January 23, 2017

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OHS 550122

Mr. Jim Newton
Mining Engineer
BMC Minerals (No. 1) Ltd.
530 - 1130 West Pender Street
Vancouver, BC V6E 4A4

Dear Jim,

Re: Kudz Ze Kayah Pre-Feasibility Study – Class A Storage Facility Stability Assessment

1 – INTRODUCTION

BMC Minerals (No.1) Ltd. (BMC) is currently developing the Kudz Ze Kayah Project (the Project), a proposed copper-zinc-lead-gold mine, to a Pre-Feasibility Study (PFS) level. The Project is located approximately 250 km northeast of Whitehorse, Yukon Territory, Canada.

Knight Piésold Ltd. (KP) is providing overall geotechnical support work for the PFS. Details of the PFS tailings, waste rock and water management designs are presented in KP report VA101-640/02-3.

Dewatered tailings using filter press technology and Strongly Potentially Acid Generating (SPAG) rock will be co-disposed in the Class A Storage Facility. This letter provides preliminary information to support the development of the Class A Storage Facility. The following information is provided:

- Tailings/SPAG rock, construction and foundation material strength parameters and assumptions
- Preliminary static and seismic stability analysis results, and
- General guidelines for reclamation.

2 – PREVIOUS WORK AND BACKGROUND INFORMATION

Previous site investigation and design programs were conducted in the Project area since 1995 by others. This work includes:

- Feasibility Level Geotechnical and Hydrogeological Site Investigation – ABM Deposit by Golder Associates (Golder), January 1996. Seventy-five geotechnical drillholes and eighty-seven test pits completed by Golder and Cominco in 1995 for the proposed mine, storage facilities, tailings storage facility, and millsite locations. The site investigation program included piezometer installations, temperature measurements, and laboratory testing of overburden samples (Theriault, 2015).
- Feasibility Level Mining Geotechnical Design Criteria by Golder Associates, January 1996. This report focused on pit slope design, mine dewatering, and storage facility stability.
- Tailings Embankment Design Report by Golder Associates, October 1996. This report focused on design criteria established from the 1995 site investigation program results.
- Tailings Embankment Design Report – Water License Application by Golder Associates, December 1997.
- Water License Application by Cominco Ltd., December 1997.
- Pre-Feasibility Study for Finlayson Project by Hatch, November 2000. This report summarizes the viability of mining and processing the Kudz Ze Kayah and Wolverine deposits as a single project.
- Tetra Tech 2015 Monitoring Well Program.

KP completed a geotechnical and hydrogeological site investigation, carried out in 2015, which included:

- Drilling and logging of six geotechnical and hydrogeological drillholes, including;
  - Standard Penetration Testing (SPT) in overburden
  - Hydraulic conductivity (Lugeon) packer testing and falling head testing in bedrock

  - Installation of solid PVC pipe for thermistor installation
  - Installation and calibration of four thermistors and data loggers
- Laboratory testing of select soil and rock core samples from drillholes

KP completed a geotechnical and hydrogeological site investigation, carried out during July and August 2016, which included:

- Excavation and logging of 53 test pits
- Drilling and logging of 16 HQ3 geotechnical drillholes including;
  - Standard Penetration Testing (SPT) in overburden
  - Point Load Testing
  - Hydraulic conductivity testing in bedrock
  - Installation of nine thermistor cables
  - Installation of three vibrating wire piezometers
  - Installation of eight monitoring wells and one standpipe piezometer
- Laboratory testing of select soil and rock core samples from test pits and drillholes

Geotechnical data from the 1996 Golder Associates and the 2015 and 2016 KP site investigations were utilized for the Class A PFS design and stability analyses.

3 – DESIGN BASIS

Rock from the open pit excavation will be separated during excavation into Class A rock, Class B rock, and Class C rock and stored in three separate locations. Class A rock will be co-disposed with dewatered tailings in the Class A Storage Facility. The Class A Storage Facility is located on the western hillside of Geona Creek, north of the Mill Site location and is shown in Figures A1 and A2. Table 1 summarizes the Class A Storage Facility design basis.

Table 1 Class A Storage Facility Parameters (KP, 2016c)

Parameter	Value	Source
Rock Tonnage	11.6 t	BMC
Tailings Tonnage	15.1 t	BMC
Rock Density	2.0 t/m^3	BMC
Tailings Density	2.1 t/m^3	Specified by KP based on preliminary tailings testwork
Total Rock and Tailings Volume	15 Mm^3 (approximately 7 Mm^3 rock and 8 Mm^3 tailings)	Calculated value, includes 5% uncertainty allowance for tailings and 15% allowance for rock
Overall Pile Slope Angle	4H:1V	Specified by KP
Crest Elevation	1,495 masl	Specified by KP
Overburden Description	Organic layer 0 - 0.4 m, overlying silty SAND and sandy SILT with varying amounts of gravel and cobbles, well graded, non-plastic to low plasticity, 'compact'.	KP, 2016b
Permafrost	Permafrost was not encountered in the test pits or observed in the thermistors within the Class A facility footprint	KP, 2016a and KP, 2016b
Depth to Bedrock	Bedrock was intercepted at 2.5 m to 5.0 m.	KP, 2016a
Bedrock Description	Weathered and fractured interbedded argillite mudstone, mafic tuff and chlorite calcite schist.	KP, 2016a
Groundwater level (mbgs)	1.0 to 9.0 m	KP, 2016a

Data used to characterize the foundation conditions for the Class A Storage Facility was sourced from the 1996 site investigation data report (Golder 1996), which was completed to support a feasibility level study, and the 2016 Site Investigation program (KP, 2016b).

4 – STABILITY ANALYSIS

4.1 MATERIAL PARAMETERS AND ASSUMPTIONS

Six geotechnical units were defined for the purpose of the stability analysis:

- In Situ Overburden
- Bedrock
- Zone S (Bedding Layer)
- Overliner Drainage Material (Class C Rock)
- Class C Rock, and
- Class A Material (Tailings and SPAG Rock).

Surficial deposits ranged in depth from 0.2 to 10.4 mbgs. The deepest deposits typically occur in the valley bottom and towards the north end of the facility. The shallowest deposits occur at the higher elevations along the valley sides (KP, 2016b). Overburden was modelled as a layer 3 m thick at the higher elevations increasing to 10 m thick at the lower elevations. Overburden was completely removed to bedrock underneath the Class C buttress as per the design concept. Class A material was fully saturated therefore the phreatic surface was modelled at the surface of the facility. Overburden strength parameters were estimated based on the available standard penetration test data from the 2016 Site Investigation program and correlated with typical soil properties for compact gravelly silty sand (Carter and Bentley, 1991 and Look BG, 2007).

Shear strength of the Class C rock fill was defined using a lower bound Leps average that defines the variation with shear strength with normal stress. This strength function is based on published information on the shear strength properties of rockfill (Leps, 1970 and Yanaguchi, 2009).

Class A material was conservatively modelled as tailings only (i.e. without SPAG rock). Tailings strength parameters were based on the 2016 laboratory test results on a single tailings sample (KP, 2016c). Consolidated undrained triaxial tests were completed on the floatation tailings sample at three different confining pressures to determine the peak undrained shear strength over effective vertical stress strength parameter. A 10% reduction was conservatively applied to the laboratory-determined strength to account for variability since preliminary testing involved one sample. The tailings will be placed and compacted in controlled lifts therefore it was assumed the tailings would not liquefy following a seismic event.

Table 2 summarizes the strength parameters defined for the overburden units, construction and waste materials.

Table 2 Overburden, Construction Material and Waste Material Strength Parameters

Material Type	Model	Unit Weight γ kN/m³	Effective Friction ϕ' degrees	Effective Cohesion c' kPa	Tau/Sigma Ratio
In Situ Overburden[1]	Mohr-Coulomb	17	32	0	-
Zone S (Bedding Layer)	Mohr-Coulomb	20	40	0	-
Overliner Drainage Material	Shear/Normal Function (Lower Leps)	19.6	-	-	-
Class C Rock	Shear/Normal Function (Lower Leps)	19.6	-	-	-
Tailings	S=f(overburden)	20.6	-	-	0.55

NOTES:
1. Unit Weight and effective friction angle estimated based on Carter and Bently, 1991 and Look. BG., 2007.
2. Shear strength of waste rock based on Leps (1970) and Yanaguchi (2009). Unit weight is based on values provided by BMC.
3. Effective friction angle and cohesion for frozen soils based on Smith, 1996.
4. A relationship for shear strength and effective vertical stress (S_u/p') was used to model the tailings strength.
5. This assessment does not consider the co-disposal of Class A waste rock with the tailings. It is assumed the strength of the tailings material will govern the stability of the Class A Storage Facility. This analysis will be updated as required during future design phases when the co-disposal strategy is better understood.

The bedrock unit for the stability analyses was modelled using the generalized Hoek-Brown Strength Criteria. This criterion utilizes the Unconfined Compressive Strength (UCS), Geological Strength Index (GSI), intact rock constant m_i of the rock mass to estimate the strength of a jointed rock mass. The density of the rock mass was calculated using open pit excavation tonnage and volume data provided by BMC. Table 3 presents the rock mass parameters used in the stability analysis.

Table 3 Rock Mass Strength Parameters

Material Type	Model	Unit Weight kN/m³	GSI -	UCS MPa	m_i -
Mudstone / Mafic Volcaniclastic	Generalized Hoek-Brown Criteria	25.6	35	25	6

4.2 MODELLING APPROACH

Stability analyses of the Class A Storage Facility were completed using the limit equilibrium computer program SLOPE/W (GeoStudio, 2012).

In accordance with the Canadian Dam Association guidelines (CDA, 2014) and standard industry practice the minimum acceptable Factor of Safety (FOS) for the facility under static conditions is 1.5 during construction and for long term (post-closure) of the storage facility. The model conservatively assumes instantaneous construction to the full height of the facility for this preliminary stability assessment.

A cross section was developed for the stability analysis which intersects through the facility with the highest slope and deepest foundations.

Two scenarios were analyzed:
- Static conditions – End of Construction, and
- Seismic conditions – Post Closure.

The peak horizontal ground acceleration for the 1:2,475-year earthquake event (0.131g) was utilized for the seismic analyses. This value was determined using the 2015 National Building Code of Canada seismic hazard calculator. The pseudo-static approach undertaken in this stability assessment requires a deformation analysis if the pseudo-static FOS is less than unity. The estimated seismically-induced deformations are evaluated against management criteria, such as freeboard, for water-retaining structures.

The cross section for the Class A Storage Facility is presented in Figure 1.

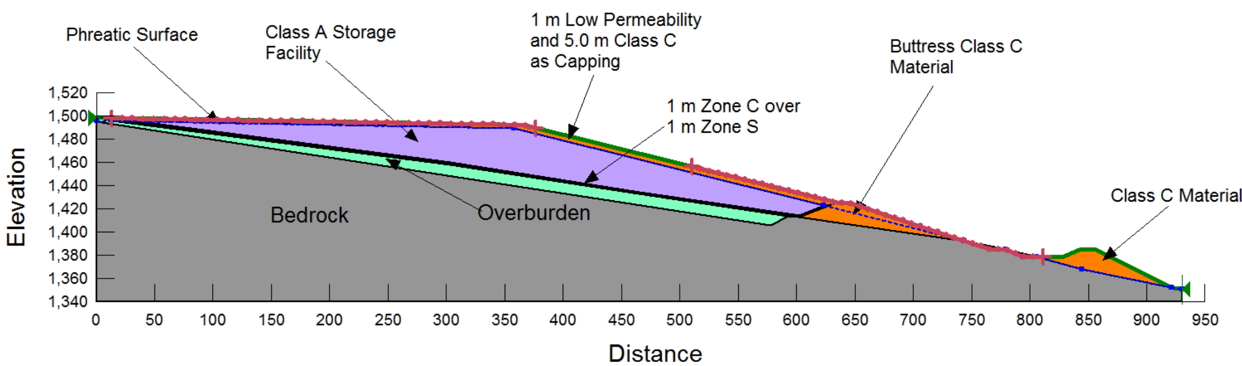

Figure 1 Class A Storage Facility Model (Facing North)

4.3 STABILITY ANALYSIS RESULTS

The calculated FOS for each of the loading conditions considered in this study was found to meet the minimum required FOS. A FOS summary for the cases analysed are presented in Table 4.

Table 4 Limit Equilibrium Stability Analysis Results

Loading Condition	Factor of Safety	
	Minimum Required	Calculated
Static	1.5	1.55
Seismic	n/a – See Note 1	1.01

NOTES:
1. A deformation analysis is required for a factor of safety of less than 1.0 under seismic loading conditions.
2. The stability analyses will be updated as additional tailings testwork is completed.

5 – RECLAMATION

Reclamation of the Class A Storage Facility is required for mine closure. As much as practical the reclamation will be carried out concurrent with mine operations. Reclamation will be conducted in conjunction with on-going environmental monitoring to ensure that sediment control and water quality objectives are met.

The facility will be progressively reclaimed with a low permeability cover material followed by five meters of Class C for frost protection and to improve the overall stability of the facility.

On-going monitoring of the Class A facility will be required for mine closure. The design of the post-closure monitoring program will be developed over the mine life as experience is gained during the construction and operation of the two facilities. On-going monitoring will be defined in the closure design for the Class A facility. The preliminary closure requirements for the Class A facility are expected to include:

- On-going monitoring of surface and groundwater quality and flow rates
- Regular periodic inspection of the waste piles, and
- Deformation monitoring.

This letter presents a summary of the stability analyses undertaken for the Class A Storage Facility for the Kudz Ze Kayah Pre-Feasibility Study.

We trust the information contained herein meets your needs at this time. Should you require additional information please contact the undersigned.

Yours truly,
Knight Piésold Ltd.

PROFESSIONAL
YUKON
L.J. GALBRAITH
TERRITORY
ENGINEER
23/17

Prepared: for Janine O'Dea, P.Eng.
Intermediate Engineer

Reviewed: Les Galbraith, P.Eng.
Specialist Engineer | Associate

Approval that this document adheres to Knight Piésold Quality Systems:

Attachments:

Figure A1 Rev 0	Class A Storage Facility – Plan
Figure A2 Rev 0	Class A Storage Facility – Sections and Details

References:

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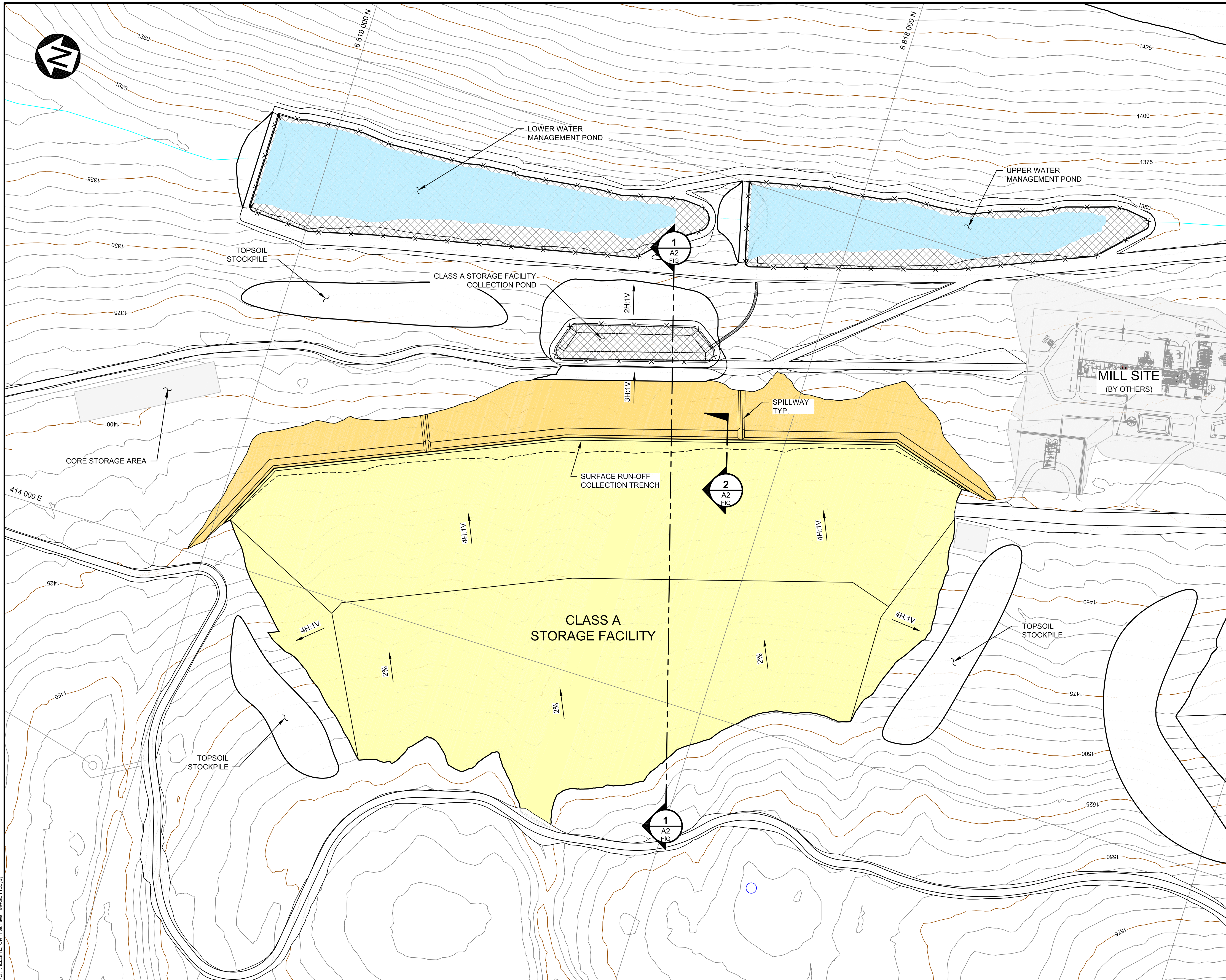

PLAN
SCALE A

NOTES:

1. COORDINATE GRID IS UTM NAD 83 9N.
2. TOPOGRAPHIC DETAIL BASED ON INFORMATION PROVIDED BY BMC FEBRUARY 02, 2016.
3. CONTOUR INTERVAL IS 5 METRES.
4. ALL ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

SCALE A 80 40 0 100 200 300 400 m

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0	20JAN'17	ISSUED WITH LETTER	JTO	KJM	LJG
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED

BMC MINERALS (NO. 1) LTD.

KUDZ ZE KAYAH PROJECT

CLASS A STORAGE FACILITY PLAN

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-640/2	VA17-00109

FIGURE A1 REV 0

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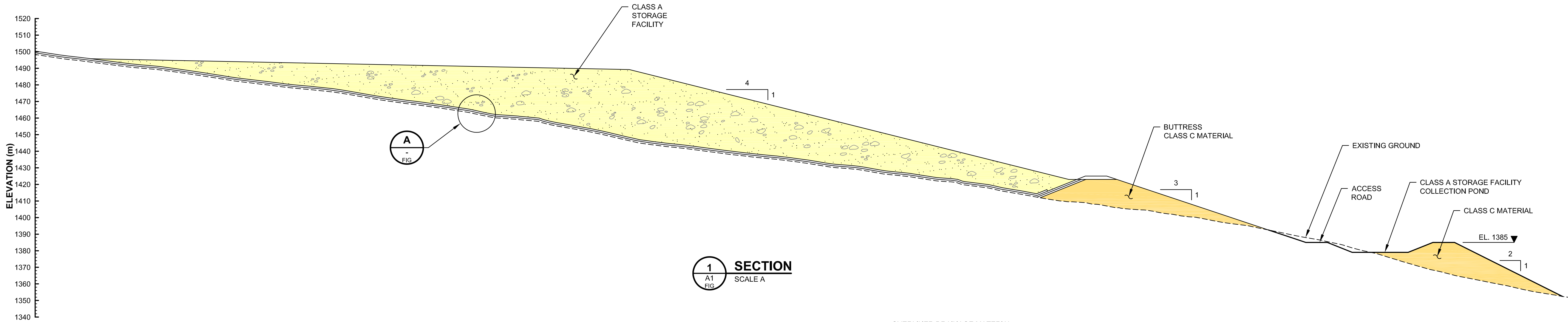
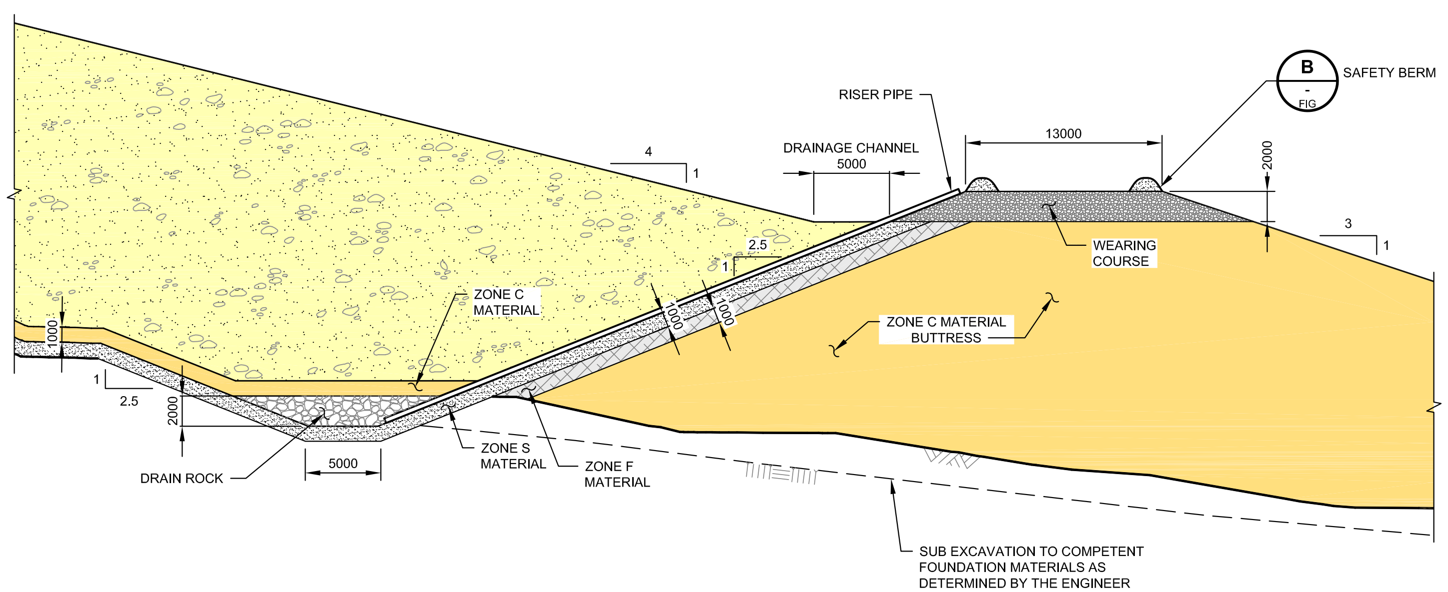
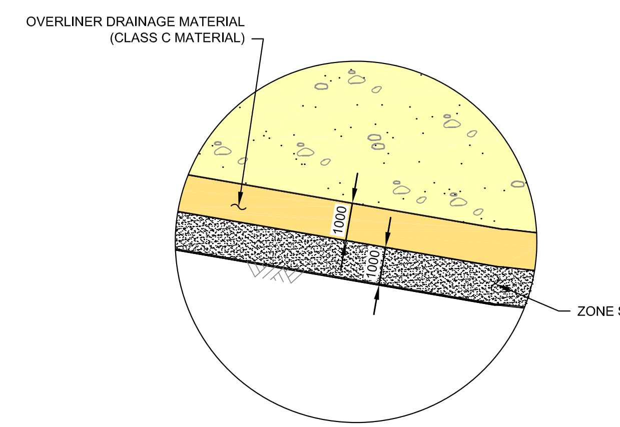


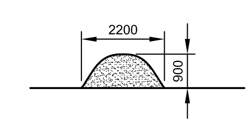
1 A1 FIG **SECTION**
SCALE A



2 A1 FIG **SECTION**
SCALE B



A - FIG **DETAIL**
NTS



B - FIG **DETAIL**
SAFETY BERM
NTS

LEGEND:

- CLASS A MATERIAL
- CLASS C MATERIAL
- DRAIN ROCK
- ZONE F
- ZONE S (BEDDING LAYER)
- WEARING COURSE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS IN METRES, UNLESS NOTED OTHERWISE.
2. PROGRESSIVE RECLAMATION NOT SHOWN.

SCALE A 25 12.5 0 25 50 75 100 125 m
SCALE B 5 2.5 0 5 10 15 20 25 m

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KUDZ ZE KAYAH PROJECT

CLASS A STORAGE FACILITY SECTIONS AND DETAILS

Knight Piésold CONSULTING

P/A NO. VA101-640/2 REF NO. VA17-00109

FIGURE A2 REV 0

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