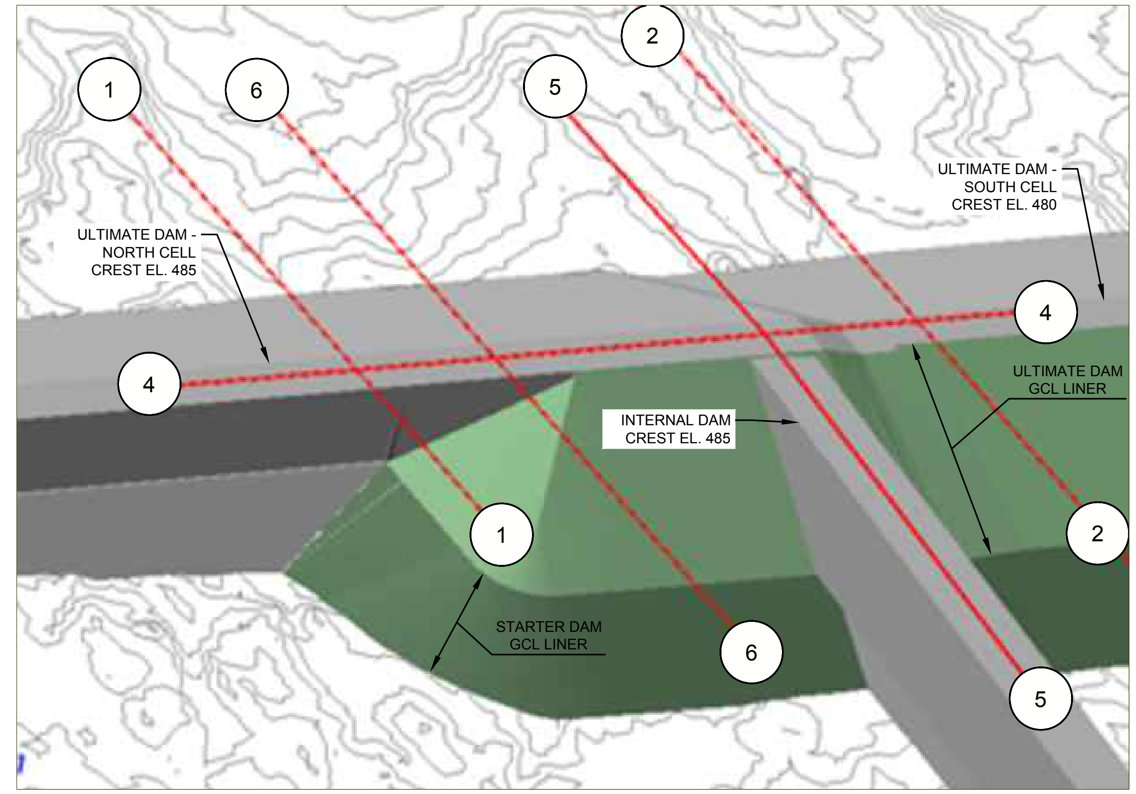
LEGEND

CONSTRUCTION MATERIALS:

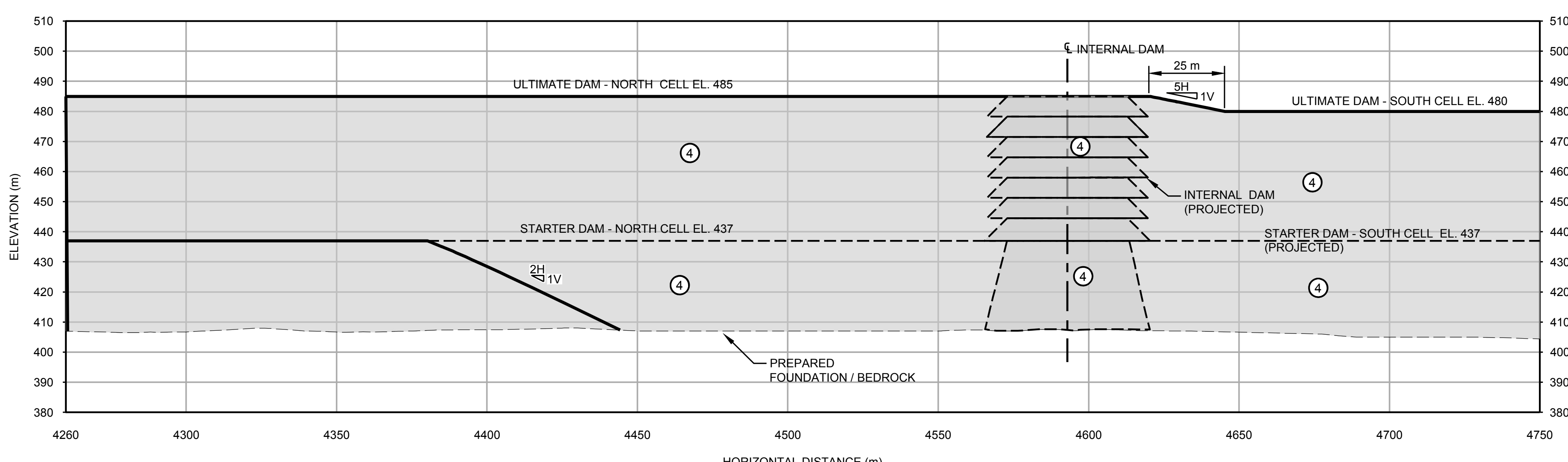
4 ZONE 4: COARSE ROCKFILL (900MM MINUS)



STARTER DAM CONFIGURATION - ISOMETRIC VIEW
SCALE NTS



ULTIMATE DAM CONFIGURATION - ISOMETRIC VIEW
SCALE NTS



SCALE 1:1000 4 / 5.1 PROFILE ALONG ULTIMATE PERIMETER DAM

NOT FOR CONSTRUCTION

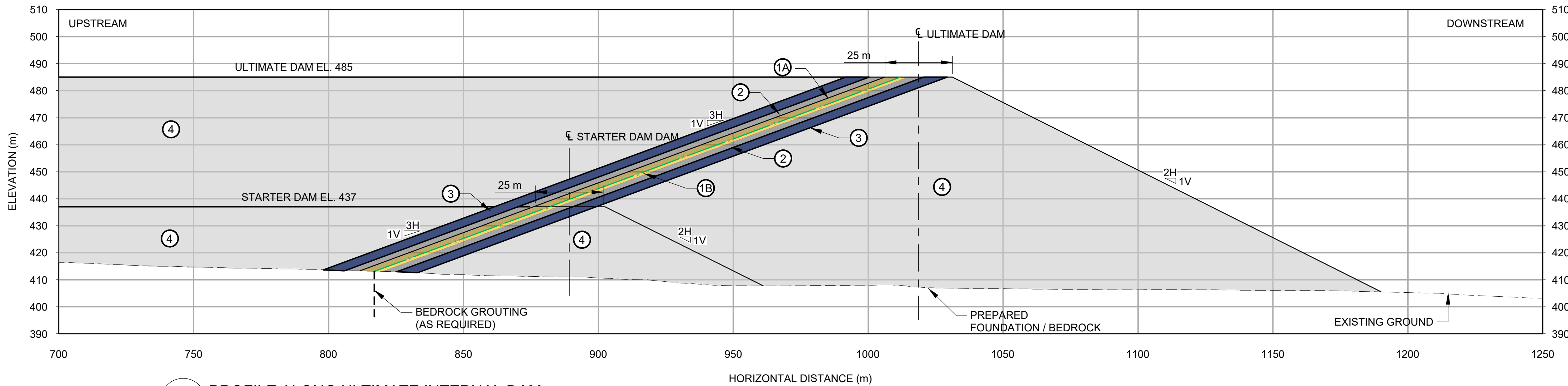
0 50 100
1:1,000 METRES

CLIENT	FIRST MINING GOLD
CONSULTANT	WSP
YYYY-MM-DD	2024-07-19
DESIGNED	GN
PREPARED	NR \ SC
REVIEWED	GN
APPROVED	GN

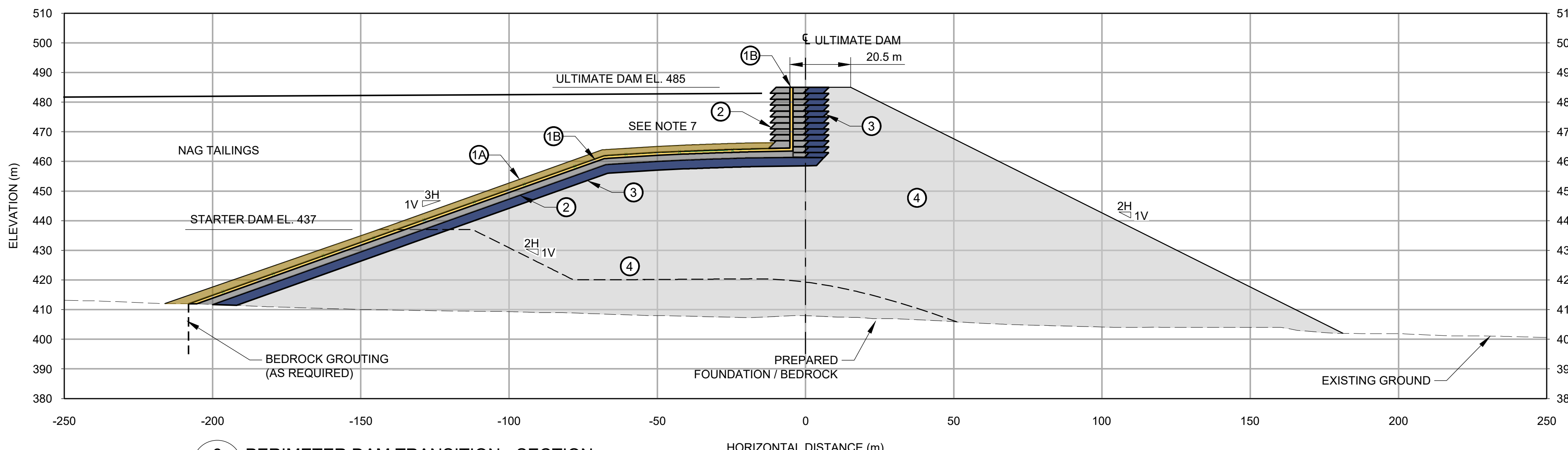
PROJECT
SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

TITLE
ULTIMATE CONFIGURATION DESIGN ARRANGEMENT PROFILES AND SECTIONS

PROJECT NO.	CONTROL	REV.	FIGURE
OMGM2215	0001	A	5-3



SCALE 1:1000 5 / 5.1 PROFILE ALONG ULTIMATE INTERNAL DAM



SCALE 1:1000 6 / 5.1 PERIMETER DAM TRANSITION - SECTION

NOTE(S)

1. THIS FIGURE ILLUSTRATES THE CO-DISPOSAL FACILITY PERIMETER AND INTERNAL DAMS TRANSITION SEGMENT BETWEEN SOUTH AND NORTH CELLS AND TYPICAL SECTIONS AND DETAILS.
2. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS. GRID COORDINATES ARE IN NAD 1983 UTM ZONE 15N.
3. THE DIGITAL FILES FOR THE BASE MAP WERE PRODUCED FROM DRAWING105877-0000-G-001, PROVIDED BY AUSENCO.
4. NORTH AND SOUTH CELLS STARTER DAMS WERE SIZED TO CONTAIN 2 YEAR OF COMMERCIAL PRODUCTION.
5. THE GCL LINED SOUTH CELL DAMS ARE EXTENDED INTO NORTH CELL TO MINIMIZE SEEPAGE LOSSES FROM SOUTH CELL.
6. PERIMETER DAMS ARE TO BE FOUNDED ON PREPARED FOUNDATION (DENSE OVERBURDEN OR BEDROCK).
7. THIS SURFACE IS PERPENDICULAR TO THE SECTION 6. SEE FIGURE 5.3 SECTION LOCATION.
8. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING DESIGN REPORT.

LEGEND

CONSTRUCTION MATERIALS:

- 1A — ZONE 1A (MIN 2.0 m THICK): OVERBURDEN FILL, PROTECTION LAYER OVER GCL
- 1B — ZONE 1B (MIN 1.0 m THICK): BEDDING/FILTER - SAND & GRAVEL
- 2 — ZONE 2 (MIN 2.0 m THICK): TRANSITION ZONE (150 MM MINUS)
- 3 — ZONE 3 (MIN 5.0 m THICK): ROCKFILL (600 MM MINUS)
- 4 — ZONE 4: COARSE ROCKFILL (900MM MINUS)
- GCL (PROVIDE GEOTEXTILE UNDERNEATH)

NOT FOR CONSTRUCTION

0 50 100
1:1,000 METRES

FIRST MINING GOLD

	2024-07-19
	GN
	NR \ SC
	GN
	GN

SPRINGPOLE GOLD PROJECT
CO-DISPOSAL FACILITY (CDF)

ULTIMATE CONFIGURATION DESIGN ARRANGEMENT
PROFILES AND SECTIONS

	CONTROL		FIGURE
OMGM2215	0001	A	5-4

6.0 MATERIAL TAKE-OFFS

This section summarizes the material take-offs for the CDF.

Estimated quantities for construction of the CDF are summarized in Table 6-1. The estimated quantities are based on the PFS update design described in this report and intended to be specific to the earthwork materials at the CDF over the life of operation and conceptual closure measures.

6.1 Mass Balance

This section discusses mass balance with respect to required construction materials for the CDF perimeter dams. Required construction material for the east and west cut-off dikes (located at the south end of open pit) and other site infrastructures are also discussed.

A LOM NAG and PAG mine rock production schedule is provided in Section 4.1 and 4.5. It is intended that suitable NAG mine rock from open pit operation will be used for the construction of the CDF perimeter dams. As such, a mass balance was completed comparing required NAG rockfill for the CDF construction and available NAG mine rock from the open pit at Year 0, Year 5 and end of LOM. The estimated NAG rockfill requirement is shown in Figure 6-1 together with the available NAG mine rock from open pit operation. It is noted that low RQD NAG mine rock is likely to be suitable for use in the CDF dam construction.

As shown in the Figure 6-1, approximately 81 Mm^3 of NAG rock is required for the LOM CDF construction. Available and suitable NAG mine rock is currently 66.8 Mm^3, indicating a deficiency of about 14 Mm^3. Mass balance for the starter dams' construction indicates a higher deficiency of about 16 Mm^3, due to a limited supply of NAG mine rock at the start of the Project.

Approximately 0.3 Mm^3 of NAG non-metal leaching rockfill will be required for the cut-off dikes at the start of the Project. Further, additional NAG rockfill will be required for the site infrastructures such as access road, equipment pads, concrete structures, etc. at the start of the Project. Overall, approximately 17 Mm^3 of NAG rock will be required from quarries at start of the Project.

A fish compensation habitat area will be developed east of open pit to provide a fish habitat offsetting and compensation measure. In order to reduce NAG rock deficiency and minimize Project footprint, the fish habitat will be quarried at start of the Project. The final configuration of the fish habitat area will be determined in a detailed design, but it is currently estimated that approximately 3.8 Mm^3 of NAG rock will be available from the fish habitat development. Static testing results of the drill core indicated that the rock proposed for quarrying from the fish habitat development area is NAG, and metal content analyses indicated a generally low potential for metal leaching.

Based on above discussed NAG rock requirement and mass balance, more than 13 Mm^3 of NAG rock needs to be quarried from within the CDF or elsewhere. It would be beneficial to develop quarry within CDF as it will help provide storage below the existing elevated ground surface and reduce the overall CDF height. Further, geochemical assessment data to date is supportive of the CDF area rock being a favourable construction material source for the Project. Additional geochemical assessment will be completed to confirm the specific volumes of available rock however based on the surface area available within the CDF footprint it is anticipated that sufficient rock volume will be available.

If the low RQD rock is found to be not suitable for construction, additional rock would be quarried from the CDF quarry. Timing of the availability of the NAG rock may also necessitate a CDF quarry if sufficient NAG rock is not available during site capture and pre-production construction.

Table 6-1: CDF Construction Material Take-Offs

Item	Unit	Totals Qtys	Starter Dam/Initial Qtys	Future Raises Qtys	Notes & Comments
Logging	Ha	250	250	-	Assumed 50% of the CDF Site requires logging.
Clearing and grubbing	Ha	230	230	-	CDF dams, access roads and ditches footprint.
Topsoil stripping	Mm^3	0.90	0.90	-	Assume 0.3m thick topsoil / peat / organics.
Foundation preparation for CDF dams - excavate, haul	Mm^3	4.7	2.1	2.6	Assume 2m thick overburden within CDF dams footprint.
Zone 4 - Coarse rockfill (900 mm minus) - load, haul, place, compact	Mm^3	72	15	57	NAG coarse rockfill (minus 900 mm).
Zone 3 - Rockfill (600 mm minus) - load, haul, place, compact	Mm^3	5.5	2.6	2.9	NAG rockfill (minus 600 mm).
Zone 2 - Rockfill (transition zone, 150 mm minus) - load, haul, place, compact	Mm^3	5.0	1.1	3.9	NAG rockfill (minus 150 mm).
Zone 1B - Liner bedding or sand and gravel filter - process, load, haul, place, compact	Mm^3	1.1	0.5	0.6	Sand & Gravel (minus 50 mm).
Zone 1A – Protection layer / upstream fillWhy the big change?	Mm^3	3.1	1.1	2.0	Suitable fill materials over GCL (south cell dam) and over filter zone (north cell starter dam).
Geotextile - material, place	Mm^2	0.6	0.23	0.34	On upstream slope of south cell Ultimate
Reinforced GCL - material, place	Mm^2	0.6	0.23	0.34	On upstream slope of CDF south cell Ultimate & 200 m of north cell Starter Dams.
Foundation bedrock grout curtain along south perimeter cell starter dams and segment of north cell starter dam upstream toe	m	1,000	1,000	-	Grouting to improve shallow bedrock permeability (assumed 33% of south cell perimeter requiring bedrock grouting).
Concrete plinth along south perimeter cell starter dams and segment of north cell starter dam upstream toe	m	3,000	3,000	-	Plinth to anchor GCL.
Ground improvement (deep soil mixing) (for dam segment with deep and soft/loose overburden)	m^3	50,000	50,000	-	Estimated volume of deep soft/loose soil zone requiring ground improvement.
Access road around CDF	m	9,000	9,000	-	Entire CDF perimeter.
Seepage & run-off collection ditch around CDF	m	9,000	9,000	-	Entire CDF perimeter.
Seepage and run-off collection ponds	EA	10	10	-	Located at low-lying area around CDF perimeter.

Table 6-1: CDF Construction Material Take-Offs

Item	Unit	Totals Qtys	Starter Dam/Initial Qtys	Future Raises Qtys	Notes & Comments
Internal spillway	EA	7	1	6	Internal spillway will be constructed across the starter dam and raises yearly.
Emergency spillway	EA	1	-	1	Emergency spillway will be constructed as part of the last south cell perimeter dam raise.
North Cell erosion protection cover	Mm^2	0.6	-	0.6	North cell cover will be constructed at end of LOM. Assume 0.3 m thick rockfill or sand and gravel cover.
South Cell cover	Mm^2	0.7	-	0.7	South cell cover will be constructed at end of LOM.
Instrumentation – Inclinometers	EA	20	10	10	Slope inclinometers to monitor perimeter dams' deformation performance.
Instrumentation – VWPs	EA	30	20	10	VWPs to monitor / confirm pore pressure conditions / phreatic surface within tailings, dam foundation and dam fill.
Tensiometers	EA	30	20	10	Tensiometers to monitor degree of saturation within PAG tailings and co-disposed PAG rock.
Oxygen monitors	EA	30	20	10	Oxygen monitors within PAG tailings and co-disposed PAG rock.
Instrumentation - Survey monuments	EA	20	10	10	Survey monuments to monitor perimeter dams' settlement / deformation performance.
Instrumentation - Data loggers	EA	10	10	-	Data loggers to collect instrument data.

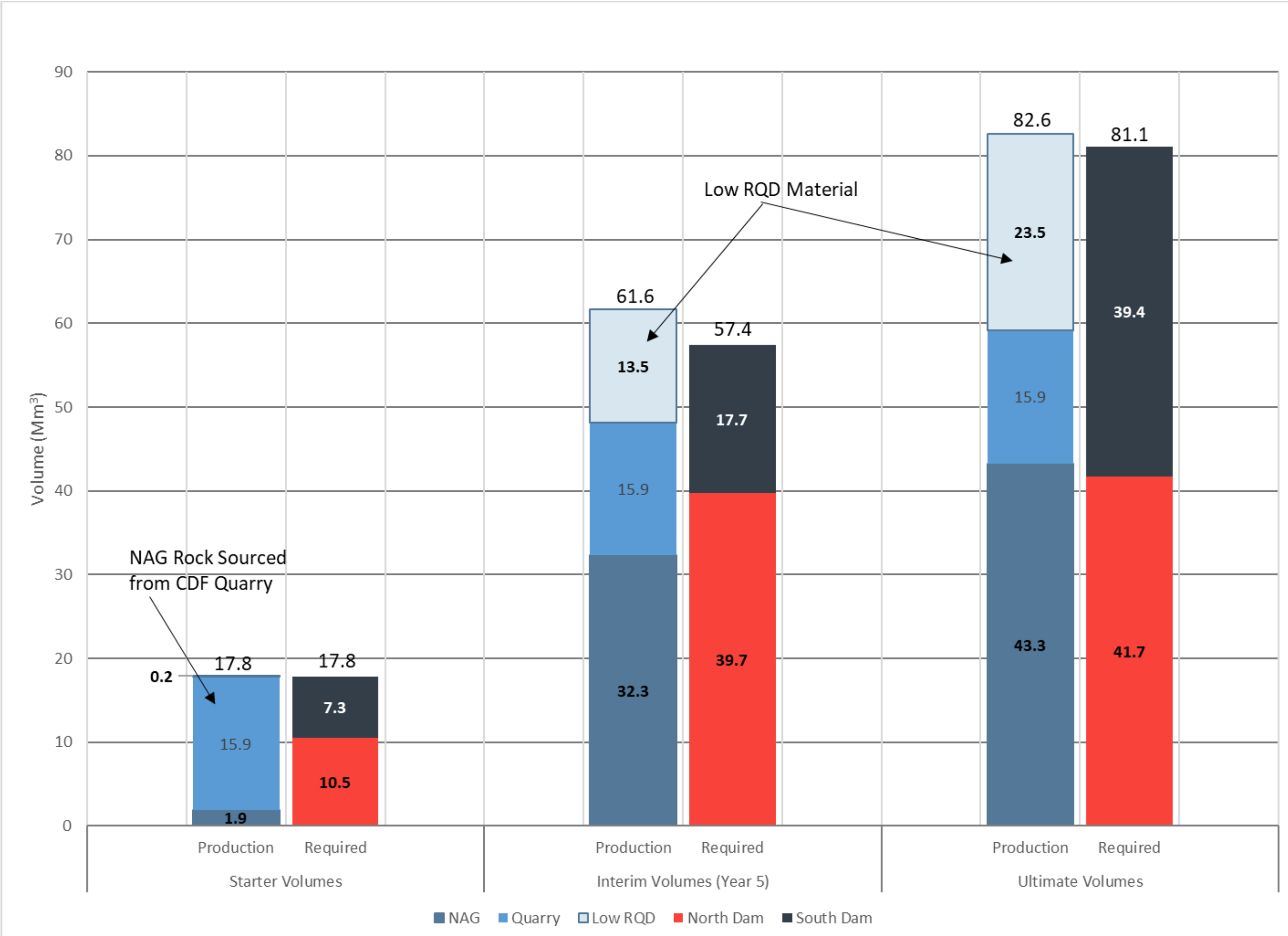


Figure 6-1: Mass Balance – NAG Rockfill

7.0 RECOMMENDATIONS AND OPPORTUNITIES

The CDF design update is presented in this design brief. The update has been to optimize the CDF design and incorporate input from FMG and the IGTRB. The following recommendations are made for next steps to further advance the CDF design:

- The mass balance indicates a construction NAG rock deficiency of approximately 17 Mm^3 at the start of the Project. It is recommended that a construction rock quarry be included within the CDF footprint. During later engineering stages, the CDF height should be refined and optimized considering additional storage volume available from the development of rock quarry within the CDF footprint. The optimization should consider potential additional PAG rock from the CDF quarry and fish compensation quarry which will increase the CDF storage requirement.
- Once the initial construction rock requirement is addressed by means of a rock quarry, there may be excess NAG mine rock of approximately 1.5 Mm^3 at end of LOM. A portion of this excess NAG rock may be used, depending on the gradation, as a cover for the overburden stockpiles and/or the CDF. Further, excess NAG rock may be used to backfill and recontour the open pit at closure and the creation of fish habitat features.
- Approximately 23 Mm^3 of Low RQD NAG mine rock material is expected from the open pit mining operation. It is expected that transition and filter materials can be sourced from the Low RQD material by screening and crushing. Further, depending on the Low RQD material gradation and suitability as filter material, larger filter zone and larger incremental dam raise may be feasible. It is recommended to assess these potential opportunities when additional information on Low RQD material and the mine plan becomes available.
- Once the mining schedule is established, develop detailed mine rock and tailings deposition plans for the CDF and develop plan for management and construction of transition and filter zones to support the 6 m/year north cell perimeter dam centreline raise.
- For detailed closure planning, additional geochemistry and hydrogeological modeling are required to confirm performance requirements for the covers in the CDF. In addition, unsaturated transitory conditions including drought need to be considered at the feasibility design stage.
- Perform advanced laboratory testing on tailings to establish potential range of hydraulic conductivities and anisotropies and update seepage analyses to facilitate geotechnical and geochemical modelling during detailed engineering.
- Perform three-dimensional seepage analyses to assess and confirm required extension of the GCL lined south cell perimeter dam into the north cell to limit seepage losses from the south cell pond.
- Considering the CDF rate of rise of 6 m/year, it is proposed to construct the spillway as part of the final dam raise. As such, allowance has been made to contain EDF and IDF within the south cell during operation. Detailed hydrologic analyses should be performed to refine the EDF and IDF storage allowance and define pumping rates to pump down pond level following design storm events.
- The site wide water balance indicated a negative water balance for the CDF. The water balance should continue to be updated as the designs are advanced.
- Additional site investigations along the CDF perimeter dams are required to further characterize shallow bedrock hydraulic conductivity and thick overburden areas. These investigations will facilitate advancing design details for the perimeter seepage collection system.

- The perimeter seepage and runoff collection system design should be advanced to establish (a) ditch/berm configuration; (b) collection ponds sizing; and (c) pumping requirements.
- Additional site investigation and testing is recommended to refine volumes and extraction scheduling of available NAG rock from potential CDF quarry and fish compensation quarry.

As the Project details advances through the above noted studies and design stages additional updates and studies will be required to optimize and advance the CDF design to construction readiness.

8.0 CLOSURE

This report has been prepared summarizing the PFS design update of the CDF and is subject to terms and conditions of that work. The report was prepared by Nam Pham and Ganan Nadarajah, and reviewed by David Bleiker. The analyses, results and figures were performed and/or prepared by Nam Pham, Nanthinee Porchelvam and Eddie Sokolowski.

We trust that the information presented in this report meets your current requirements. Should you have any questions, or concerns, please do not hesitate to contact the undersigned.

Yours Sincerely,

WSP Canada Inc.

Prepared By:

Original Signed

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Attachment A
Seepage Analyses

Summary of Hydraulic Properties:

Soil Unit	Vertical Hydraulic Conductivity, K_v (m/s)	Anisotropy, K_h/K_v	Reference
PAG Tailings (South Cell)	1×10^{-8}	1	Typical value based on WSP's experience and available laboratory tests.
Co-disposed PAG Mine Rock (North Cell)	1×10^{-4}	1	
NAG Tailings (North Cell)	5×10^{-8} 1×10^{-7}	2	
Dam Fill – Rockfill	1×10^{-3}	1	
GCL (Reinforced)	5×10^{-11}	1	Terrafix's datasheet.
Overburden (granular soil)	1×10^{-6}	1	Typical value based on available overburden information at CDF footprint and WSP's experience.
Shallow Bedrock	1×10^{-7}	1	Packer testing data
Deep Bedrock	1×10^{-8}	1	

Summary of Boundary Conditions:

Boundary Location	South Cell	North Cell
Downstream Slope (Rockfill)	9.2×10^{-9} m/sec/m Infiltration(1) and Potential Seepage Face	
Upstream Boundary (Upstream End of Seep/W Model)	Total Head: 477(2)	No Flux Boundary
Upstream Tailings & Co-disposed PAG Mine Rock	N/A	6.9×10^{-9} and 9.2×10^{-9} m/sec/m Infiltration(3)
Downstream Boundary (Downstream End of Seep/W Model)	Total Head: 390.0 m (4)	

Notes:

1. Infiltration is assumed to be approximately 40% of the average annual precipitation.
2. Assumed invert elevation of closure overflow spillway.
3. Infiltration is assumed to be approximately 30% and 40% of the average annual precipitation for low (5×10^{-8}) and high (1×10^{-7}) permeability tailings, respectively.
4. Downstream head is assumed at approximate elevation of low-lying waterlogged area / Springpole Lake level.

South Cell Perimeter Dam - Summary of Calculated Seepage Rates

Case	Bedrock Permeability (m/S)		Seepage (m^3/d/m)		
	Shallow Bedrock	Deep Bedrock	Seepage from South Cell	Seepage from South Cell to Environment	Seepage from South Cell Collected by the Perimeter Ditch
Long-term Steady State Seepage	1×10^{-7}	1×10^{-8}	0.339	0.023	0.316

North Cell Perimeter Dam - Summary of Calculated Seepage Rates

Case	Bedrock Permeability (m/s)		Seepage (m^3/d/m)		
	Shallow Bedrock	Deep Bedrock	Seepage from North Cell	Seepage from North Cell to Environment	Seepage from North Cell Collected by the Perimeter Ditch
Long-term Steady State Seepage – Low Permeability Tailings	1×10^{-7}	1×10^{-8}	0.300	0.027	0.273
Long-term Steady State Seepage – High Permeability Tailings			0.400	0.027	0.373

Color	Name	Hydraulic Material Model	Vol. WC. Function	Sat Kx (m/sec)	Ky/Kx' Ratio
	Bedrock - Deep	Saturated Only		1e-08	1
	Bedrock - Shallow_	Saturated Only		1e-07	1
	GCL	Saturated Only		5e-11	1
	Overburden	Saturated Only		1e-06	1
	PAG Tailings	Saturated / Unsaturated	Tailings Measured		1
	Rockfill	Saturated Only		0.001	1

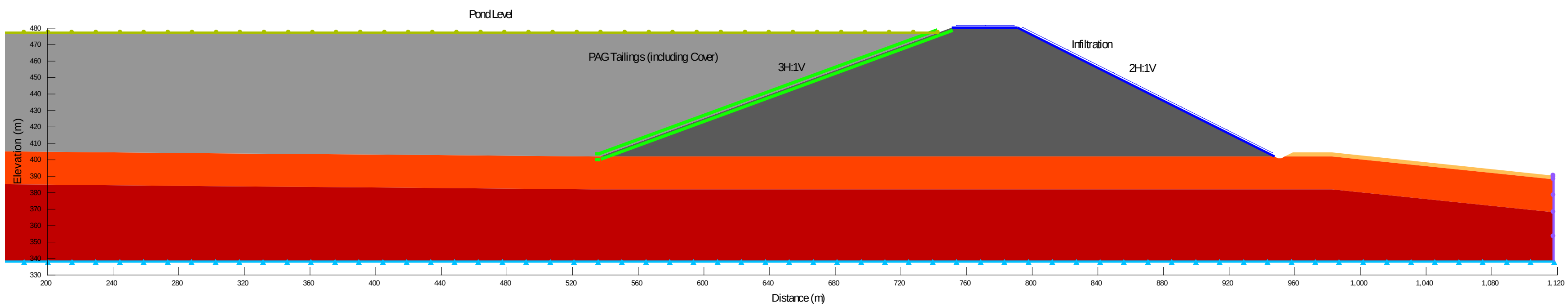

Figure A-1: CDF South Cell Perimeter Dam, Typical Section – Seepage Analysis Model

Color	Name	Hydraulic Material Model	Vol. WC. Function	Sat Kx (m/sec)	Ky/Kx' Ratio
	Bedrock - Deep	Saturated Only		1e-08	1
	Bedrock - Shallow_	Saturated Only		1e-07	1
	GCL	Saturated Only		5e-11	1
	Overburden	Saturated Only		1e-06	1
	PAG Tailings	Saturated / Unsaturated	Tailings Measured		1
	Rockfill	Saturated Only		0.001	1

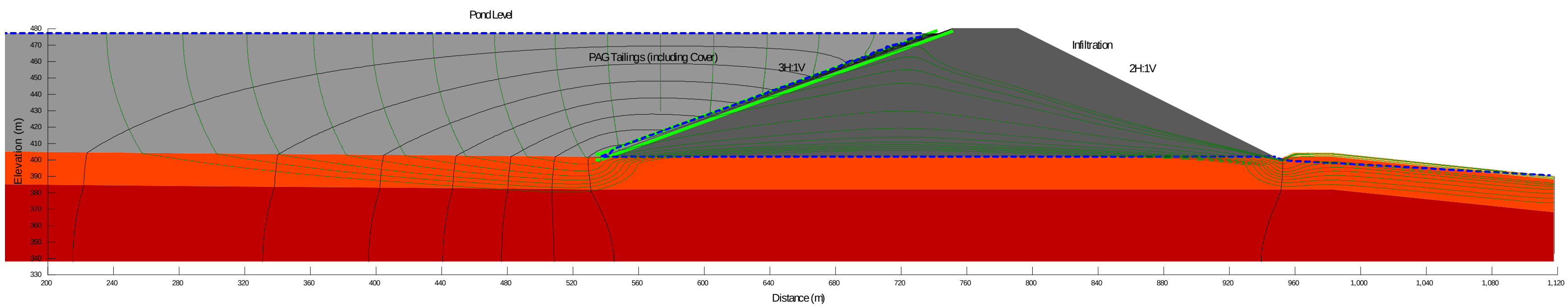

Figure A-2: CDF South Cell Perimeter Dam, Typical Section – Steady State Seepage Analysis Result

Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Sat Kx (m/sec)	Ky'/Kx' Ratio
	Bedrock - Deep	Saturated Only			1e-08	1
	Bedrock - Shallow_	Saturated Only			1e-07	1
	Overburden	Saturated Only			1e-06	1
	PAG Mine Rock	Saturated / Unsaturated	PAG Mine Rock	PAGMineRock_Ksat 1e-4		1
	Rockfill	Saturated Only			0.001	1
	Tailings_5e-8_Ani2	Saturated / Unsaturated Kv = 5e-08 m/sec	Tailings measured	Tailings measured_Ani 2_5e-8		0.5

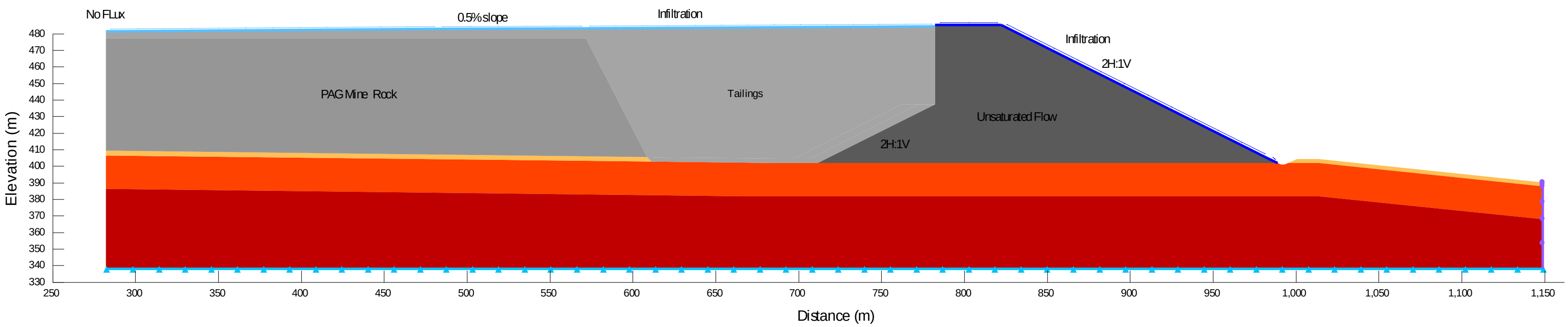

Figure A-3: CDF North Cell Perimeter Dam, Typical Section – Seepage Analysis Model

Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Sat Kx (m/sec)	Ky'/Kx' Ratio
	Bedrock - Deep	Saturated Only			1e-08	1
	Bedrock - Shallow_	Saturated Only			1e-07	1
	Overburden	Saturated Only			1e-06	1
	PAG Mine Rock	Saturated / Unsaturated	PAG Mine Rock	PAGMineRock_Ksat 1e-4		1
	Rockfill	Saturated Only			0.001	1
	Tailings_2e-8_Ani5	Saturated / Unsaturated Kv = 2e-08 m/sec	Tailings measured	Tailings measured_Ani 5_2e-8		0.2

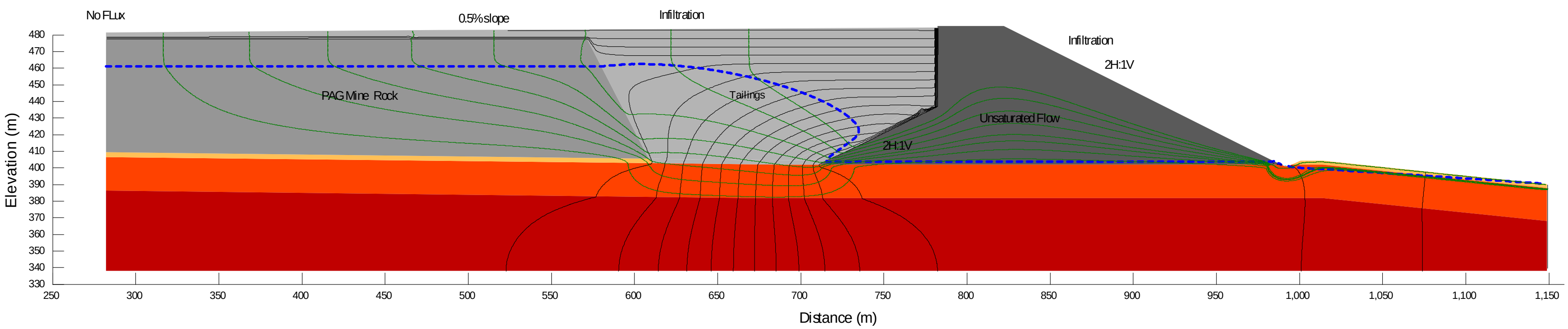

Figure A-4: CDF North Cell Perimeter Dam, Typical Section – Steady State Seepage Analysis Result (Low Permeability Tailings Kv = 5x10^{-8} m/s)

Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Sat Kx (m/sec)	Ky'/Kx' Ratio
	Bedrock - Deep	Saturated Only			1e-08	1
	Bedrock - Shallow_	Saturated Only			1e-07	1
	Overburden	Saturated Only			1e-06	1
	PAG Mine Rock	Saturated / Unsaturated	PAG Mine Rock	PAGMineRock_Ksat 1e-4		1
	Rockfill	Saturated Only			0.001	1
	Tailings_1e-7_Ani2	Saturated / Unsaturated Kv = 1e-07 m/sec	Tailings measured	Tailings measured_Ani 2_1e-7		0.5

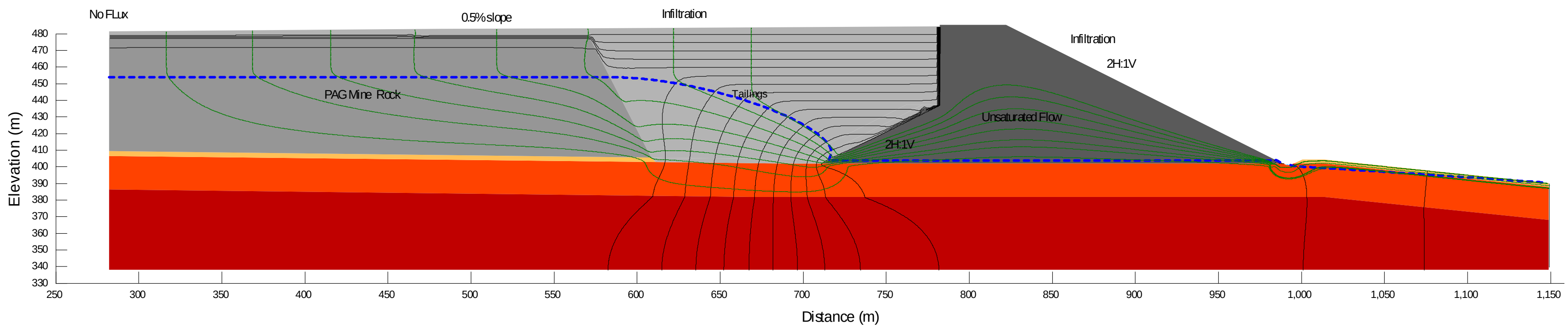

Figure A-5: CDF North Cell Perimeter Dam, Typical Section – Steady State Seepage Analysis Result (High Permeability Tailings Kv = 1x10^{-7} m/s)

Attachment B
Stability Analyses

Summary of Shear Strength Parameters

Soil Type	Unit Weight (kN/m^3)	Drained Shear Strength Parameters		Undrained Shear Strength Parameters		
		Cohesion, c' (kPa)	Friction Angle, ϕ' (degrees)	Su_{min} (kPa)	Su/σ'_{vo}	B-Bar
PAG / NAG Tailing	19	-	-	0	0.20[3]	-
Co-disposed PAG Mine Rock[1] (North Cell)	22	-	30	-	-	-
Dam Fill - Rockfill[2]	22	-	Lep's Lower Bound Shear Strength	-	-	-
Overburden	20	-	33	-	-	-

Notes:

1. Typical friction angle of tailings is conservatively adopted for the co-disposed PAG Mine Rock considering potential for NAG tailings flowing into PAG Mine Rock.
2. LEP's lower bound shear strength envelope is adopted for the rockfill.
3. Liquefied strength of NAG and PAG tailings is assumed as $Su/\sigma'_{vo} = 0.1$ and Su_{min} (kPa) = 0 kPa.

Summary of Factors of Safety

Analysis Section	Loading Condtion	Calculated Minimum Factor of Safety	Required Minimum Factor of Safety (CDA, GISTM)
South Cell Perimeter Dam Downstream Slope	Long-term steady state seepage condition	1.76	1.5
	Design earthquake (Pseudo-static) loading	1.32	1.1
North Cell Perimeter Dam Downstream Slope	Long-term steady state seepage condition	1.75	1.5
	Design earthquake (Pseudo-static) loading	1.31	1.1

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Bedrock	Bedrock (Impenetrable)							
	GCL	(None)							
	Overburden - Slope	Mohr-Coulomb	20				0	33	0
	PAG Tailings - Slope	SHANSEP	19		0	0.2			
	Rockfill - LEP	Shear/Normal Fn.	22	LEP Lower Bound					0

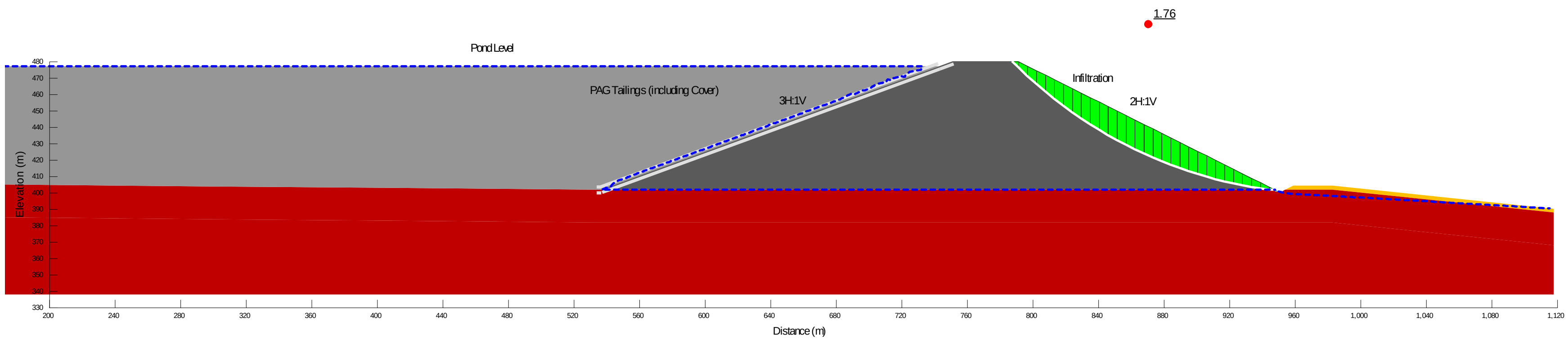

Figure B-1: CDF South Cell Perimeter Dam, Typical Section – Stability Analysis of Long-term Loading Condition

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Bedrock	Bedrock (Impenetrable)							
	GCL	(None)							
	Overburden - Slope	Mohr-Coulomb	20				0	33	0
	PAG Tailings - Liquefied	SHANSEP	19		0	0.1			
	Rockfill - LEP	Shear/Normal Fn.	22	LEP Lower Bound					0

Horz Seismic Coef.: 0.13

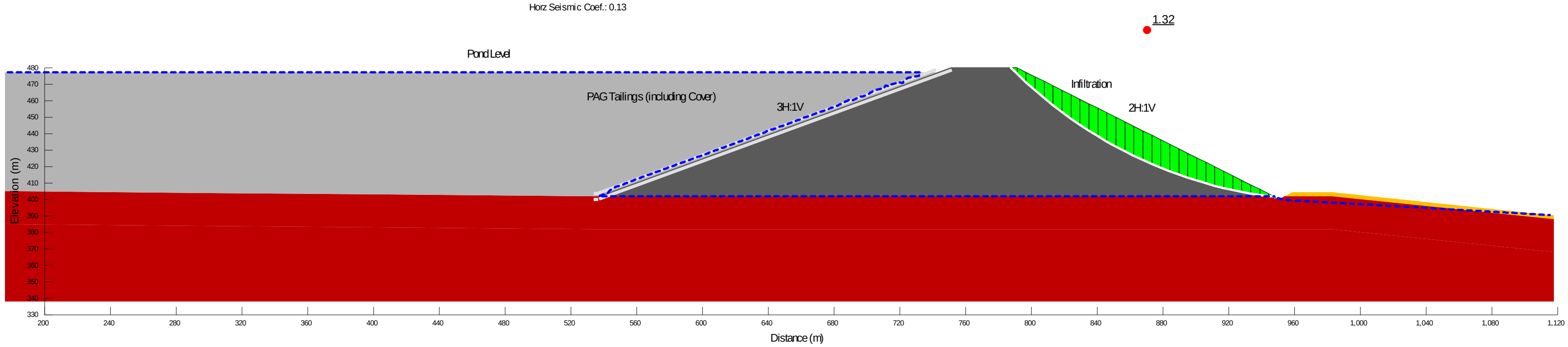

Figure B-2: CDF South Cell Perimeter Dam, Typical Section – Stability Analysis of Design Earthquake Loading (Pseudo-static) Condition

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Bedrock	Bedrock (Impenetrable)							
	Co-minged waste_	Mohr-Coulomb	22				0	30	0
	Overburden_	Mohr-Coulomb	20				0	33	0
	Rockfill_LEP	Shear/Normal Fn.	22			LEP Lower Bound			0
	Tailings_	SHANSEP	19	0	0.2				

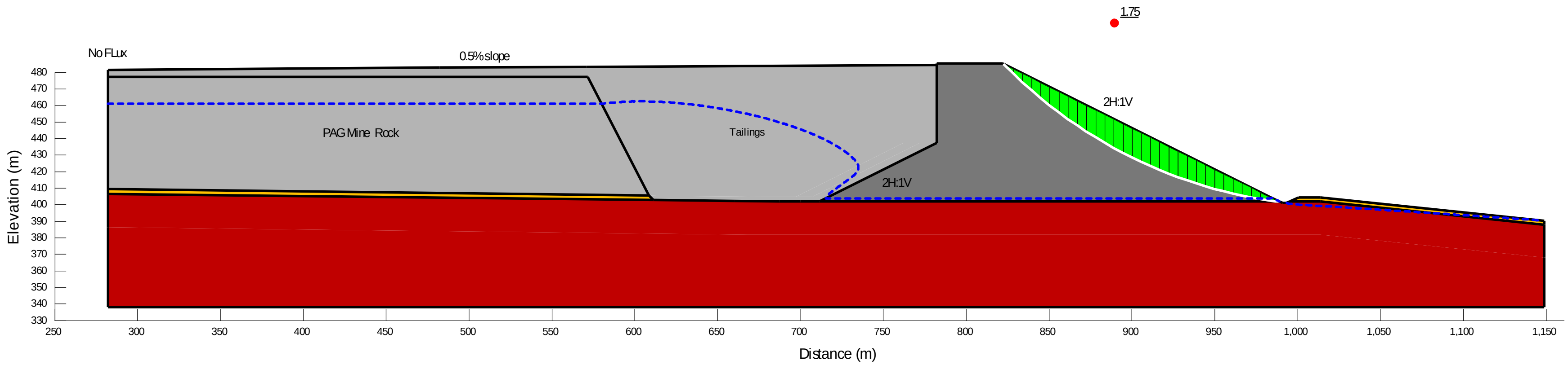

Figure B-3: CDF North Cell Perimeter Dam, Typical Section – Stability Analysis of Long-term Loading Condition

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Bedrock	Bedrock (Impenetrable)							
	Co-minged waste_	Mohr-Coulomb	22				0	30	0
	Overburden_	Mohr-Coulomb	20				0	33	0
	Rockfill_LEP	Shear/Normal Fn.	22			LEP Lower Bound			0
	Tailings_Liquefied	SHANSEP	19	0	0.1				

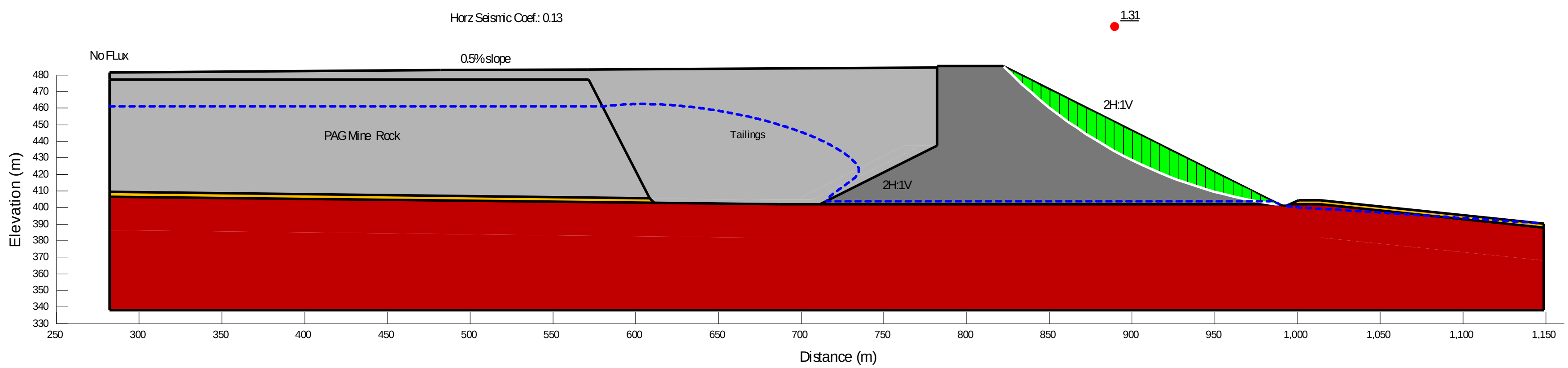

Figure B-4: CDF North Cell Perimeter Dam, Typical Section – Stability Analysis of Design Earthquake Loading (Pseudo-static) Condition