IDM MINING LTD.
RED MOUNTAIN PROJECT



TAILINGS BEST AVAILABLE TECHNOLOGY ASSESSMENT

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VA101-594/4-1
Rev 1
August 29, 2017

IDM MINING LTD.
RED MOUNTAIN UNDERGROUND GOLD PROJECT

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Rev	Description	Date
0	Issued in Final	June 30, 2017
1	Issued with updated Section 3.4 and References. Added Appendix D.	August 29, 2017

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EXECUTIVE SUMMARY

The Red Mountain Underground Gold Project (the Project) is a proposed gold mine being developed by IDM Mining Ltd. (IDM). The Project is located approximately 18 km east-northeast of Stewart, BC. This report presents a tailings Best Available Technology (BAT) assessment to support the Feasibility Study (FS) and Environmental Assessment Application (EAA) for the Tailings Management Facility (TMF). The assessment incorporates the results from the TMF Location Assessment Study undertaken in February 2016, which identified the Bromley Humps Upper Site as the preferred TMF location.

The proposed mine includes a mill throughput of 1,000 tonnes per day over a 6 year mine life for a total ore production of 1.95 million tonnes. The mill tailings will be delivered to the TMF in a single stream. Test results indicate the tailings are potentially acid generating and will become metal leaching after approximately 20 years of exposure to atmospheric conditions (oxidation).

The BAT assessment considered the following three tailings technologies and management strategies for the Bromley Humps TMF:

- Candidate 1: Thickened Tailings
- Candidate 2: Ultra-thickened Cemented Tailings, and
- Candidate 3: Filtered Tailings.

Environmental, technical, social and economic assessment criteria were considered in the assessment. Each criteria was assigned a relative weight according to its importance in its specific category. Higher weights indicate greater relative importance and reflect the site conditions and issues relative to the proposed development. The weightings were developed by KP with input from IDM, JDS Energy & Mining Inc. (JDS) and Brownhill Consulting Services (BCS). Ratings were developed to compare the criteria. General ratings of “Preferred”, “Acceptable” and “Least Preferred” were assigned to the site specific criteria of each candidate. Scores of 3, 2 and 1 were associated with the ratings, respectively.

The weighted results of the assessment are as follows:

- Candidate 1 (Thickened Tailings) had the highest rating of the three alternatives, achieving a weighted score of 1.39
- Candidate 2 (Cemented Tailings) had the second highest score of 1.30, and
- Candidate 3 (Filtered Tailings) had the lowest score of the three alternatives with a score of 1.26.

The BAT assessment recommends Candidate 1: thickened tailings management. The main factors for this conclusion are as follows:

- The tailings deposition and water management strategy is operationally simpler than the other candidates.
- Process and runoff water is contained within the same facility. Water for mill reclaim and surplus water treatment and release is sourced from the supernatant pond in the TMF.
- No additional mill processes are required.
- There is a lower risk of operational problems (complications due to climactic conditions, etc.).
- A greater ability to mitigate ARD/ML generation potential with continuous tailings deposition, wetting of the beach surface and maintenance of a pond within the facility.

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ABBREVIATIONS

Acid Rock Drainage	ARD
Best Available Technology	BAT
Brownhill Consulting Services	BCS
British Columbia	BC
Environmental Assessment Application	EAA
Feasibility Study	FS
IDM Mining Ltd.	IDM
JDS Energy & Mining Inc.	JDS
Knight Piésold Ltd.	KP
Liquid Limit	LL
Mean Annual Precipitation	MAP
Metal Leaching	ML
Meters above sea level	masl
Million tonnes	Mt
Non Potentially Acid Generating	non-PAG
Potentially Acid Generating	PAG
Positive Displacement	PD
Preliminary Economic Assessment	PEA
Plasticity Index	PI
Plastic Limit	PL
Qualitative Multiple Accounts Assessment	QMAA
Red Mountain Underground Gold Project	the Project
SRK Consulting	SRK
Tailings Management Facility	TMF
Tonne per day	tpd
Tonnes per cubic metre	t/m^3

1 – INTRODUCTION

1.1 GENERAL

The Red Mountain Underground Gold Project (the Project) is a proposed gold mine being developed by IDM Mining Ltd. (IDM). The Project is located approximately 18 km east-northeast of Stewart, BC. This report presents a tailings Best Available Technology (BAT) assessment to support the Feasibility Study (FS) and Environmental Assessment Application (EAA) for the Tailings Management Facility (TMF). The BAT assessment builds upon the tailings management concepts developed in the '*Waste and Water Management Design for Preliminary Economic Assessment'* that was prepared Knight Piésold Ltd. (KP) in June 2016 (KP, 2016a) in support of the Preliminary Economic Assessment (PEA). The BAT assessment also incorporates the results from the TMF Location Assessment Study (KP, 2016b) undertaken in February 2017, which identified the Bromley Humps Upper Site as the Preferred TMF Location.

The proposed mine includes a mill throughput of 1,000 tonnes per day (tpd) over a six year mine life for a total ore production of 1.95 million tonnes (Mt). The mill tailings will be delivered to the TMF in a single stream. Test results indicate the tailings are potentially acid generating (PAG) and will become metal leaching (ML) after approximately 20 years of exposure to atmospheric conditions (oxidation).

1.2 SCOPE

This report summarizes the tailings characterization test results and the BAT assessment for the Project. The assessment is based on the current mine design and operating criteria, and considers the Project setting and tailings test results. The report may be updated as the Project progresses through permitting and design and as additional information becomes available.

The BAT assessment does not include or address management of waste rock material. This will be undertaken by JDS Energy & Mining Inc. (JDS) who are leading the ongoing feasibility studies and are responsible for management of the waste rock material on site.

1.3 PROJECT DESCRIPTION

The Project deposit is located in Red Mountain Cirque, at elevations ranging between 1,500 and 2,000 meters above sea level (masl). The proposed TMF and process plant site are situated in the Bitter Creek valley, at the Bromley Humps area, approximately 7 km northwest of the underground portal, at elevations ranging between 400 and 500 masl.

The Project site is characterized by rugged, steep terrain with sparse overburden cover, prevalent bedrock outcrops and weather conditions typical of the north coastal BC mountains. Climatic conditions at Red Mountain are dictated primarily by its altitude and proximity to the Pacific Ocean. Temperatures are moderated year-round by the coastal influence. The region is characterized by high precipitation with a mean annual precipitation (MAP) of 1,847 mm. Over one-third of the annual precipitation falls as snow. This proportion is greater at higher elevations. Avalanches are a concern in the Bitter Creek drainage, where the TMF is situated. The heavy snowfall, steep terrain and frequent windy conditions are important considerations for tailings and water management.

The water balance conducted for the FS and EAA indicates there is sufficient water to meet the mill requirements without the need for additional make-up water. A water surplus in the range of 0.2 to 0.3 million m^3 per year was estimated based on a range of annual precipitation values (KP, 2017a).

1.4 TMF LOCATION ASSESSMENT

KP conducted a TMF location assessment to identify the preferred TMF location in February, 2016 (KP, 2016b).The assessment was completed with input from JDS and considered factors such as mine planning and infrastructure, tailings storage capacity, future expansion potential, and embankment configuration. The assessment results are attached as Appendix A.

The location assessment considered the use of conventional slurry tailings as the tailings technology base case. The assessment identified nine TMF options in eight different sites. Three alternatives failed the Phase 1 pre-screening and were eliminated from contention. The remaining six TMF locations, described below, were advanced to the Phase 2 trade-off and comparison assessment.

Option 1 – Cirque TMF (JDS PEA Option)

The Cirque TMF is located in the Red Mountain Alpine Area between the Cambria Ice fields and the Bromley Glacier. The area has an average elevation of approximately 1,500 m and has little vegetation. Foundation conditions consist mainly of talus deposits overlying fractured bedrock. Due to the relatively poor topographical conditions for impoundment capacity and dam construction, a large dam is required to provide sufficient storage. There are also concerns related to weather and snow accumulation for this option. This location was used in the 2014 Preliminary Economic Assessment.

Option 2 – Top of Cirque TMF

The Top of Cirque TMF site is located in the Red Mountain Alpine Area. The facility is located at approximate El. 1700 m above the Option 1 (Cirque) TMF. The steep topography requires an extremely large dam and results in very poor storage efficiency for tailings. There are also concerns related to weather and snow accumulation for this option. This area was originally considered a possible option due to the close proximity to the portal.

Option 5A and 5B – Bromley Humps TMF (Formerly Otter Creek Upper and Lower TMF)

The Bromley Humps TMF site is located along the north bank of Bitter Creek adjacent to the confluence of Otter Creek and Bitter Creek at an approximate elevation of 450 m. Topographically this area is a more efficient tailings storage site. An additional cell downstream of the North TMF Embankment provides additional expansion potential. The Bromley Humps TMF is more protected and winter operations are expected to be safer and more reliable at this location.

Option 6 – Roosevelt Creek TMF

The Roosevelt Creek TMF site is located on a terrace along the north bank of Bitter Creek at approximate El. 350 m. The topography slopes at approximately 20-25% and a large dam would be required to provide storage. The terrace consists of an outwash deposit of permeable sandy gravel with cobbles and boulders. The site has a potential for avalanches and debris slides. The site is currently not within the Project’s environmental baseline study boundary.

Option 7 – Highway TMF

The Highway TMF is located where Bitter Creek merges with Bear River, and is adjacent to Clements Lake. Clements Lake is Provincial Park and the TMF site is currently not within the Project's environmental baseline study boundary.

Results

The TMF location assessment identified that Option 5A, the Bromley Humps Upper TMF, is the preferred location for storage of tailings. This option is advantageous for the following reasons:

- Located at a lower elevation, therefore more favourable climatic conditions. Winter operations are expected to be safer and more reliable at a lower elevation.
- Clear from the Otter Creek avalanche path.
- Provides the best storage efficiency of the alternatives.
- Mill and TMF are in close proximity to each other (approx. 500 m), with Mill at a higher elevation than the TMF resulting in lower energy requirements for pumping.
- More favourable water management strategies compared to other options (deep groundwater levels, favourable topography for non-contact water diversion, etc.)
- Could be developed in combination with Option 5B, the lower TMF impoundment, for additional capacity.
- Geotechnical and Hydrogeological Site Investigations in the area were completed in 2016 by KP and in 1996 by Golder Associates in this area.
- TMF and Mill location is advantageous from a construction schedule and project execution standpoint. Construction could begin on the Mill and TMF while the road between Otter Creek and the mine is being constructed.
- Lower capital, sustaining and operating costs than other options.

2 – TAILINGS PROPERTIES AND CHARACTERISTICS

2.1 GENERAL

Tailings samples for testing were generated from metallurgical testwork on ore samples from two zones within the deposit: the Marc and AV zones. Geotechnical testing was conducted on tailings samples at the KP Soils Laboratory in Denver, Colorado, and tailings filtration testwork was completed by Tenova TAKRAF in Burnaby, BC.

2.2 TAILINGS TESTING DESIGN CRITERIA

Milling will be conducted at a production rate of 1,000 tpd (year round). JDS conducted a mill process optimization that identified a mill grind size of 25 µm (i.e. 80% passing the No.500 (25 micron) sieve) as the preferred grind.

The tailings testwork assumed the tailings are thickened at the mill to a slurry solids content of 50% by weight before being pumped to the TMF. The tailings will be conveyed in a single overland pressure pipeline and discharged from the TMF embankments via spigoted offtakes.

2.3 TESTWORK SUMMARY

2.3.1 Geotechnical Testwork Summary

The geotechnical testing program was conducted to evaluate the physical characteristics of the tailings materials. Testing was completed on two tailings samples provided by JDS: AV Master Comp and Marc Master Comp. The test program included index testing to enable geotechnical classification of the materials, and slurry settling, air drying and consolidation testing to determine the characteristics of the tailings following deposition for a range of possible field conditions.

The index test results were similar for both samples and the tailings can be generally described as an inorganic silt with low plasticity (PL = 25, LL = 30-31, PI = 5-6). The specific gravity of the tailings solids was determined to be 3.095 for the AV tailings, and 3.031 for the Marc tailings.

Slurry settling (or sedimentation) tests provide an estimate of the density the tailings slurry will settle in a sub-aqueous environment, under undrained and drained conditions. The tests provide an indication of the tailings dry density achieved in the TMF after settling and before any significant consolidation or air drying occurs. Air drying tests were carried out on tailings samples to estimate the effect of air drying after initial slurry settling and removal of supernatant water. Slurry consolidometer tests were carried out to provide information on the consolidation, compressibility and permeability characteristics over a wide range of confining stresses corresponding to expected field conditions. The tests were completed on the AV and Marc tailings at a design solids content of 50%.

A complete report on the results of the geotechnical testing program is included in the Project FS.

2.3.2 Consolidation Modelling

Consolidation modelling was completed using a one dimensional finite difference computer model and the results from the geotechnical test program. The model predicts the magnitude and rate of tailings consolidation, the amount of consolidation seepage (i.e. water losses from the tailings mass) and the corresponding average dry density of the tailings mass. Each model was completed assuming both a fully drained base and an impermeable base. Outputs from tailings consolidation modelling can be used to refine embankment height requirements, provide input to the tailings deposition strategy to correspond with operational and closure objectives, and facilitate water management planning, operational water balance modelling, watershed modelling and associated water chemistry predictions.

Results of the consolidation modelling indicate the average dry density of the tailings mass increases over time, from approximately 1.21 tonnes/m^3 at Year 1, to 1.30 tonnes/m^3 at the end of operations, and 1.36 tonnes/m^3 at the beginning of the reclamation period (i.e. 2 years post-operations). Post closure consolidation of the tailings is estimated to reduce the average thickness of the tailings mass by less than 1 m.

Consolidation modelling was completed based on the TMF layout, design, and tailings deposition strategy from the Feasibility Design of Tailings and Water Management by KP (KP, 2017b). This assumes that conventional thickened tailings were discharged from the embankments.

2.3.3 Tailings Thickening Testwork

A laboratory testing program was conducted by Tenova TAKRAF to confirm the filtration characteristics, suitability for filtered tailings, and to determine the pre-leach thickener parameters.

The thickening tests, which were undertaken to determine the pre-leach thickener required for the system, included:

- Flocculent preparation and screening
- Settling
- Compaction
- Rheology
- Dynamic thickening, and
- Static thickening.

Thickener testwork and Delkor methodology for thickener selection considers three zones operating in a thickener:

1. Clarified Liquor Zone
2. Settling Zone, and
3. Compaction Zone.

The testwork concluded that a thickener of diameter 18 m with a tank wall of 3 m and slope of 9° would be required to achieve the desired solids content and water recovery in the thickener underflow.

2.3.4 Filtration Testwork

The pressure filtration testwork consisted of preparing a filter cake through a three-stage process. Cake washing, an optional fourth stage, was not considered for this program. The three stages included:

1. *Filling and dewatering stage:* Feed slurry is introduced to the filter press by the feed pump. Solids are trapped by the filter cloth and filtrate is discharged via a plate drainage grid connected

to the corner ports. The filtration rates and final cake moisture contents can be optimized by increasing the feed pressure produced by the feed pump.

2. *Membrane squeezing stage (membrane filter press only):* This is a mechanical squeezing of the filter cake formed in the chamber through the use of air or water. The cake is compressed when a rubber membrane bulges with water/air and pressed against the cake, reducing cake volume to create space for air drying/air blowing. Filter cakes are squeezed up to 16 bar pressure based on the application.
3. *Air blowing stage:* This is the final dewatering stage to remove entrained water between interstitial particles that cannot be removed by mechanical squeezing. Compressed air is blown through the cake in the filtrate channel. Regulation of the blowing medium is controlled by blowing pressure and time. The cake is kept compressed by membranes during blowing to avoid cracks in the filter cake.

The following design parameters were developed by Tenova TAKRAF from the testwork results:

- Filtered tailings dry density: 1.72 t/m3
- Feed filling pressure: 6-10 bar
- Filtration pressure: >10 bar
- Filtration time: 6 minutes (includes fill time)
- Air blowing pressure: 10 bar
- Air blowing time: 4 minutes, and
- Estimated total cycle time: 15.57 minutes.

The testwork concluded that Project tailings were suitable for filtered tailings production using a recessed plate filter press design. The press would consist of a 1,500 mm plate of depth 40 mm with 99 chambers for filter cake production.

3 – TAILINGS TECHNOLOGY ASSESSMENT

3.1 GENERAL

This section evaluates the BAT for tailings management at Bromley Humps TMF location. The BAT can be defined as the most suitable, site specific tailings technology and management strategy for the Project based on the tailings characteristics and the TMF location. The overall objective of the BAT Assessment is to identify "*the site specific combination of technologies and techniques that most effectively reduce the physical, geochemical, ecological and social risks associated with tailings storage during all stages of operation and closure*" (BC MEM, 2016).

3.2 PAG CLASSIFICATION

Potentially Acid Generating (PAG) tailings require additional care to manage the acid generation potential. Geochemical testing of the tailings, conducted by SRK, indicate the tailings are PAG and are anticipated to become Metal Leaching (ML) after approximately 20 years of exposure to oxidation. Tailings are still acceptable for sub-aerial disposal; however, maintaining a degree of saturation will be important to mitigate the acid generation risk. Saturation can be achieved through management of the TMF supernatant pond or application of new layers of tailings to prevent prolonged oxidation of the exposed beach.

3.3 TAILINGS TECHNOLOGIES

Mine tailings are described by their approximate solids content at delivery. Tailings can be produced according to a range known as the tailings continuum, shown on Figure 3.1.

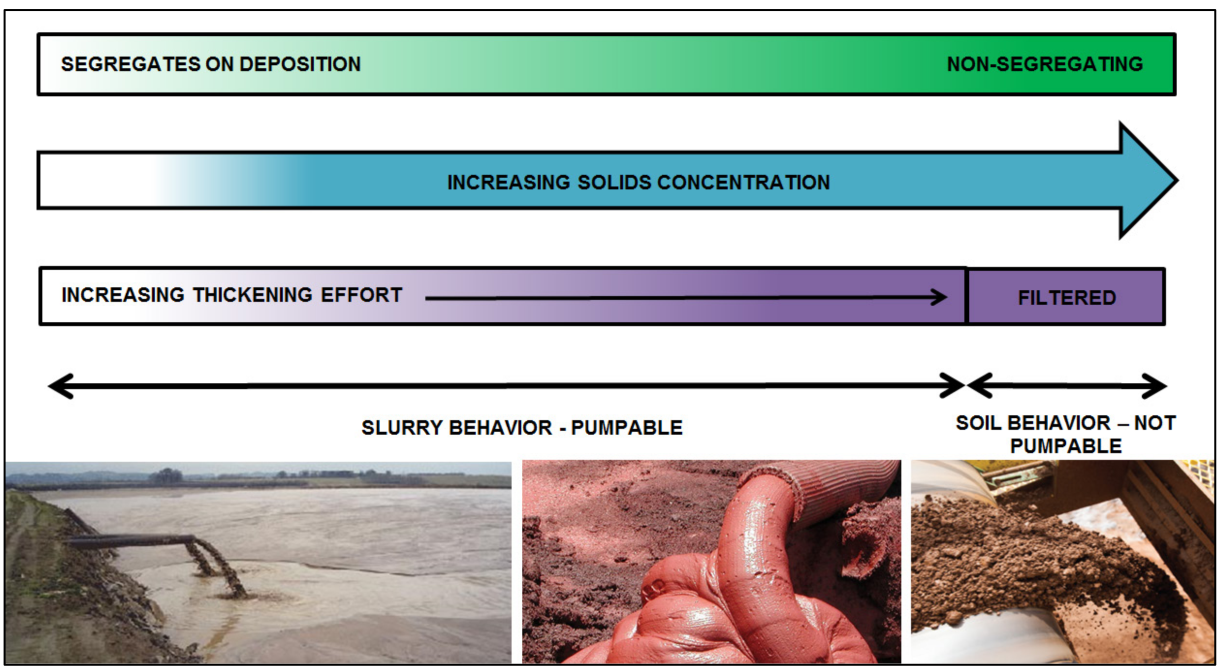

Figure 3.1 Tailings Continuum

The continuum qualitatively describes the tailings solids content, the thickening effort (and/or dewatering effort) required, the method of conveyance, and segregation potential of the tailings.

Certain points within the tailings continuum are recognized as “tailings technologies” for this assessment. The five tailings storage technologies discussed in this section include:

- Conventional Slurry Tailings
- Thickened Slurry Tailings
- Ultra-Thickened (Paste) Tailings
- Cemented Tailings, and
- Filtered Tailings.

3.3.1 Conventional Slurry Tailings

Conventional slurry tailings are discharged from the mill at about 20 to 35% solids (by weight). The tailings may be pumped by centrifugal pumps, flow by gravity, or a combination thereof. Slurry is discharged through off-takes along the embankments or around the perimeter of the TMF to optimize basin filling and control the location of the supernatant pond. Segregation occurs in the tailings, with coarser particles settling out near the discharge points to form tailings beaches, while the fines are transported further. Supernatant water and runoff are reclaimed for processing.

Subaqueous deposition of conventional slurry tailings is commonly used for tailings which are PAG to preclude oxidation. Subaqueous disposal typically incorporates point discharge of slurry tailings beneath the supernatant pond water surface. The concept is that tailings solids settle on the bottom of the TSF and remain under a water cover in perpetuity.

Conventional slurry tailings disposal is well suited to project sites that operate with a surplus water balance and for facilities that contain PAG or ML waste materials that require saturation to prevent adverse chemical reactions. The largest costs associated with conventional slurry tailings disposal are associated with embankment construction, lining systems, and water management, including diversions and water reclaim systems. Although conventional slurry is the most water intensive tailings disposal option, it is operationally the simplest method provided water management is addressed adequately.

3.3.2 Conventional Thickened Tailings

Thickening is used to increase the solids content to a solids content of approx. 40 to 55% by weight. The excess process water generated during the thickening process is typically reused in the mill. Thickened tailings can be transported in smaller diameter pipelines for the equivalent mill throughput, but may require greater pumping pressures. Centrifugal pumps are typically used; however booster pump stations may be required with higher densities and longer pipelines. Tailings deposition is similar to conventional slurry tailings. Supernatant water and runoff is reclaimed from the TMF supernatant pond for processing.

Capital costs for tailings transport and water reclaim systems may be lower than for conventional slurry tailings; however the cost of the thickeners and tailings pumps must be considered and may offset the capital cost savings related to pipeworks. Operating costs are typically higher due to thickener maintenance, the addition of flocculants, higher pump energy requirements, etc. Thickened tailings are appropriate for sites that require extensive pumping, or sites that require more water conservation.

3.3.3 Ultra-Thickened (Paste) Tailings

The ultra-thickened tailings technology requires additional thickening or additives to increase the solids content to about 60 to 75% by weight. Ultra-thickened tailings are sometimes referred to as paste tailings; however the term paste is only relevant if certain yield stress criteria are met.

Ultra-thickening results in greater water recovery at the mill and less water delivered to the TMF. The tailings flowrate is less and therefore conveyed in smaller pipeline sizes, however greater pumping pressures may be required and positive displacement (PD) pumps are typically used. Reclaim pumping requirements are usually low because less water is delivered to the TMF with the tailings. A separate water management pond is likely required for a ultra-thickened tailings facility for management of storm water from the TMF.

Capital costs for tailings pipelines may be lower than for thickened or conventional tailings; however, the cost of additional thickening/flocculants and tailings pumps must be considered. PD pumps are significantly more expensive to purchase in comparison to the centrifugal pumps. Operating costs are typically higher for an ultra-thickened tailings system when compared to thickened or conventional tailings disposal.

Ultra-thickened tailings are most appropriate for sites that operate in a significant water deficit and require a high level of water conservation, i.e. where water supply is significantly limited or prohibitively expensive.

3.3.4 Cemented Tailings

A variation of ultra-thickened tailings is cemented tailings, which utilize cement, fly ash or slag additives to create a non-flowable, low permeability tailings mass once the tailings are deposited and have settled. Cemented tailings are typically deposited as underground backfill for mining stopes and voids.

Cemented tailings with higher slurry solids content are produced in gravity thickeners (paste plant) with the addition of flocculants to increase the rate of sedimentation and enhance liquid-solids separation. A large proportion of the recoverable process water is reclaimed in the thickeners and the remaining tailings are mixed with cement, fly ash or slag and transported to the TMF by pumping.

PD pumps are required to transport ultra-thickened cemented tailings. These pumps are significantly more expensive to purchase in comparison to the centrifugal pumps typically used for conventional slurry or thickened tailings delivery. A separate water management pond is likely required for a cemented tailings facility for management of storm water from the TMF.

3.3.5 Filtered Tailings

Mechanical dewatering of tailings can be used to remove process water to a point at which the tailings behave like a soil. A partially saturated filter cake is developed for disposal in a filtered tailings stack. Mechanical dewatering of the tailings can be achieved through a variety of technologies including vacuum and pressure filtration processes. Filtered tailings are typically dewatered to a moisture content of approximately 15% and placed and compacted in thin lifts. Filtering and transport of dewatered tailings by conveyor or haul truck can be costly in comparison to pipeline disposal of tailings slurry. In addition, a contingency alternative method for tailings discharge is required (i.e. pipeline system and/or emergency dump pond in the event of a filter system failure).

Depending on the angle of repose of the final filtered tailings, confining berms and buttresses may be required to construct the filtered tailings stack. In some cases, full TMF embankments may be required to contain the filtered tailings in a safe and efficient manner.

A separate water management pond is required to store process water and storm water runoff from the surface of the TMF as the water cannot be stored on the filtered tailings in order to maintain the mass in an unsaturated condition. The water management pond must be large enough to manage storm water runoff and to provide a buffering volume for fluctuations in process water requirements and periods of low rainfall and/or runoff, such as during winter operations.

A key requirement for filtered tailings is maintaining the stack in a relatively dry (unsaturated) condition, which is a challenge in wet environments. Continued snow removal would be required during the winter months to allow for on-going tailings placement and to reduce the impacts of snowmelt during the freshet period. Excessive moisture may be present in the stack and can result in high pore pressures with stability problems. The operational complexity and high capital and operating costs, coupled with the risks of reactive tailings management, are critical issues that may require additional design measures.

3.4 ALTERNATIVES ASSESSMENT CANDIDATES

The following three points on the tailings continuum were selected for evaluation in the BAT Assessment.

- ***Candidate 1 – Conventional Thickened Tailings (current design and base case) –*** Thickened tailings delivered in one stream to a lined TMF.
- ***Candidate 2 – Ultra thickened Cemented Tailings –*** Ultra-thickened cemented tailings delivered in one stream to a lined TMF.
- ***Candidate 3 – Filtered Tailings –*** Tailings trucked, placed and compacted in thin lifts, forming a tailings stack.

Two of the tailings continuum points identified in Section 3.3, Conventional slurry and Ultra-thickened (without cement), were not included in the assessment. Conventional slurry tailings was excluded as the mill process optimization study identified a tailings solids content of 50% (thickened slurry) could be achieved using the regular mill process. Pumping tailings at a lower solids content and higher flowrate was therefore considered inefficient. Ultra-thickened tailings (without cement) was not included in the assessment due to the operating and processing similarities with the ultra-thickened cemented tailings alternative. Ultra-thickened cemented tailings was preferred for inclusion in the assessment due to its increased performance as a non-flowable, non-segregating mass.

The use of paste tailings as backfill for the underground mine workings was also considered in a separate assessment (KP, 2017c). This assessment concluded that paste tailings backfill was not a viable candidate for tailings disposal at the Project. The assessment and results of the assessment are provided in Appendix D.

3.4.1 Candidate 1: Conventional Thickened Tailings

Candidate 1 is a conventional thickened tailings impoundment. The tailings are gravity thickened as part of the routine mill circuit to approximately 50% solids by weight and subsequently delivered to the TMF in a single overland pipeline.

The tailings material segregates upon deposition with the coarsest particles settling near the discharge spigots and finer particles settling farther downslope on the tailings beaches. The sub-aerially deposited tailings will form a beach with a slope of approximately one percent near the discharge points. Finer tailings particles are carried out to the supernatant pond in suspension and settle over time. The sub-aqueous portion of the beach will have an initial slope ranging between three to five percent, gradually becoming flatter. The continuous discharge and deposition of new layers of tailings on the beach surface promotes wetting of the tailings mitigating acid generation potential.

Water released from the thickened slurry will accumulate in the lowest area of the TMF forming the supernatant pond. The size of the supernatant pond requires management to provide adequate retention time to allow finer tailings particles to settle out before the water is pumped back to the site for reuse. The pond also promotes saturation of the tailings that limits tailings oxidation and acid generation. Seepage from the facility will be managed with a low-permeability geosynthetic liner, a basin underdrain system, and a foundation drain system.

The lined facility is expanded using the downstream embankment construction method with material from local borrow sources. The pond is kept away from the embankments using selective tailings deposition to develop beaches adjacent to the embankments. The tailings beaches enhance stability and reduce potential seepage from the TMF.

The closure plan includes removal of the supernatant pond and installation of a closure cap with a geosynthetic liner to preclude oxidation, therefore limiting acid generation potential. The closure plan also includes a graded waste rock or overburden cover to promote all run-off through spillways constructed in the embankments, and a revegetated topsoil cover on the final graded closure cover.

Basic design criteria for Candidate 1 are summarized below:

- Design solids content: 50% solids by weight
- Average dry density: 1.3 t/m^3, and
- TMF tailings volume: 1.5 Mm^3.

A preliminary general arrangement for Candidate 1 is presented in Figure 3.2.

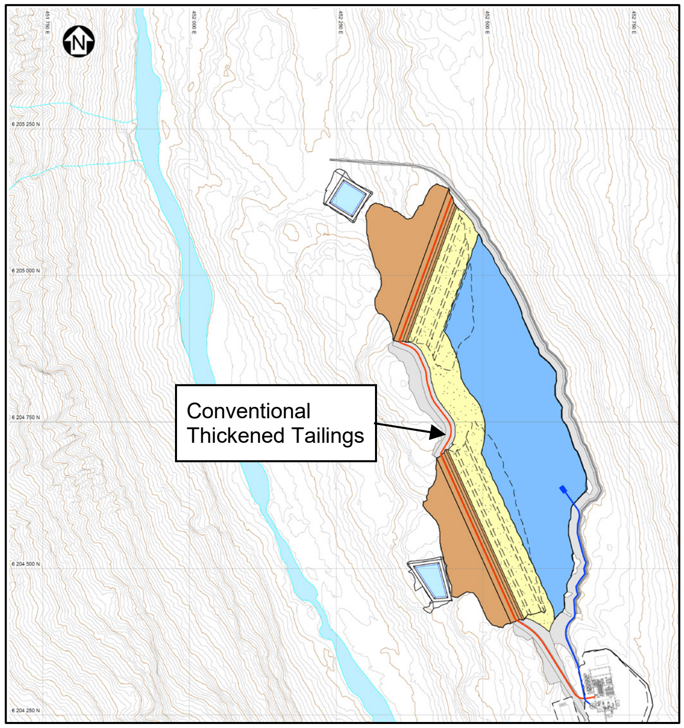

Figure 3.2 General Arrangement - Candidate 1 Conventional Thickened Tailings

Advantages of Candidate 1 include:

- A simplified mill process. A pre-leach thickener recovers water for re-use in the mill.
- A simplified tailings deposition and water management strategy. The process water is contained within one facility and used for mill reclaim.
- A lower risk of operational problems due to climatic factors (snow and cold weather).
- A greater ability to mitigate ARD/ML generation potential with continuous tailings deposition, wetting of the beach surface and maintenance of a pond within the facility.

Disadvantages of Candidate 1 include:

- Thickened tailings may be mobilized in the event of a dam failure, and could impact the downstream environment
- Trafficability on the TMF for closure capping will be more challenging, and
- A surplus TMF water balance requires active management of excess water in the supernatant pond.

3.4.2 Candidate 2: Ultra-thickened Cemented Tailings

Candidate 2 is an ultra-thickened cemented tailings impoundment. The tailings are thickened at the mill using specialized tailings thickener tanks and flocculants to approximately 70% solids by weight. Cement additive is mixed into the tailings at the mill site before being discharged to the TMF in a single overland pipeline with PD pumps. Seepage from the TMF will be managed with a low-permeability geosynthetic liner, a basin underdrain system, and a foundation drain system. The lined TMF would be expanded using the downstream construction method, with material from local borrow sources. The non-segregating behavior associated with the ultra-thickened cemented tailings enables the facility to develop relatively steep beach slopes of between two to six percent. These steeper slopes can become difficult to maintain during periods of high rainfall or higher than specified water content of the tailings.

Theoretically, there is no TMF supernatant pond or water reclaim system required for ultra-thickened cemented tailings operations as all recoverable process water is reclaimed in the thickeners at the plant site. A small pond collecting minimal tailings bleed water, however, is likely to form within the facility. Storm water runoff will also contribute to the formation of a pond within the facility. A separate water management pond will likely be required to store additional process water for reuse in the plant to provide a buffering volume for fluctuations in process water requirements, and supply makeup water during periods of low rainfall (i.e. winter operation). The associated dam(s) and basin would require appropriate design and construction to prevent seepage losses.

The closure plan includes removal of the smaller supernatant pond and installation of a closure cap which includes a geosynthetic liner to preclude oxidation therefore limiting acid generation potential, a graded waste rock or overburden cover to promote all run-off through spillways constructed in the embankments, and a revegetated topsoil cover on the final graded closure cover.

Basic design criteria for Candidate 2 are summarized below:

- Design solids content: 70% solids by weight
- Average dry density: 1.6 t/m^3, and
- TMF tailings volume: 1.25 Mm^3.

A preliminary general arrangement for Candidate 2 is presented in Figure 3.3.

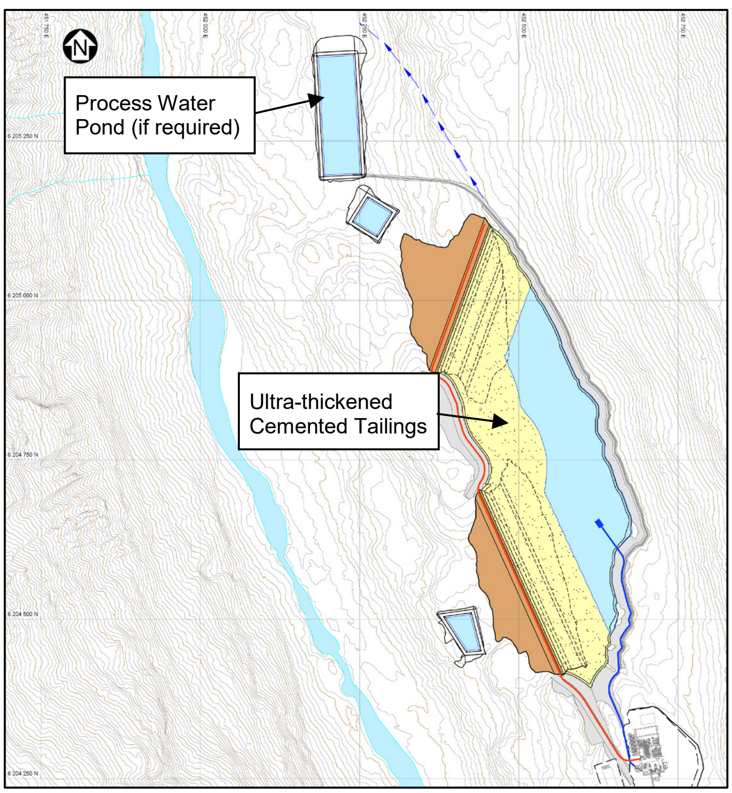

Figure 3.3 General Arrangement - Candidate 2 Ultra-thickened Cemented Tailings

Advantages of Candidate 2 include:

- Cemented tailings are non-flowable and not considered to pose a risk of mobilization in the event of a dam failure due to the non-segregating nature of the tailings mass.
- A smaller supernatant pond is likely to form as all available process water recovered in the mill.
- A greater ease of trafficability on the TMF for closure cover construction.
- A higher average dry density is anticipated, increasing storage capacity of the TMF.

Disadvantages of Candidate 2 include:

- An additional mill process requirement of a paste plant adds complexity and capital and operating costs.
- The addition of cement or other additives to the tailings material increases operating costs.
- An additional process water pond will likely be required.
- Positive displacement pumping is required to discharge thickened and cemented tailings a distance of 400 m from Process Plant site (El. 490 masl) to TMF (El. 470 masl).

3.4.3 Candidate 3: Filtered Tailings

Candidate 3 consists of a filtered tailings stack for management of tailings. The tailings are dewatered at the mill using either vacuum or pressure filtration units to a solids content of approximately 85% solids by weight. The dewatered tailings are delivered to the TMF in trucks or by conveyor. The filtered tailings stack would be constructed in compacted lifts, with a low permeability geosynthetic liner to manage seepage. A separate water management pond will be required to manage process water. The filtered tailings facility will require a confining embankment, or buttress due to the fine grind size and low angle of repose of the filtered tailings.

A separate water management pond is required for filtered tailings operations to store process water before reuse in the plant and manage storm water runoff from the TMF as the filtered tailings should be maintained in an unsaturated condition. The pond must be capable of handling both flows, of providing a buffering volume for fluctuations in process water requirements, and of supplying makeup water during periods of low rainfall (e.g. during winter months).

The moist tailings solids placed in the stack are unlikely to remain dry during periods of high rainfall or snowmelt, such as spring freshet. Snow removal is required throughout the winter to allow for ongoing tailings placement and to reduce the impacts of the snowmelt in the spring. A contingency stacking location is required to allow for placement of tailings during periods of heavy snow, extremely cold weather, and heavy rainfall, as the conditions on the primary stack may not be suitable for tailings placement.

The closure plan for the filtered tailings facility includes progressive reclamation with a geosynthetic liner to preclude oxidation therefore limiting acid generation potential and placement of cover soil to promote re-vegetation.

Basic design criteria for Candidate 3 are summarized below:

- Design solids content: 85% solids by weight
- Average dry density: 1.72 t/m^3, and
- TMF tailings volume: 1.16 Mm^3.

A preliminary general arrangement of Candidate 3 is presented in Figure 3.4.

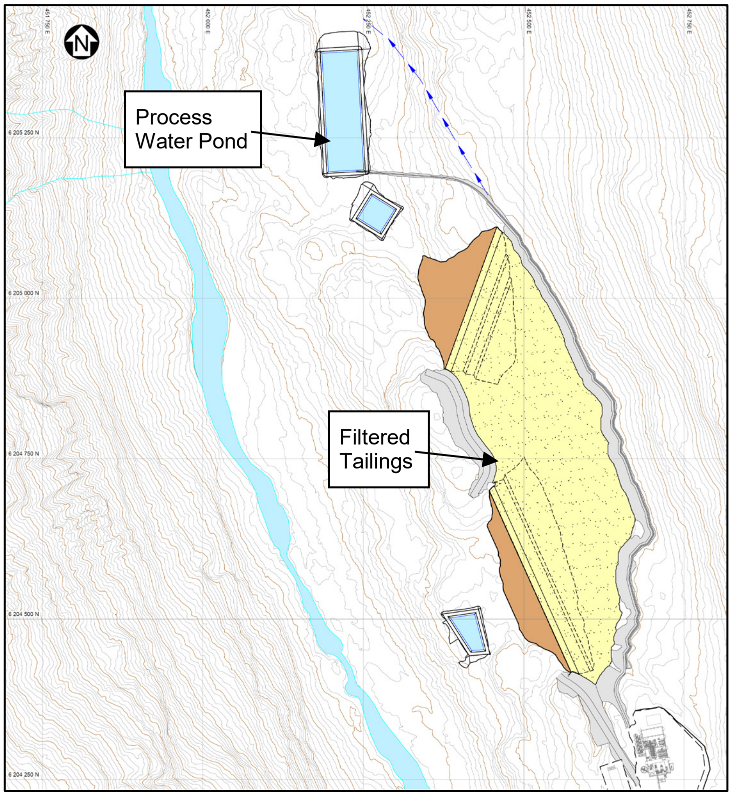

Figure 3.4 General Arrangement - Candidate 3 Filtered Tailings

Advantages of Candidate 3 include:

- The filtered tailings will not be mobilized in the event of any buttress or embankment failure.
- A greater ease of trafficability on the filtered tailings surface for closure cover construction.
- A high tailings dry density is expected (based on the filtration testwork results), increasing TMF storage capacity.

Disadvantages of Candidate 3 include:

- Management the filtered tailings will likely be challenging due to the high mean annual precipitation and cold temperatures in the winter months.
- Aggressive water management strategies will be required to maintain filtered tailings in an unsaturated state.
- An additional mill process requirement of a paste plant and filter plant adds significant capital and operating costs.
- A separate water management pond is required.
- The exposed filtered tailings increase the rate of oxidation, therefore increasing acid-generating potential and accelerating the metal-leaching rate compared to saturated tailings.
- Significant confining embankments are still required for filtered tailings mass due to low angle of repose of filtered tailings due to small grain size (<25 μm).

3.5 ASSESSMENT RATING AND RANKING

3.5.1 Assessment Criteria

A Qualitative Multiple Accounts Assessment (QMAA) was completed to evaluate the candidates for tailings management presented above. The QMAA used four assessment categories to compare the relative merits and risks of each tailings management strategy. The categories were divided into sub-categories, which were further divided into assessment criteria. The QMAA categories included:

- Environmental – This category assesses the likely impact to the environment, specifically considering the disturbance footprint area, impacts to water quality, flora and fauna, chemical stability of the stored tailings, and reclamation. Candidates that are easier to reclaim, minimize the need for active management in closure, and can achieve a suitable final land use are preferred.
- Technical – This category identifies and assesses the constructability, long-term operational viability, operational complexity, and potential for future expansion. It also considers potential concerns relating to permitting as candidates that are uncommon, or unconventional may be more difficult to permit and can result in extended permitting timelines.
- Social – This category considers the safety characteristics of tailings storage, and the ability to limit the effect of the proposed technology on the community. It also includes the safety of workers on site.
- Economic – This category assesses overall expected costs. Higher costs may be considered acceptable if the expenditure improves the performance in other categories. Alternatives that have the potential to significantly affect profitability or viability of the operation are less preferable.

The categories, sub-categories and criteria are summarized in Table 3.1.

Table 3.1 Categories, Sub-Categories and Criteria

Category	Sub-Category	Criteria
Environmental	Surface and Ground Water	Chemical Stability
		Groundwater Quality
		Surface Water Quality
	Environmental Impacts	Physical Properties of Proposed TMF
		Closure
		Flora & Fauna & Land Use
Technical	Construction and Operation Considerations	Constructability
		Complexity of Operation
		Containment Design
		Complexity of Water Management
		Average Annual Water Balance Impacts
	Optimization and Permitting Considerations	Future Expansion Potential
		Proven Technology
Social	Health and Safety	Safety Considerations
	Effect on Existing Community	Public Acceptance
		Cultural Heritage
Economic	Cost	Schedule
		Capital Costs
		Operating and Maintenance Costs
		Closure and Reclamation Costs

Each category, sub-category and criteria was assigned a relative weight according to its importance in its specific category by KP, and in consultation with JDS, IDM and Brownhill Consulting Services (BCS). The tiered weighting system was developed to remove bias that may be caused by having different numbers of matrix sub-categories and evaluation indicators in the model.

Table B.1 provides the weights for the categories, sub-categories and criteria listed above. Higher weights indicate greater relative importance and reflect the site conditions and issues relative to the proposed development.

3.5.2 Methodology

The three tailings technology candidates were ranked and scored for each of the assessment criteria based on a qualitative scale “Preferred” (3), “Acceptable” (2) and “Least Preferred” (1). Table 3.2 summarizes the ratings, descriptions and scores.

Table 3.2 Ratings and Descriptions

Rating	Environmental	Technical	Social	Economic	Score
Preferred	Lower impact to the environment	Conditions are thoroughly understood, design objectives are feasible	Negligible impact to the health and safety of the community or workers	Lower impact to project costs	3
Acceptable	Impact to the environment with feasible mitigation	Conditions are known to be challenging, however design objectives are feasible	Impact to the health and safety of the community or workers with feasible mitigation	Cost to implement is anticipated to be within project budget, however may be a risk to the project in different market conditions	2
Least Preferred	Impact to the environment with challenging mitigation	Design objectives or requirements add potential risk to the project	Impact to the health and safety of the community or workers with challenging mitigation	Higher impact to project costs anticipated to pose a risk to the project	1

The candidate scores for each criteria were then multiplied by the criteria weight factors and summed to determine the total weighted score for the criteria. The combined total weighted score for each sub-category was multiplied by the sub-category weight factor and summed to determine the total weighted score for each category.

A summary of the candidate ratings and scores are presented in Tables B.2 and Table B.3. The final candidate scores are summarized on Table B.4. The highest score represents the highest ranked option. The maximum possible score is 3 and the minimum possible score is 1.

3.6 RESULTS OF ASSESSMENT

3.6.1 Unweighted Assessment

The results from the rankings assessment were totalled for each candidate to determine the total score for each candidate prior to category weightings being applied. The results of the assessment are summarized in Table 3.3, and these results are as follows:

- Candidate 1 (thickened tailings) had the highest score of the three alternatives, achieving an unweighted score of 46.
- Candidate 2 (ultra-thickened cemented tailings) had the second highest score of 38.
- Candidate 3 (filtered tailings) had the lowest score of 35.

Table 3.3 Alternatives Assessment Results – Unweighted Analysis

Category	**Candidate 1** *Thickened Slurry Tailings*	**Candidate 2** *Ultra-thickened Cemented Tailings*	**Candidate 3** *Filtered Tailings*
Environmental	11	12	13
Technical	18	13	10
Social	7	5	6
Economic	10	8	6
Results	**46**	**38**	**35**
Ranking	**1**	**2**	**3**

3.6.2 Weighted Assessment

The category and sub-category weightings were applied to the results of the assessment to remove bias from the assessment, as described above, and these results are as follows:

- Candidate 1 (thickened tailings) had the highest score of the three alternatives, achieving a weighted score of 1.39.
- Candidate 2 (ultra-thickened cemented tailings) had the second highest score of 1.30.
- Candidate 3 (filtered tailings) had the lowest score of 1.26.

The results of the assessment are summarized in Table 3.4.

Table 3.4 Alternatives Assessment Results – Weighted Analysis

Category	**Candidate 1** *Thickened Slurry Tailings*	**Candidate 2** *Ultra-thickened Cemented Tailings*	**Candidate 3** *Filtered Tailings*
Environmental	1.63	1.76	1.71
Technical	1.19	0.86	0.82
Social	1.00	0.60	0.80
Economic	1.25	1.00	0.75
Results	**1.39**	**1.30**	**1.26**
Ranking	**1**	**2**	**3**

Given the maximum possible score of 3 and the lowest possible score of 1, the resultant scores for each candidate are close (i.e. within 6% of each other).

3.6.3 Sensitivity Analysis – Economic Criteria

A sensitivity analysis was performed to determine whether the scoring of the economic criteria impacted the results of evaluation. The economic scores were removed from the assessment; however, the overall result remained unchanged.

The rankings and scores excluding the economic criteria are as follows:

- Candidate 1 (thickened tailings) had the highest score of the three alternatives, achieving a weighted score of 1.41
- Candidate 2 (ultra-thickened cemented tailings) had the second highest score of 1.33, and

- Candidate 3 (filtered tailings) had the lowest score of 1.31.

The results of the sensitivity analysis are summarized in Table 3.5.

Table 3.5 Alternatives Assessment Results – Weighted Analysis – Economics Excluded

Category	**Candidate 1** *Thickened Slurry Tailings*	**Candidate 2** *Ultra-thickened Cemented Tailings*	**Candidate 3** *Filtered Tailings*
Environmental	1.63	1.76	1.71
Technical	1.19	0.86	0.82
Social	1.00	0.60	0.80
Results	**1.41**	**1.33**	**1.31**
Ranking	**1**	**2**	**3**

3.7 RANKING EVALUATION CONCLUSION

The results of the three assessments (unweighted, weighted and sensitivity analysis) have all concluded that Candidate 1, thickened tailings, is the preferred tailings technology for tailings disposal at the Project. The unweighted analysis identified a rating score difference of 24% between the three candidates; 17% between the top two candidates - Candidate 1 and Candidate 2. The weighted and sensitivity analysis however reduced the rating score differences to 9% and 7% respectively between the three candidates.

4 – CONCLUSION AND RECOMMENDATIONS

Candidate 1 (thickened tailings) was identified as the preferred option in this BAT assessment. This candidate is a conventional thickened tailings facility. The tailings are delivered in a single stream and selectively discharged from the embankments to maintain beach slope development. The supernatant pond is operated to remove surplus water while retaining sufficient volume to provide storm storage, meet process water requirements and maintain a degree of saturation within the tailings mass.

The main factors for this conclusion are as follows:

- The tailings deposition and water management strategy is simple relative to the other candidates.
- The process water is contained within the same facility and used for mill reclaim.
- No additional mill processes are required.
- There is a lower risk of operational problems (complications due to climactic conditions, etc.).
- There is a greater ability to maintain a degree of saturation within the tailings mass to reduce exposure of the tailings to oxidation and to limit ARD/ML generation potential.

Opportunities for optimization of Candidate 1 include:

- Refinement of tailings deposition strategies including tailings solids content.
- Incorporation of drainage measures to promote densification and consolidation of deposited tailings.
- Confirmation of water management requirements and operating practices.
- Confirmation of geochemical characteristics.

5 – REFERENCES

Knight Piésold Ltd. (KP, 2016a). *Waste and Water Management Design for Preliminary Economic Assessment*. VA101-594/04-1 Rev.0. Prepared for IDM Mining Ltd., June 13, 2016.

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Knight Piésold Ltd. (KP, 2017b). *Red Mountain Underground Gold Project – Tailings and Water Management Feasibility Design Report.* VA101-594/04-4 Rev.1. Prepared for IDM Mining Ltd., August 8, 2017.

Knight Piésold Ltd. (KP, 2017c). *Paste Backfill as a Tailings Disposal Alternative.* KP Memorandum VA17-01312. Prepared for IDM Mining Ltd., August 24, 2017

SRK Consulting (Canada) Inc. (SRK). 2017. *Red Mountain Underground Gold Project – Baseline Climate and Hydrology Report*. Report prepared for IDM Mining. February 2017.

6 – CERTIFICATION

This report was prepared and reviewed by the undersigned.

29-Aug-2017

PROFESSIONAL PROVINCE OF
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44041
BR COL ENG

<Original signed by>

Prepared:

Jim Fogarty, P.Eng.
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APPENDIX A

KP LETTER VA16-00197

(Pages A-1 to A-30)

February 17, 2016

File No.:VA101-00594/01-A.01
Cont. No.:VA16-00197

FS 64925
EMS 550121
OHS 550122

Mr. Rob McLeod
President & CEO
IDM Mining Ltd.
1500-409 Granville Street
Vancouver, British Columbia
Canada, V6C 1T2

Dear Rob,

Re: Red Mountain Gold Project - Tailings and Water Management

1 – INTRODUCTION

JDS Energy & Mining Inc. (JDS) is completing a high level review of the Red Mountain Gold Project for IDM Mining Ltd. (IDM). Knight Piésold Ltd. (KP) was retained to complete an options assessment for tailings and water management for the Project, and provide relevant design and cost estimates according to the requirements and information provided by IDM and JDS.

Red Mountain is situated in northwestern British Columbia, approximately 18 km east-northeast of Stewart. The project is located at 55° 57' N latitude and 129° 42' W longitude between the Cambria Ice Field and the Bromley Glacier at elevations ranging between 1,500 and 2,000 m. The area is characterized by rugged steep terrain with weather conditions typical of the north coastal mountains.

Climatic conditions at Red Mountain are dictated primarily by its altitude (1,742 masl at the centre of the deposit) and proximity to the Pacific Ocean. Temperatures are moderated year-round by the coastal influence. Precipitation is significant in all months, with October being the wettest. Even at sea level, over one-third of the annual precipitation falls as snow. This proportion is greater at higher elevations, where snow may fall at almost any time of year.

The heavy snowfall, steep terrain and frequently windy conditions are important considerations for tailings and water management. Blizzard conditions are frequent in the immediate vicinity of Red Mountain during winter and avalanches pose a significant threat in the Bitter Creek drainage.

2 – DESIGN CRITERIA

The basic design criteria for the Tailings Management Facility (TMF) options assessment were established with JDS and are summarized in Table 1. A detailed design basis is provided in Appendix A (Table A.1). The design throughput for the mill is currently being investigated and will vary depending on mill location and annual operating time determined suitable for the project. The average mill throughput is assumed to be 1,000 tpd.

Table 1 Design Criteria Summary

Parameter	Units	Value
Average Mill Throughput	tpd	1,000
Design Life	yrs	5
Total Tonnes of Tailings (Design)	Mt	1.4
Year 1 – Tailings Tonnage	Mt	0.3
Year 2 – Tailings Tonnage	Mt	0.2
Year 3 – Tailings Tonnage	Mt	0.3
Year 4 – Tailings Tonnage	Mt	0.3
Year 5 – Tailings Tonnage	Mt	0.3
Tailings Final Settled Dry Density (average)	t/m^3	1.2
Final Required Tailings Storage Volume	Mm^3	1.17
Embankment Crest Width	m	10
Embankment Upstream Slope	-	2.5H:1V
Embankment Downstream Slope	-	2H:1V
Freeboard (Storm Storage, Wave Run-Up & Freeboard)	m	5
2 Year Starter Tailings Tonnage	Mt	0.5
2 Year Starter Dam Storage Capacity	Mm^3	0.42

The following assumptions have also been taken into consideration for this study:

- All embankments will be constructed using material sourced from a local borrow.
- The tailings are potentially acid generating and will be stored subaqueously in a fully lined impoundment.
- There are no limitations on the TMF location within the boundaries of the maps provided.

2.1 TAILINGS TECHNOLOGY

The management of tailings and the tailings technologies utilized depends on multiple specific considerations such as location, climate, topography, environment, tailings geochemistry, processing requirements and throughput. The preferred tailings technology may also incorporate management of Potentially Acid Generating (PAG) waste material to prevent acid generation. Conventional slurry tailings have been chosen as the base case technology to complete this options assessment based primarily on climate and tailings geochemistry. The PAG tailings may need to be stored sub-aqueously to prevent acid generation. An alternative filtered tailings concept has been evaluated and is discussed in Section 5.

2.1.1 Conventional Slurry Tailings

Conventional slurry tailings are typically discharged from the process plant at about 30% to 40% solids by total mass of slurry. These tailings may be pumped, flow by gravity, or some combination of both, depending on the available head and distance through pipelines from the plant to the TMF. The slurry is typically discharged through multiple off-takes from header pipes located around the periphery of the TMF confining embankments. The tailings solids settle and the resulting supernatant water is recovered from the TMF and pumped back for re-use in the process. The coarse fraction of the tailings typically settles rapidly and accumulates closer to the discharge points, forming a gentle “beach” with a slope of about 0.5 to 1%. Finer tailings particles tend to travel further and settle at a flatter slope to, and beneath, the supernatant pond. Selective tailings deposition is typically used to keep the supernatant pond away from the embankments. Conventional slurry tailings disposal also allows for the subaqueous storage of PAG tailings which is an important consideration for this study because the tailings at the Red Mountain Project are PAG tailings.

3 – TMF OPTIONS ASSESSMENT

Several sites were identified as potential locations for storage of conventional slurry tailings. The locations are summarized in Table 2 and shown on Figures B.1 and B.2 in Appendix B.

Table 2 Candidate Tailings Management Facility Locations

Option	Name	Location
1	Cirque - JDS PEA	Base of Red Mountain Cirque - 2014 JDS PEA Location
2	Top of Cirque	Located above the Cirque TMF
3	SRK Side Cirque	Side Cut facility in Cirque proposed by SRK Consulting
4	Bromley Hump	Located downstream of Bromley Glacier
5A	Otter Creek Upper	Adjacent to where Otter Creek meets Bitter Creek
5B	Otter Creek Lower	Downstream of Otter Creek Upper
6	Roosevelt Creek	Terrace where Roosevelt Creek meets Bitter Creek
7	Highway	Confluence of Bitter Creek and Bear River adjacent to Clements Lake.
8	Top of Mountain	Top of Red Mountain

3.1 TMF DEVELOPMENT CONCEPTS

3.1.1 Option 1 – Cirque TMF (JDS PEA Option)

The Cirque TMF is located in the Red Mountain Cirque between the Cambria Ice fields and the Bromley Glacier. The area has an average elevation of approximately 1,500 m and has little vegetation. Foundation conditions consist mainly of talus deposits overlying fractured bedrock. Due to the relatively poor topographical conditions for impoundment capacity and dam construction, a large dam is required to provide sufficient storage. This location was used in the 2014 Preliminary Economic Assessment. Figure B.1 in Appendix B shows a general arrangement layout for Option 1 and a typical embankment section used for the assessment.

3.1.2 Option 2 – Top of Cirque TMF

The Top of Cirque TMF site is also located in the Red Mountain Cirque. The facility is located at approximate El. 1700 m above the Cirque TMF. The steep topographical grade requires an extremely large dam and results in very poor storage efficiency for tailings. This area was considered a possible option due to the close proximity to the portal. Figure B.1 in Appendix B shows a general arrangement for Option 2 and a typical embankment section used for the assessment.

3.1.3 Option 3 – SRK Side Cirque TMF

This option was proposed by SRK Consulting in 2004. The side valley impoundment is located in the Red Mountain Cirque at approximate El. 1,500 m and consists of five separate impoundments terraced along the north and south cirque slopes. The dam is constructed using the upstream method of construction. The design is described in detailing SRK Report “Red Mountain Tailings Options Study, 2004”.

3.1.4 Option 4 – Bromley Hump TMF

The Bromley Hump TMF is situated at the junction of the lower tongue of the Cambria Glacier and the tongue of the Bromley Glacier at approximate El. 800 m. The steep terrain is located on the right bank of Bitter Creek and provides little to no impoundment capacity.

3.1.5 Option 5A and 5B – Otter Creek Upper and Lower TMF

This potential TMF site is located along the north bank of Bitter Creek adjacent to where Otter Creek meets Bitter Creek. The elevated deposit is at an approximate elevation of 450 m. Topographically this area is an efficient tailings storage site with expansion potential. Figure B.1 in Appendix B shows a general arrangement for Option 5A and 5B, and a typical embankment section used for the assessment.

3.1.6 Option 6 – Roosevelt Creek TMF

The Roosevelt Creek TMF site is located on a terrace along the north bank of Bitter Creek at approximate El. 350 m. The topography has a grade of approximately 20-25% and would require a large dam to provide storage. The terrace consists of an outwash deposit of permeable sandy gravel with cobbles and boulders. The site has a potential for avalanches and debris slides. The site is currently not within the project's environmental baseline boundary. Figure B.2 in Appendix B shows a general arrangement for Option 6 and a typical embankment section used for the assessment.

3.1.7 Option 7 – Highway TMF

The Highway TMF is located where Bitter Creek merges with Bear River, and is adjacent to Clements Lake. Clements Lake is Provincial Park and the TMF site is currently not within the project's environmental baseline boundary. Figure B.2 in Appendix B shows a general arrangement for Option 7 and a typical embankment section used for the assessment.

3.2 PRELIMINARY TMF OPTIONS ASSESSMENT

An initial comparisons of key parameters for the TMF options discussed above, was completed to reduce the number of alternatives carried forward to a concept level cost comparison. The comparison has been based on potential storage capacity, expansion potential and dam construction method. Table 3 summarizes the findings of the initial comparison and identifies the options that were advanced to the cost estimate stage.

Table 3 Preliminary TMF Options Assessment

	OPTION								
	1	**2**	**3**	**4**	**5A**	**5B**	**6**	**7**	**8**
Design Storage Requirement of 1.2 Mm3	✓	✓	✓	×	✓	×	✓	✓	×
TMF Expansion Potential	✓	✓	✓	×	✓	×	✓	✓	×
Dam Construction Method	D/S	D/S	U/S	D/S	D/S	D/S	D/S	D/S	D/S
Avalanche Path	✓	✓	✓	×	×	×	✓	×	×
Option Advanced to Cost Estimate	✓	✓	×	×	✓	✓	✓	✓	×

NOTES:
1. D/S = Downstream Method of Construction, U/S = Upstream Method of Construction.

Option 3, the option proposed by SRK, is not considered a viable option as it utilizes an upstream method of dam construction. The project is located in an area of high seismicity where the upstream method of embankment construction is not recommended. The cross section included in the SRK Report "Red Mountain Tailings Options Study" details a staged facility with the embankment raise constructed entirely on top of tailings solids. This option has not been advanced further in this study.

Option 4, is located in extremely steep terrain and does not provide the design storage capacity of 1.2 Mm^3. The storage efficiency is extremely poor and is not considered as a viable option for tailings storage. It was not advanced further in this study.

Option 8 is located on Top of Red Mountain and does not provide any area suitable to store the volume of tailings required. Option 8 is therefore not advanced any further in this study.

Option 5B does not provide the design storage capacity but was advanced to the cost estimate stage as a potential location for expansion of Option 5A.

The options that are being considered for tailings and water management are as follows:

- Option 1 – Cirque TMF (JDS PEA)
- Option 2 – Top of Cirque TMF
- Option 5A – Otter Creek Upper TMF
- Option 5B – Otter Creek Lower TMF
- Option 6 – Roosevelt Creek TMF
- Option 7 – Highway TMF

3.3 TMF OPTIONS ASSESSMENT SUMMARY

Table 4 summarizes the basic information that has been used for the preliminary options selection and is divided in starter and final configurations.

Table 4 TMF Options Summary

2 Year Starter Dam (0.5 Mt)	**OPTION**				
	1 Cirque	**2 Top of Cirque**	**5A Otter Creek Upper**	**6 Roosevelt Creek**	**7 Highway**
Dam Crest Elevation (masl)	1465	1705	455	-	120
Embankment Fill Volume (Mm^3)	0.83	1.85	0.2	-	0.74
Maximum Embankment Height (m)	45	55	20	-	20
Storage Efficiency(1)	0.6	0.2	2.1	-	1.6
Tailings Transportation	Gravity	Pumping	Gravity	-	Pumping
Final Arrangement (1.4 Mt)	**OPTION**				
	1 Cirque	**2 Top of Cirque**	**5A Otter Creek Upper**	**6 Roosevelt Creek**	**7 Highway**
Dam Crest Elevation (masl)	1475	1720	465	360	135
Embankment Fill Volume (Mm^3)	1.7	5.1	0.58	1.84	2.47
Maximum Embankment Height (m)	55	70	35	35	35
Storage Efficiency(1)	0.7	0.2	2.1	0.7	0.2
Tailings Transportation	Gravity	Pumping	Gravity/Pumping	Gravity/Pumping	Pumping

NOTES:
1. Storage efficiency is defined as the relation: TSF Capacity / Embankment fill volume.

3.4 COST ESTIMATE

The conceptual design of each of the selected TMF options has been completed to a level sufficient for comparing the alternatives on an economic basis at a high level. Conceptual level initial capital costs, combined sustaining capital and operating costs have been developed by applying similar rates and assumptions to all alternatives.

For all options it has been assumed that the confining embankments will be constructed with material from a local borrow. There is potential to create additional storage in each facility by developing the borrow area within the TMF impoundment. This has not been considered at this stage except for Option 6 where a cut was required to obtain sufficient capacity in the impoundment. It is also assumed that transition and drainage layers of finer materials will be processed from borrow areas nearby.

Earthworks unit rates were developed from first principles using equipment rental rates from the 2013-2014 Blue Book (B.C. Road Builders & Heavy Construction Association, 2013), equipment capacities and production rates from the Caterpillar Performance Handbook (Caterpillar Inc., 2014) and an assumed labour rate of $104/hr (typical BC labour rate).

All other unit rates (pumps, pipelines, instrumentation, geosynthetics, electrical cables and transformers) were developed from available vendor quotes and from recent and relevant project experience.

Operating costs were developed from a power cost of $0.04/kWh, provided by JDS. Other operating costs include allowances for pump and pipeline maintenance (approximately 2% of total capital cost of pumps and pipelines per year of operation).

An overall summary of the estimated Initial Capital Costs (CAPEX), Sustaining Capital and Operating Costs (OPEX) is shown in Table 5. These costs are in 2016 Canadian Dollars and do not include a contingency factor. A contingency of 50% is typically applied for the TMF at this level of study. Detailed costing tables, including the 50% contingency allowance, for the options listed below, are included in Appendix C.

Table 5 Cost Estimate Summary

TMF OPTION	CONVENTIONAL SLURRY TAILINGS			
	INITIAL CAPITAL (CAD$)	SUSTAINING CAPITAL AND OPERATING COSTS (CAD$)	TOTAL (CAD$)	$/TONNE (CAD$)
Option 1 - Cirque (JDS PEA)	$11,800,000	$9,600,000	**$21,400,000**	**$15.3**
Option 2 - Top of Cirque	$20,800,000	$31,800,000	**$52,600,000**	**$37.6**
Option 5A - Otter Creek Upper	$6,000,000	$5,100,000	**$11,100,000**	**$7.9**
Option 5B - Otter Creek Lower[4]	$8,700,000	$100,000	**$8,800,000**	**$6.3**
Option 6 - Roosevelt Creek	$23,700,000	$200,000	**$23,900,000**	**$17.1**
Option 7 - Highway	$11,000,000	$18,200,000	**$29,200,000**	**$20.9**

NOTES:
1. All prices in CAD$ (Conversion Rate CAD$0.75 = USD$1).
2. Cost of fuel provided by JDS Mining as CAD$1.1/litre.
3. No contingency applied to costs.
4. Option 5B included as an expansion option and does not provide sufficient storage for the design storage of 1.4 Mt of tailings.

3.5 RECOMMENDATIONS

This TMF options assessment indicates that Option 5A (Otter Creek Upper) is likely the preferred location from an engineering and cost perspective. This option is advantageous for the following reasons:

- Lower capital, sustaining and operating costs than all other options, resulting in the lowest cost per tonne.
- Best storage efficiency which therefore requires the smallest embankment volume.
- Expansion potential within the 5A impoundment with additional expansion potential in Option 5B, the Otter Creek Lower impoundment. This potential facility is adjacent to 5A and downstream of the mill making it favorable for tailings deposition.

- The water management required for Option 5A is minimal and is supported by natural drainage. The location is also clear from the Otter Creek avalanche path.
- Golder Associates completed hydrogeological and geotechnical investigations in the Otter Creek area in 1996. The dam sites have several drillholes which would be useful at the next stage of design. Figure B.3 in Appendix B indicates where the geotechnical holes were drilled in the Otter Creek impoundment. Dillhole locations are approximate as no drillhole coordinates were available. The deposit forms part of the lateral moraine feature that extends up to El. 500 m. Grab samples taken at various locations indicate the material is uniform sandy gravel with cobbles and less than 10% fines passing the 75 micron sieve size.
- The Otter Creek TMF and Mill location is also advantageous from a construction schedule and project execution standpoint. Construction could begin on the Mill and TMF while the road between Otter Creek and the mine is being constructed.

4 – TMF DESIGN

The slurry tailings option developed for Option 5A (Otter Creek Upper) provides storage capacity for 1.75 million cubic meters for tailings, process water, storm storage and freeboard to an elevation of 465 m. This will provide storage for 5 years of mine operations. The depth/area/capacity (DAC) relationship for the site to an elevation of 465 m is shown on Figure 1.

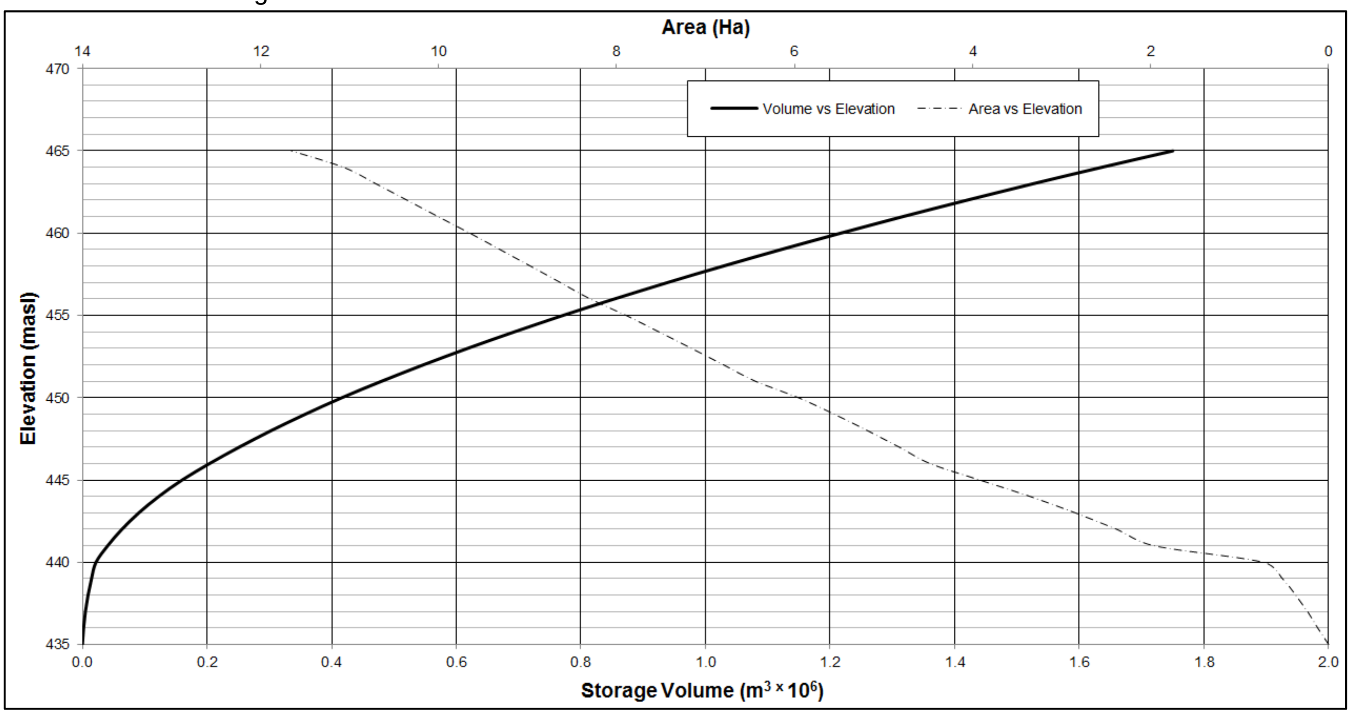

Figure 1 Option 5A Otter Creek Upper TMF Depth-Area-Capacity Relationship

The tailings dam is designed to be a rock-filled structure with granular filter zones on the upstream face. The impoundment and upstream face of the dam will be covered with a geosynthetic liner to minimize seepage of tailings and water into the surrounding area. The filter zones provide a bedding surface for the liner to prevent the migration of fines downstream in the event of liner damage.

Expansion of the TMF would be through the downstream method using locally borrowed materials. An initial starter dam would be constructed to contain the first two years of tailings production in order to minimize upfront capital expenditure. The dam would be raised once over the mine life to increase the storage capacity and maintain a minimum of 5 m freeboard at all times.

The facility would have sufficient freeboard to manage run-off, storm storage and process water. Reclaim water would be recirculated back to the mill and used as process water. A conceptual design and layout for Option 5A is shown on Figure B.4 in Appendix B.

The staged filling schedule for Option 5A is shown on Figure 2.

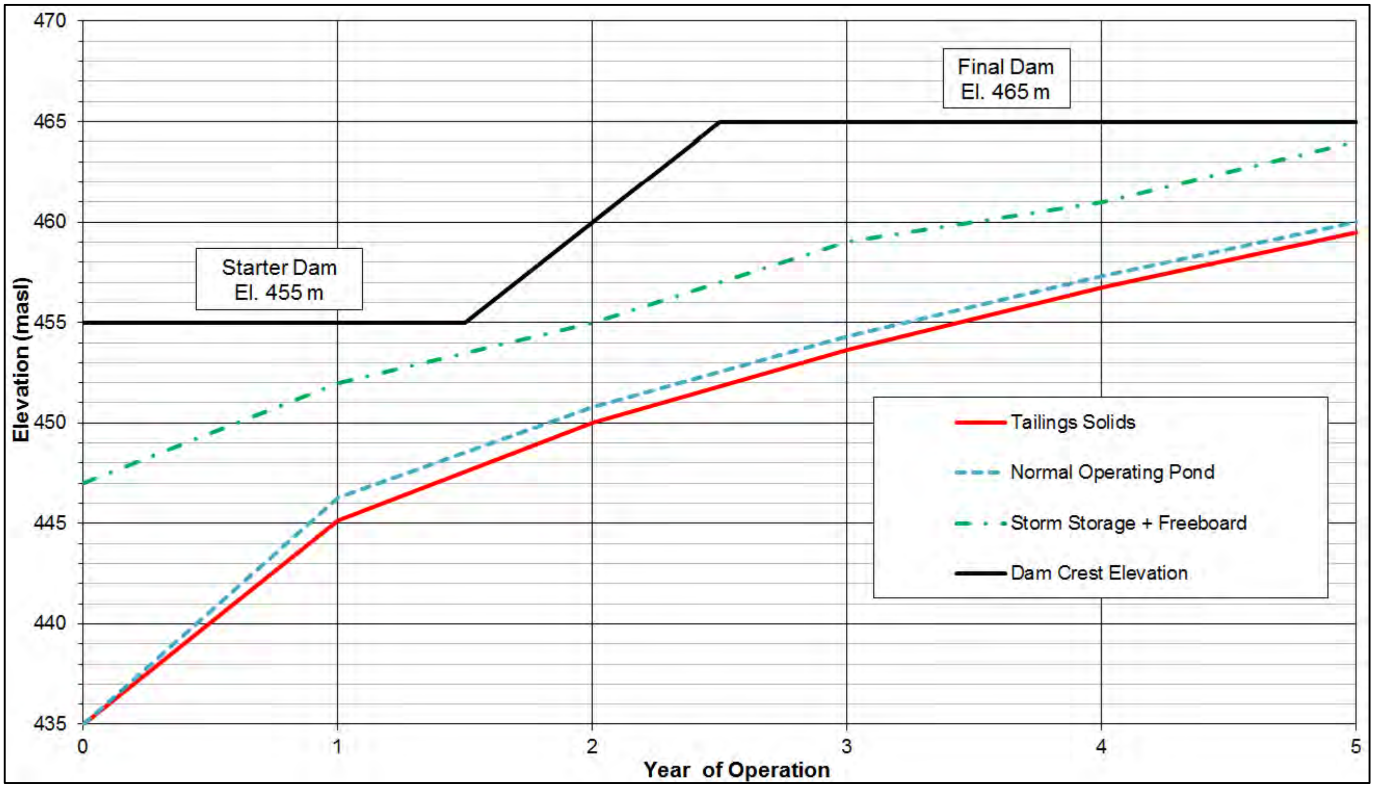

Figure 2 Option 5A Otter Creek Upper Filling Schedule

NOTES:

1. Year 2 tailings production of 200,000 tonnes/year, Year 1,3-5 tailings production of 300,000 tonnes/year (Table A.1).
2. Average settled tailings dry density assumed to be 1.2 t/m^3.
3. Normal operating pond volume included for capacity allowance.
4. The minimum freeboard requirements is assumed to be 5 meters (Includes storm storage, wave run-up and freeboard). This will be confirmed in future design phases.

5 – FILTERED TAILINGS

KP also investigated using filtered tailings technology at the Otter Creek location as an alternative method to manage the tailings.

5.1 FILTERED TAILINGS TECHNOLOGY

Filtered tailings are produced using pressure or vacuum force in presses, drum, or belt filtration units, and are typically dewatered to a moist cake-like consistency. The materials are then transported by conveyors or trucks to a filtered tailings stack where they can be compacted in lifts to improve density, trafficability, and stability. No operating pond is maintained with dewatered or filtered tailings. The filtered tailings stack typically requires buttressing for stability, particularly in seismically active areas.

Filtered tailings management typically requires a separate water management pond for storage of storm water run-off and snowmelt from the TMF surface, as well as for process water storage. There is no storage for water management within the filtered tailings stack facility unlike slurry tailings facilities. Filtered tailings operations may also include back-up systems as the efficiency for filtered operations can be less than conventional tailings.

Filtered tailings do not provide for effective isolation of PAG tailings from oxygen diffusion and potential acid generation. Geochemical stability of the ‘dry’ stack would need to be considered and the PAG tailings may require subaqueous disposal in a separate facility.

5.2 SLURRY TAILINGS & FILTERED TAILINGS MANAGEMENT AT OTTER CREEK

For this study it was assumed that 30% of the tailings are PAG and would require subaqueous disposal in a separate fully lined facility and the remaining 70% would be filtered in a filter plant at the mill and delivered to the TMF via truck/conveyor for storage in an unlined facility.

5.2.1 Design Criteria

The basic design criteria for the slurry and filtered tailings combination facilities is summarized in Table 6.

Table 6 Design Criteria Summary

Parameter	Units	Value
Average Mill Throughput	tpd	1,000
Design Life	yrs	5
Design Total Tonnes of Tailings	Mt	1.4
Tonnes of PAG Tailings	Mt	0.42
Tailings Final Settled Dry Density (average)	t/m^3	1.2
Final Required PAG Tailings Storage Volume	Mm^3	0.35
Tonnes of NAG Tailings	Mt	0.98
Filtered Tailings Dry Density (average)	t/m^3	1.6
Final Required Filtered Tailings Storage Volume	Mm^3	0.62
Embankment Crest Width	m	10
Embankment Upstream Slope	-	2.5H:1V
Embankment Downstream Slope	-	2H:1V
Freeboard (Storm Storage, Wave Run-Up & Freeboard)	m	5

The following assumptions have also been taken into consideration for this study:

- All embankments will be constructed using material sourced from a local borrow.
- PAG tailings are potentially acid generating and will be stored subaqueously in a fully lined impoundment.
- The tailings are to be managed at the Otter Creek TMF location; slurry tailings to be managed at Option 5B (Otter Creek Lower) and filtered tailings to be managed at Option 5A (Otter Creek Upper).
- Option 5B will be fully lined with a geosynthetic liner.
- Only the North Dam of Otter Creek Upper is required to manage the filtered tailings stack.

Table 7 summarizes the basic components of the slurry tailings TMF and the filtered tailings TMF. A conceptual general arrangement for the filtered tailings management option is shown on Figure B.5 in Appendix B.

Table 7 Tailings Management Design Summary

	Option 5B Otter Creek Lower Slurry Tailings	Option 5A Otter Creek Upper Filtered Tailings
Dam Crest Elevation (masl)	420	455
Embankment Fill Volume (Mm^3)	0.4	0.15
Maximum Embankment Height (m)	40	25
Storage Efficiency(1)	1	4.2
Tailings Transportation	Gravity	Truck/Conveyor

5.2.2 Cost Estimate

The conceptual design for TMF has been completed to a level sufficient for an economic basis at a high level. For each facility, conceptual level initial capital costs, combined sustaining capital and operating costs have been developed by applying similar rates and assumptions to all alternatives.

The basis of estimate discussed in Section 3.4 was used to calculate the Capital, Sustaining and Operating Costs for the two facilities. The cost to filter and transport the filtered tailings is not included in this cost estimate and is to be included as part of the mill alternatives assessment managed by JDS Mining. A cost however is included to place and compact the filtered tailings in the facility.

An overall summary of the estimated Initial Capital Costs (CAPEX), Sustaining Capital and Operating Costs (OPEX) is shown in Table 8. These costs are in 2016 Canadian Dollars and do not include a contingency factor. A contingency of 50% is typically applied for the TMF at this level of study. Detailed costing tables, including the 50% contingency allowance, for the options listed below, are included in Appendix D.

Table 8 Cost Estimate Summary (No Contingency)

	INITIAL CAPITAL (CAD$)	SUSTAINING CAPITAL AND OPERATING COSTS (CAD$)	TOTAL (CAD$)	$/TONNE (CAD$)
Option 5B – 30% PAG Slurry Tailings	$8,000,000	$ 100,000	**$8,100,000**	**-**
Option 5A – 70% NAG Filtered Tailings	$1,900,000	$1,200,000	**$3,100,000**	**-**
Total	$9,900,000	$1,300,000	**$11,200,000**	**$8**

5.2.3 Summary

There is no economic advantage associated with filtering the tailings for the Red Mountain Project. The overall tailings management cost is higher than managing conventional slurry tailings at the Otter Creek Upper facility. The additional capital cost of filters and the increased operating cost associated with filtering and transporting tailings would increase the overall cost further. There is additional complexity due to operating two facilities and placing and compacting filtered tailings in an area with high precipitation and snowfall.

6 – CONCLUSION

A high level assessment of tailings and water management options has been completed for the Red Mountain Gold Project. The study was completed for a 5 year mine life that would produce 1.4 Mt of tailings at an average mill throughput of 1,000 tonnes per day. The design mill throughput is currently being investigated and will depend on mill location and annual operating months. Preliminary comparative cost estimates (Initial Capital, Sustaining Capital and Operating Costs) were developed for the major components to assist in the selection of the preferred site for inclusion in future studies.

The assessment indicated that conventional tailings storage in the Otter Creek Upper TMF (Option 5A) is a reasonable base case tailings and water management strategy at the current time. The facility was sized to store 1.2 Mm^3 of tailings but has the potential to be expanded to store 2 Mm^3 of tailings. There is potential to store an additional 0.5 Mm^3 of tailings downstream of this option in TMF Option 5B should the ore reserve increase.

We trust this provides you with the information required at this time. Please contact the undersigned below should you have any questions or require any additional information.

Yours truly,
Knight Piésold Ltd.

<Original signed by>

<Original signed by>

Prepared: Daniel Ruane, P.Eng.
Project Engineer

Reviewed: Ken Embree, P.Eng.
Managing Principal

<Original signed by>

Approval that this document adheres to Knight Piésold Quality Systems

Attachments:

Appendix A	Design Basis
Appendix B	Figures B1-B5
Appendix C	Options Assessment - Conventional Slurry Tailings Cost Estimate Tables
Appendix D	Slurry and Filtered Tailings Cost Estimate Tables

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/dmr

APPENDIX A

DESIGN BASIS

(Page A-1)

Knight Piésold
CONSULTING

TABLE A.1

IDM MINING LTD.
RED MOUNTAIN GOLD PROJECT

TMF PRELIMIMNARY ECONOMIC ASSESSMENT
DESIGN BASIS

Print Feb/17/16 16:13:25

ITEM					SOURCE
1.0 GENERAL					
1.1	Project Location	Northwestern British Columbia, 18 km east of the town of Stewart. Project is located adjacent to the Cambria Ice Field and the Bromley Glacier on provincial crown land within the Regional District of Kitimat-Stikine.			Red Mountain Gold Project Description July 2015 - IDM Mining Ltd.
1.2	Site Coordinates	UTM Coordinates 452,450 E and 6,250,325 N (Zone 9 NAD 83) ; 55°59′04″ N, 129°45′37″ W			Preliminary Economic Assessment Report - Red Mountain Gold Project - JDS Mining
1.3	Mine Site Elevation	Ranging 1,500 to 2,000 masl			
1.4	Mine Production	Estimated mineable resource = 1.45 million tonnes (Mt)			
		Throughput = 1,000 tonnes per day (year 1-4) and 1,085 tpd (year 5)			
		Mine Life = 5 years			
1.5	Climate Conditions		**Roosevelt Creek**	**Red Mountain Cirque**	Preliminary Assessment Tailings Disposal and Hydrogeology March 1994 - LAC North America Ltd.
		Average Annual Precipitation =	2200 mm	2200 mm	
		Average Annual Snowfall =	900 mm	1500 mm	
		Average Annual Rainfall =	1300 mm	700 mm	
		Average Annual Evapotranspiration and Infiltration =	400 mm	400 mm	
		Average Annual Runoff =	1800 mm	1800 mm	
		Maximum Snowpack =	800 mm	1400 mm	
1.6	Rainfall Storm Events	1 in 50 year 24 hour precipitation =	140 mm	66 mm	
		1 in 100 year 24 hour precipitation =	156 mm	73 mm	
		Probable Maximum Precipitation 24 hr rainfall =	480 mm	250 mm	
2.0 MINE WASTE					
2.1	Tailings	1.4 million tonnes			Preliminary Economic Assessment Report - Red Mountain Gold Project - JDS Mining
		Assumed average long-term settled dry density of slurry tailings = 1.2 t/m^3			
		Storage requirements for tailings solids = 1.2 Mm^3			
		Tailings are Potentially Acid Generating (PAG)			
		Subaqueous disposal of tailings to control the acid generating potential of the tailings.			
		Year 1 = 300,000 tonnes, Year 2 = 200,000 tonnes, Year 3 = 300,000 tonnes, Year 4 = 300,000 tonnes, Year 4 = 300,000 tonnes.			
2.2	Waste Rock	1.036 million tonnes			
		Waste Rock is Potentially Acid Generating (PAG).			
		Waste Rock stored in two temporary storage areas located adjacent to the Upper and Lower portals. Waste Rock to be rehandled into the underground as backfill.			
		Year -2 = 150,000 tonnes, Year -1 = 304,000 tonnes, Year 1 = 273,000 tonnes, Year 2 = 197,000 tonnes, Year 3 = 112,000 tonnes.			
3.0 TAILINGS MANAGEMENT FACILITY (TMF)					
3.1	Function	Secure long term storage of approximately 1.2 Mm^3 of tailings and supernatant pond water.			Knight Pieosld Ltd.
3.2	Concept	An earthfill/rockfill embankment constructed using the downstream method of construction using local borrow materials. The impoundment and upstream face of the embankment would be lined with a geosynthetic liner to minimize seepage of tailings water into the surrounding area.			
		Filter zones included in embankment design to provide bedding for the geosynthetic liner and prevent the migration of fine tailings downstream. Suitable sub-base bedding layer beneath geosynthetic liner in the impoundment to provide drainage and prevent damage to the liner.			
3.4	Dam Classification	The Dam Classification for each of the alternate locations and concepts has not yet been carried out. However, it is assumed that all facilities will have at least a HIGH dam classification, as defined by Canadian Dam Association (CDA) "Dam Safety Guidelines" (2007).			
3.5	Inflow Design Flood	Inflow Design Flood (IDF) = The IDF for each alternative has not been calculated. An allowance for storm storage has been included in the freeboard.			
3.6	Design Freeboard	Freeboard for supernatant pond storage, Inflow Design Flood (IDF),wave run-up and freeboard.			
		A minimum 5 m freeboard at all times.			
3.7	Embankment Slopes	Embankment slopes constructed to maximum slope of 2.5H:1V on upstream side to facilitate geomembrane installation and 2H:1V on downstream side for reclamation.			
3.8	Operational Criteria	Expected mill throughput (tailings production rate): 1,000 tpd			
		Flood management: Inflows are contained within the impoundment or managed with spillway			
		Mine water pumped to Tailings Management Facility (TMF)			
		Available water from TMF recycled to mill process.			
		Excess water monitored and treated accordingly.			
3.9	Closure Criteria	The downstream slope of the embankment will be reclaimed with topsoil and revegetated.			'Preliminary Economic Assessment Report - Red Mountain Gold Project - JDS Mining
		Tailings will be dewatered and covered by a geosynthetic liner with a 1 m thickness of material placed on top to prevent infiltration. Revegetation of the soil capped to be completed to reduce dusting. Seepage collection and treatment systems will be maintained after closure until water quality is at acceptable levels.			
3.10	Seepage	Seepage will be primarily controlled through the use of a geosynthetic lining system covering the full TMF impoundment. Seepage control will be enhanced by strategic tailings deposition.			Knight Pieosld Ltd.
		Embankment and foundation drains will be installed to dewater any groundwater seeps and to capture potential seepage through the geomembrane lining system.			
		Collected seepage is pumped back to the TMF and monitored.			
3.11	Embankment Crest Width	Minimum of 10 m			
3.12	Seismic Design Criteria	1 in 476 = 0.083 g			Preliminary Assessment Tailings Disposal and Hydrogeology March 1994 - LAC North America Ltd.
		1 in 1,000 = 0.104 g			
		1 in 2,000 = 0.126 g			
		1 in 10,000 = 0.188 g			
3.13	Embankment Stability	Embankment slopes to be 2.5H:1V upstream and 2H:1V downstream to achieve the minimum required Factors of Safety (FOS_{min}) for the following loading conditions:			Knight Pieosld Ltd.
		End of construction (starter dam and dam raises) $FOS_{min} = 1.5$			
		Long term (at closure) $FOS_{min} = 1.5$			
		Seismic (Pseudo-static loading condition) $FOS_{min} = 1.0$			
		Seismic (Post-earthquake loading condition; full liquefaction of tailings assumed) $FOS_{min} = 1.5$			
3.14	Embankment Instrumentation	Instrumentation to be installed to accomplish the following: - Confirm that the embankments are performing in accordance with the design - Provide early warning of the development of potentially adverse changes.			
		Proposed instruments for the embankments include: - pond level indicator - surface monuments - embankment and foundation vibrating wire piezometers - seepage collection pond inflow weirs			
4.0 TAILINGS DELIVERY AND DISTRIBUTION					
4.1	Function	Transport tailings from the mill process to the TMF			Knight Pieosld Ltd.
4.2	Physical Properties	Tailings Solids Content = 40% by weight			
		Specific Gravity of Solids = 2.7			
4.3	General Criteria	Gravity discharge from mill used where sufficient head is available.			
		Pump stations as required where gravity discharge is not sufficient			
5.0 WATER MANAGEMENT SYSTEM					
6.1	Function	Provide diversion or collection of maximum practicable runoff from adjacent valley slopes and catchment areas to a natural course or to the collection pond, respectively.			Knight Pieosld Ltd.
6.2	Concept	Diversion channels established to divert non-contact water to a natural water course. Collection channels established to collect contact water that will be directed to the TMF for containment and ultimately be pumped to the plant site for use in processing.			
6.3	Dimensions	Trapezoidal cross-section, excavated in rock/overburden cut, or constructed in haul/access road fill.			
		Lining where required for erosion protection or leakage control (shotcrete, riprap, HDPE, etc.)			

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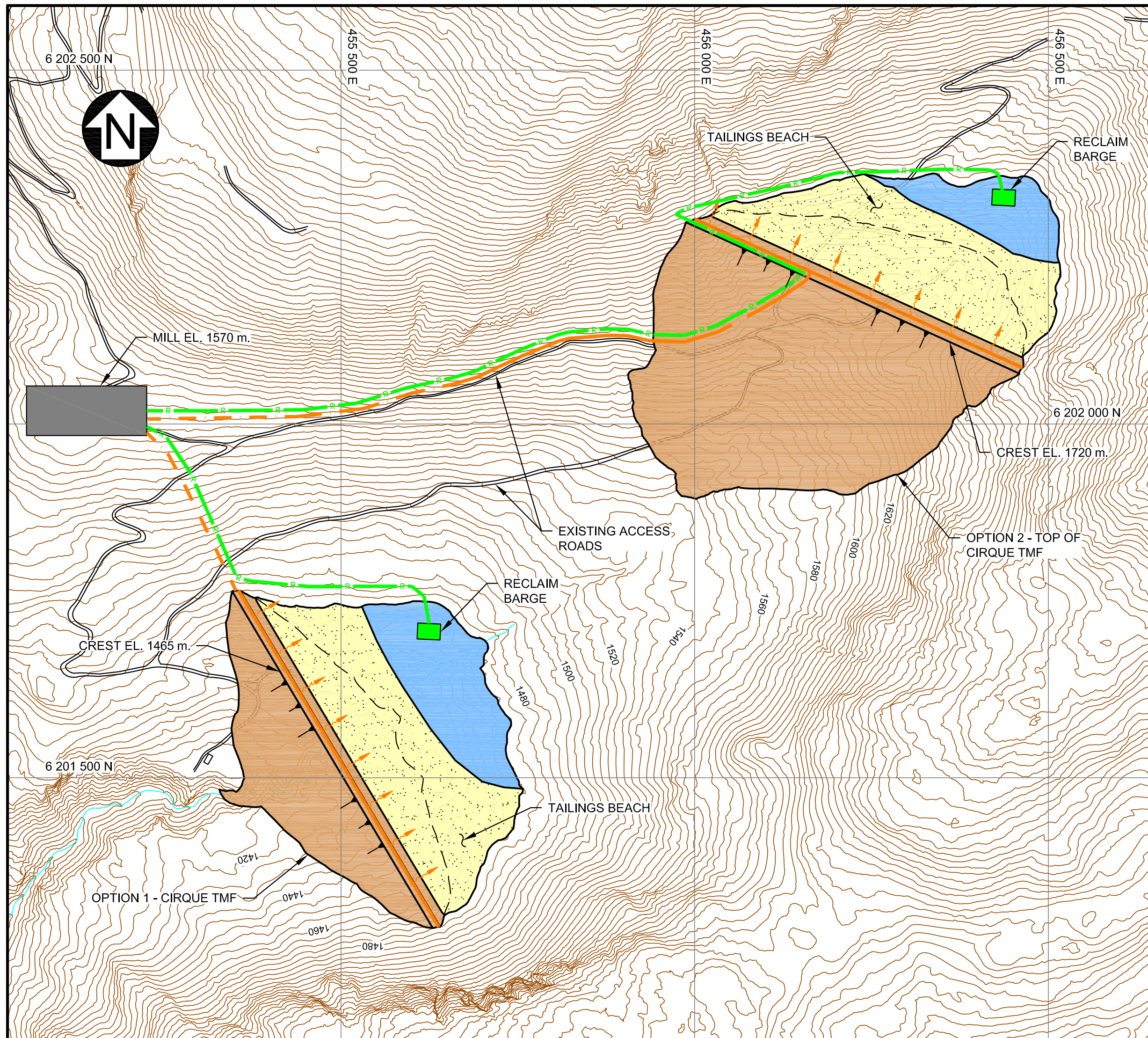
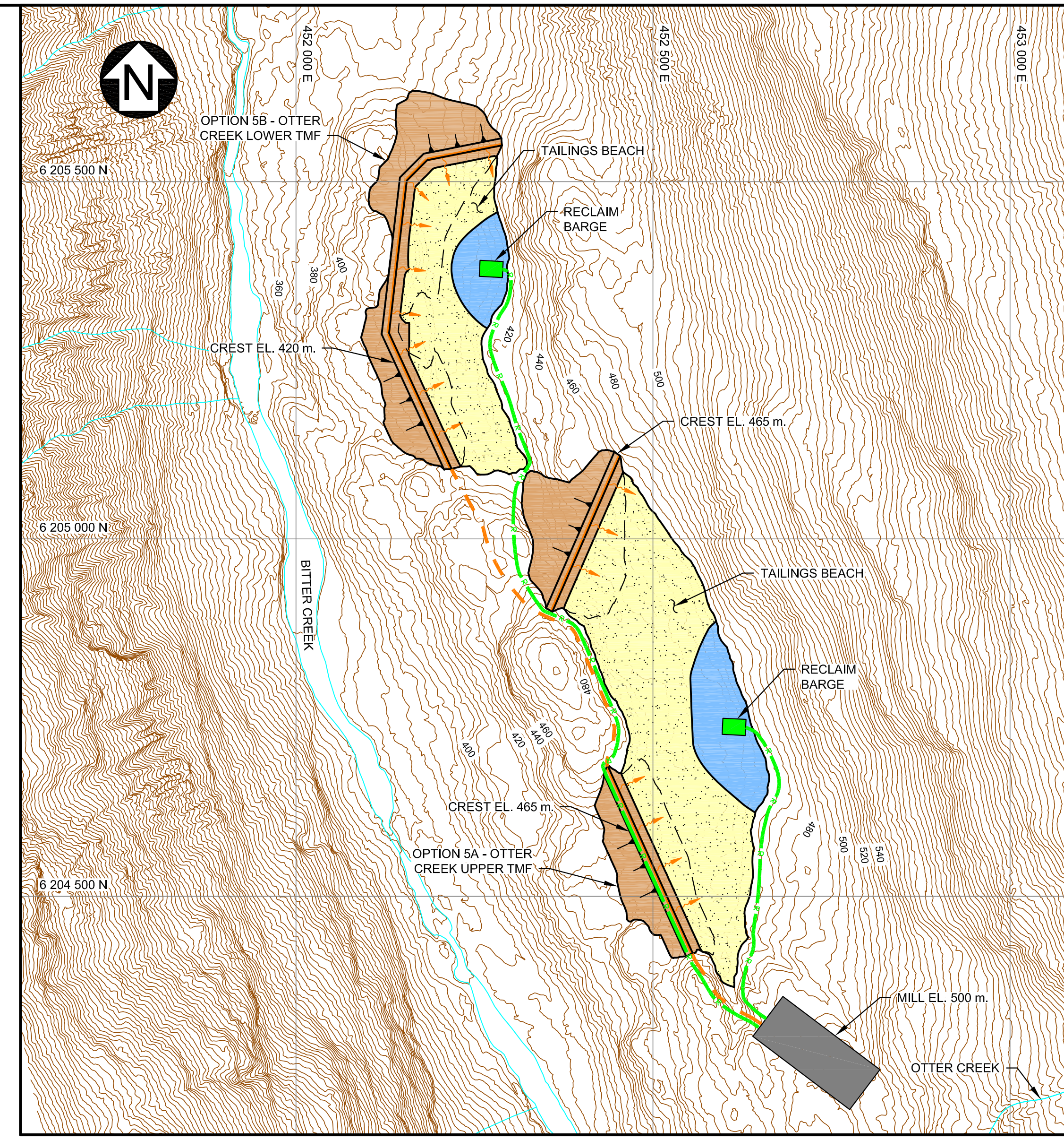
APPENDIX B

FIGURES B.1-B.5

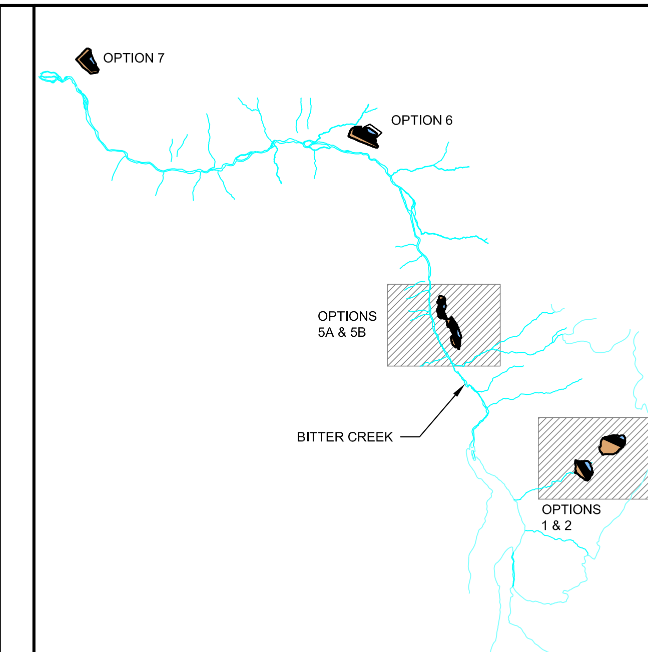
(Pages B-1 to B-5)



PLAN
FINAL TMF OPTION 1 - CIRQUE & OPTION 2 - TOP OF CIRQUE
SCALE A



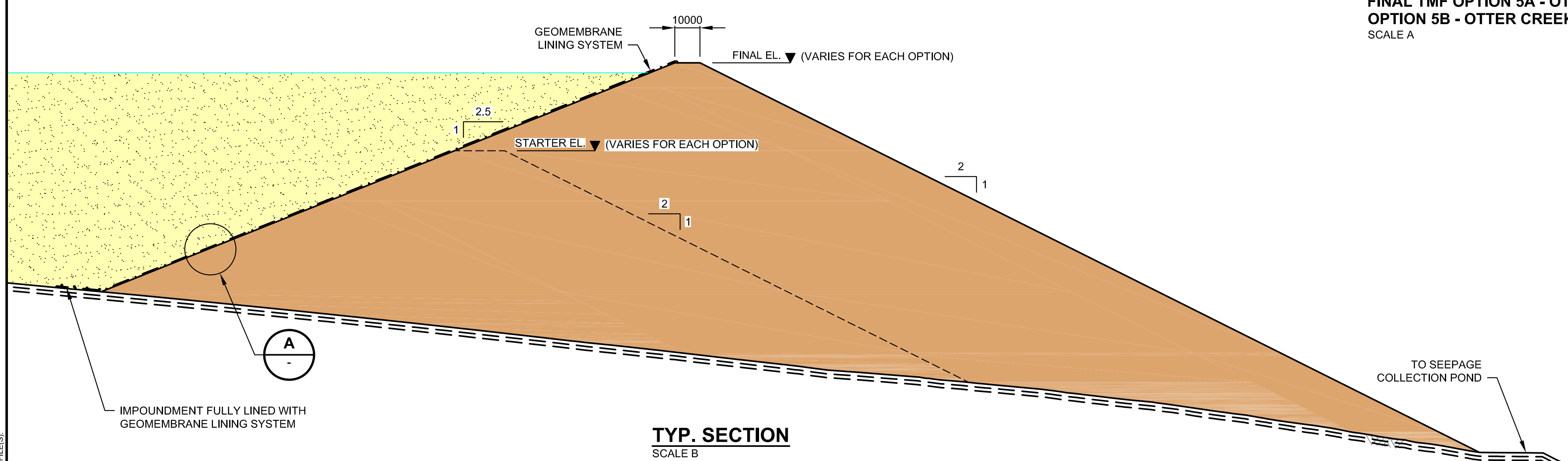
PLAN
FINAL TMF OPTION 5A - OTTER CREEK UPPER & OPTION 5B - OTTER CREEK LOWER
SCALE A



KEY PLAN
NTS

LEGEND:
- EMBANKMENT
- TAILINGS
- WATER
- RECLAIM PIPELINE
- TAILINGS PIPELINE
- EXISTING ROAD
- CREEK

NOTES:
1. COORDINATE GRID IS UTM NAD 83 ZONE 9.
2. PLAN RECEIVED BASED ON TOPO FROM JDS MINING (JANUARY 2016).
3. CONTOUR INTERVAL IS 5 METRES.
4. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
5. MILL LOCATION PROVIDED BY JDS MINING (FERUARY 2016).



TYP. SECTION
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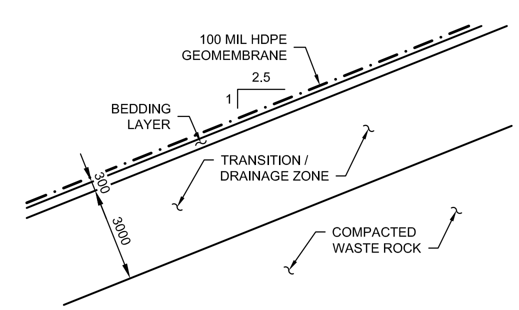

SECTION A
UPSTREAM LINER
NTS

SCALE B: 25 12.5 0 25 50 75 100 125 m
SCALE A: 100 50 0 100 200 300 400 500 m

IDM MINING LTD.

RED MOUNTAIN GOLD PROJECT

TMF OPTIONS ASSESSMENT
OPTION 1, 2, 5A, & 5B

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-594/01	VA16-00197

FIGURE B.1 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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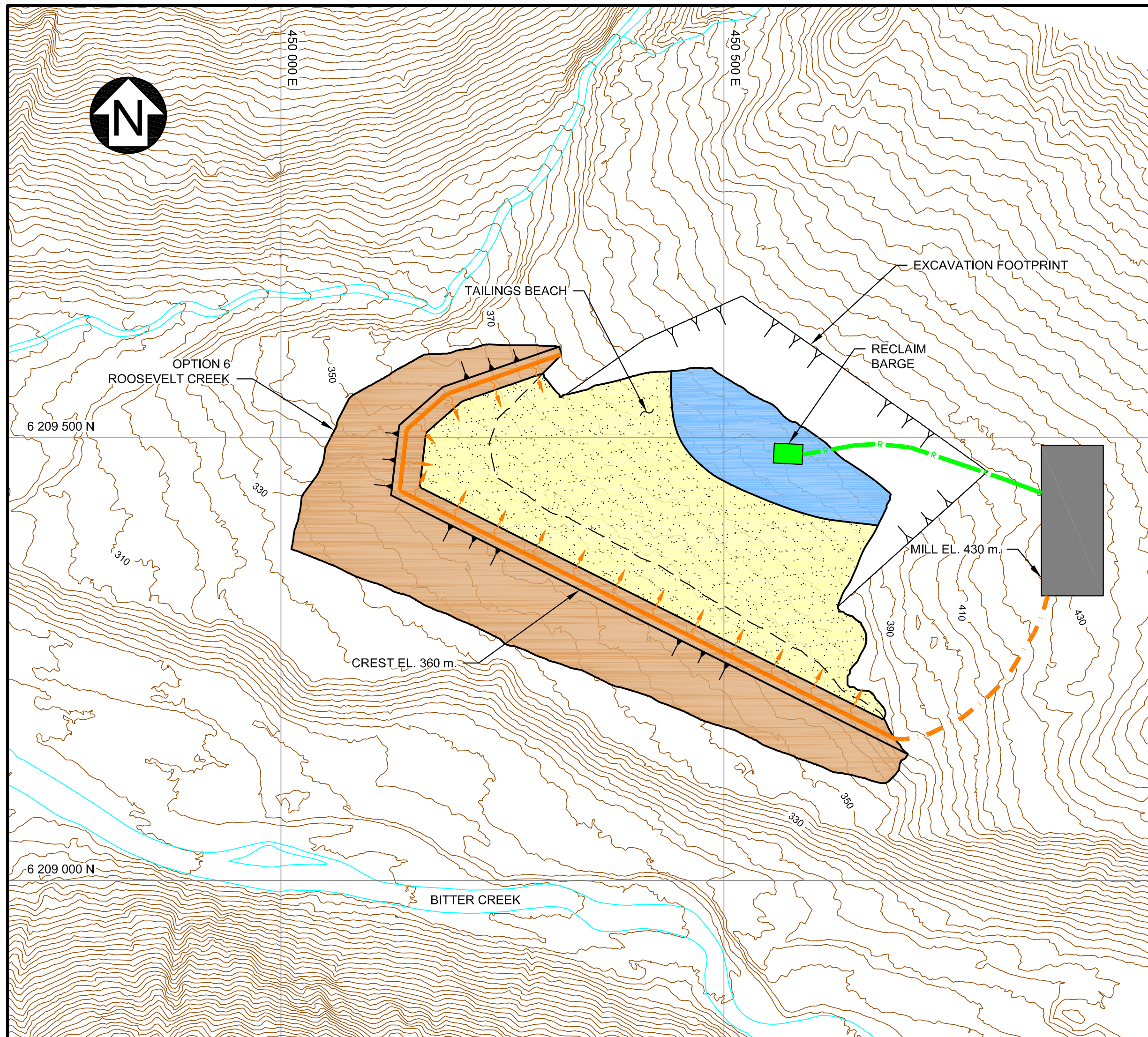
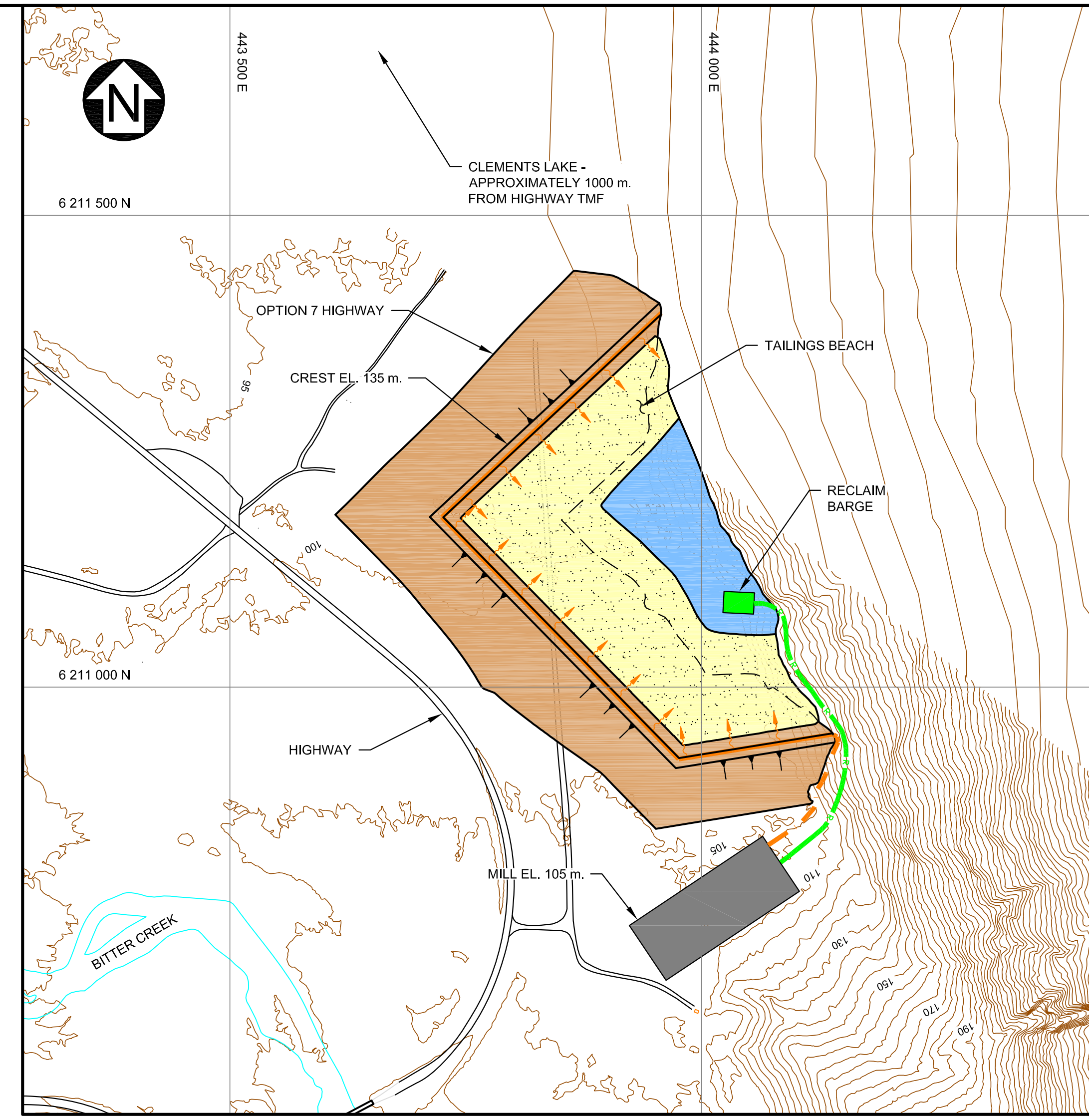


PLAN
FINAL TMF OPTION 6 - ROOSEVELT CREEK
SCALE A



PLAN
FINAL TMF OPTION 7 - HIGHWAY
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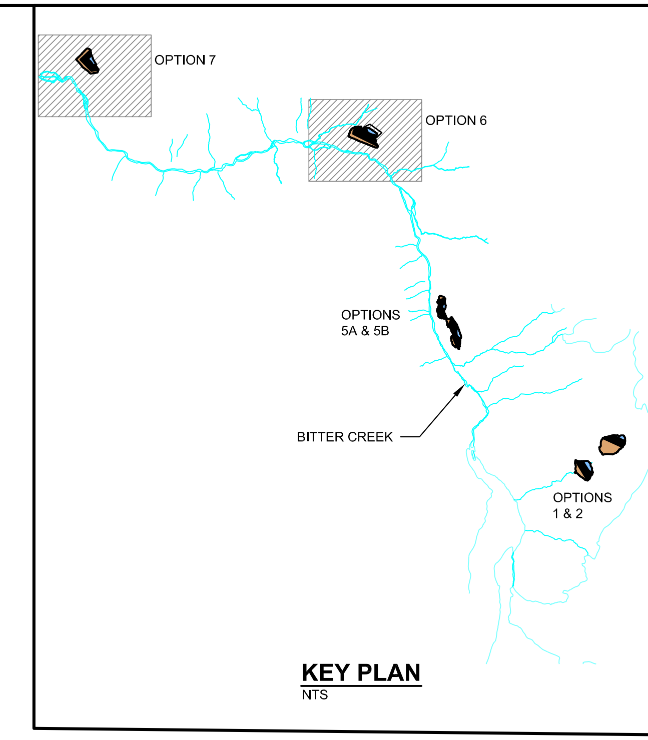
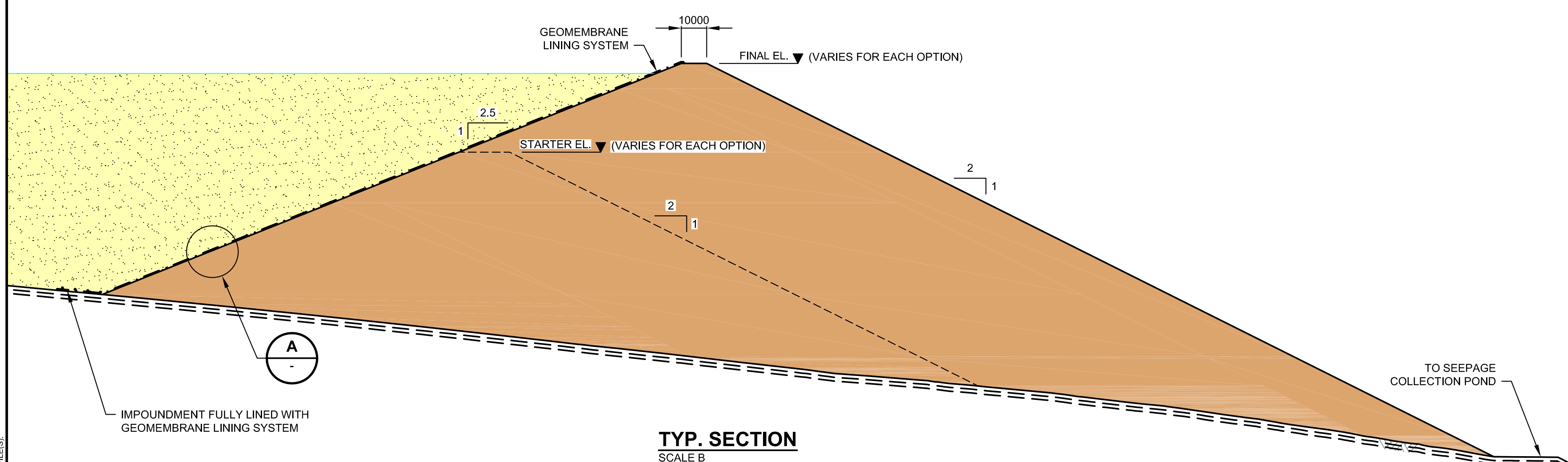


KEY PLAN
NTS

LEGEND:
- EMBANKMENT
- TAILINGS
- WATER
- RECLAIM PIPELINE
- TAILINGS PIPELINE
- EXISTING ROAD
- CREEK

NOTES:
1. COORDINATE GRID IS UTM NAD 83 ZONE 9.
2. PLAN RECEIVED BASED ON TOPO FROM JDS MINING (JANUARY 2016).
3. CONTOUR INTERVAL IS 5 METRES.
4. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
5. MILL LOCATION PROVIDED BY JDS MINING (FERUARY 2016).
6. ADDITIONAL 20 m CONTOUR DATA PROVIDED BY IDM MINING FOR OPTION 7 (FEBRUARY 2016).



TYP. SECTION
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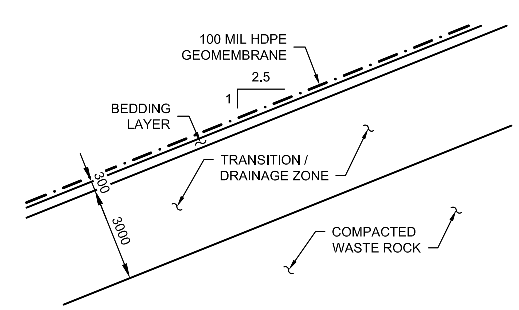

A SECTION
UPSTREAM LINER
NTS

SCALE B: 25 12.5 0 25 50 75 100 125 m

SCALE A: 80 40 0 100 200 300 400 m

IDM MINING LTD.

RED MOUNTAIN GOLD PROJECT

TMF OPTIONS ASSESSMENT
OPTION 6 & 7

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-594/01	VA16-00197

FIGURE B.2 REV 0

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SAVED: M:\1\01\00594\01\A\Acad\FIGS\B02, 2/17/2016 4:08:45 PM , EGUEVARRA PRINTED: 2/17/2016 4:15:47 PM, Fig. B.2, EGUEVARRA
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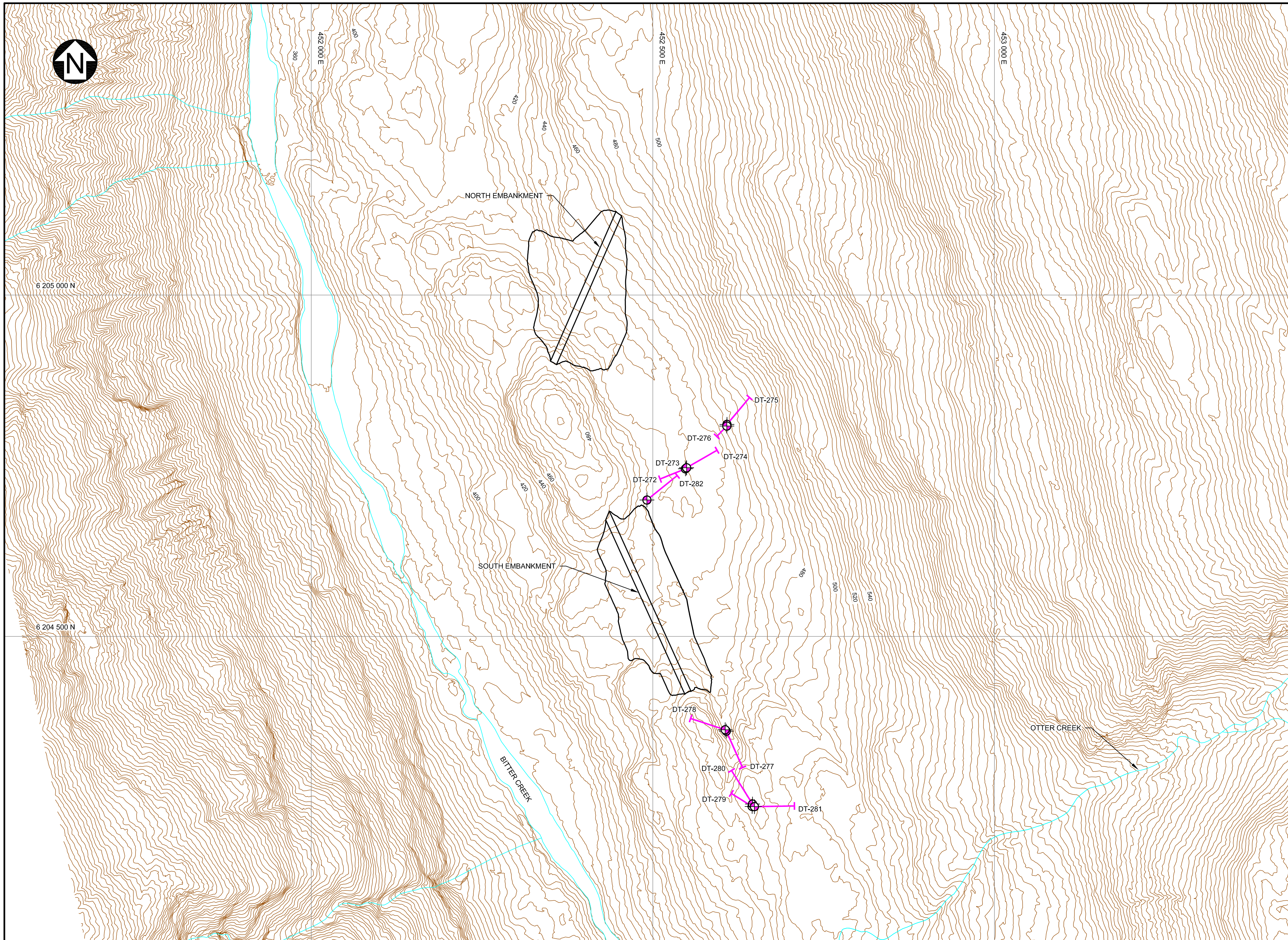
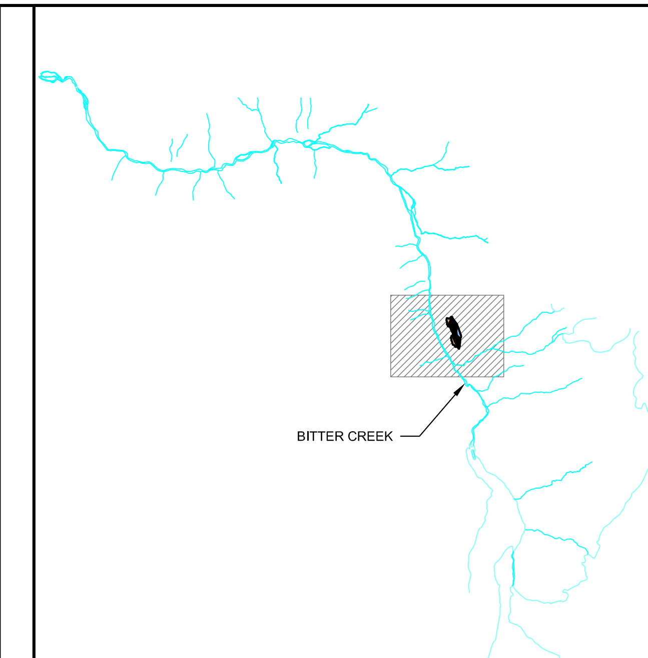


PLAN
SCALE A



KEY PLAN
NTS

LEGEND:

DT-272 HISTORIC DRILLHOLE (GOLDER ASSOCIATES)

NOTES:

1. COORDINATE GRID IS UTM NAD 83 ZONE 9.
2. PLAN RECEIVED BASED ON TOPO FROM JDS MINING (JANUARY 2016).
3. CONTOUR INTERVAL IS 5 METRES.
4. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

SCALE A 60 30 0 100 200 300 m

IDM MINING LTD.

RED MOUNTAIN GOLD PROJECT

OTTER CREEK UPPER TMF HISTORIC GEOTECHNICAL & HYDROGEOLOGICAL DRILLHOLE LOCATIONS

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-594/01	VA16-00197

FIGURE B.3 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	17FEB'16	ISSUED WITH LETTER	DMR	ELG	KDE

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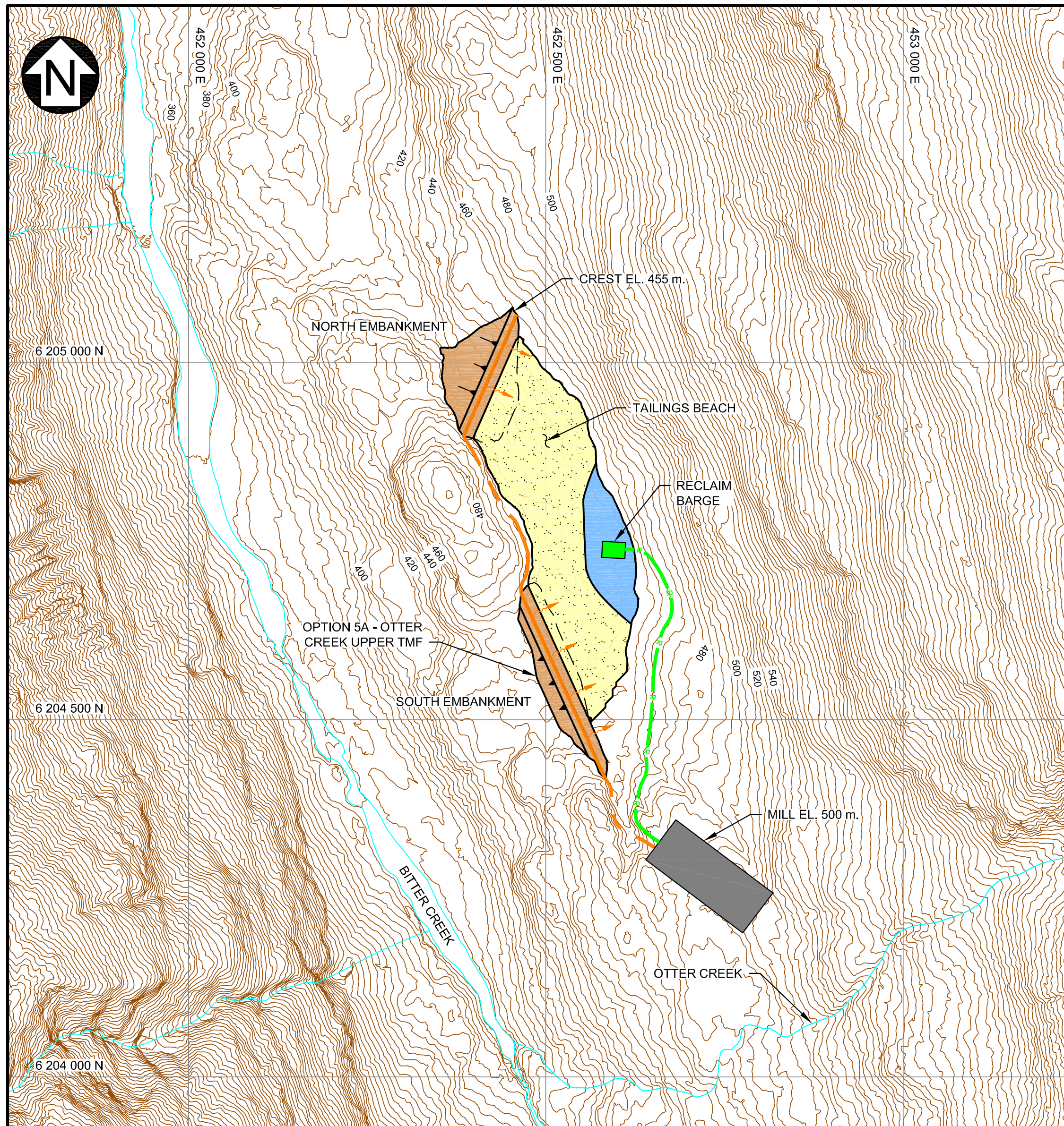
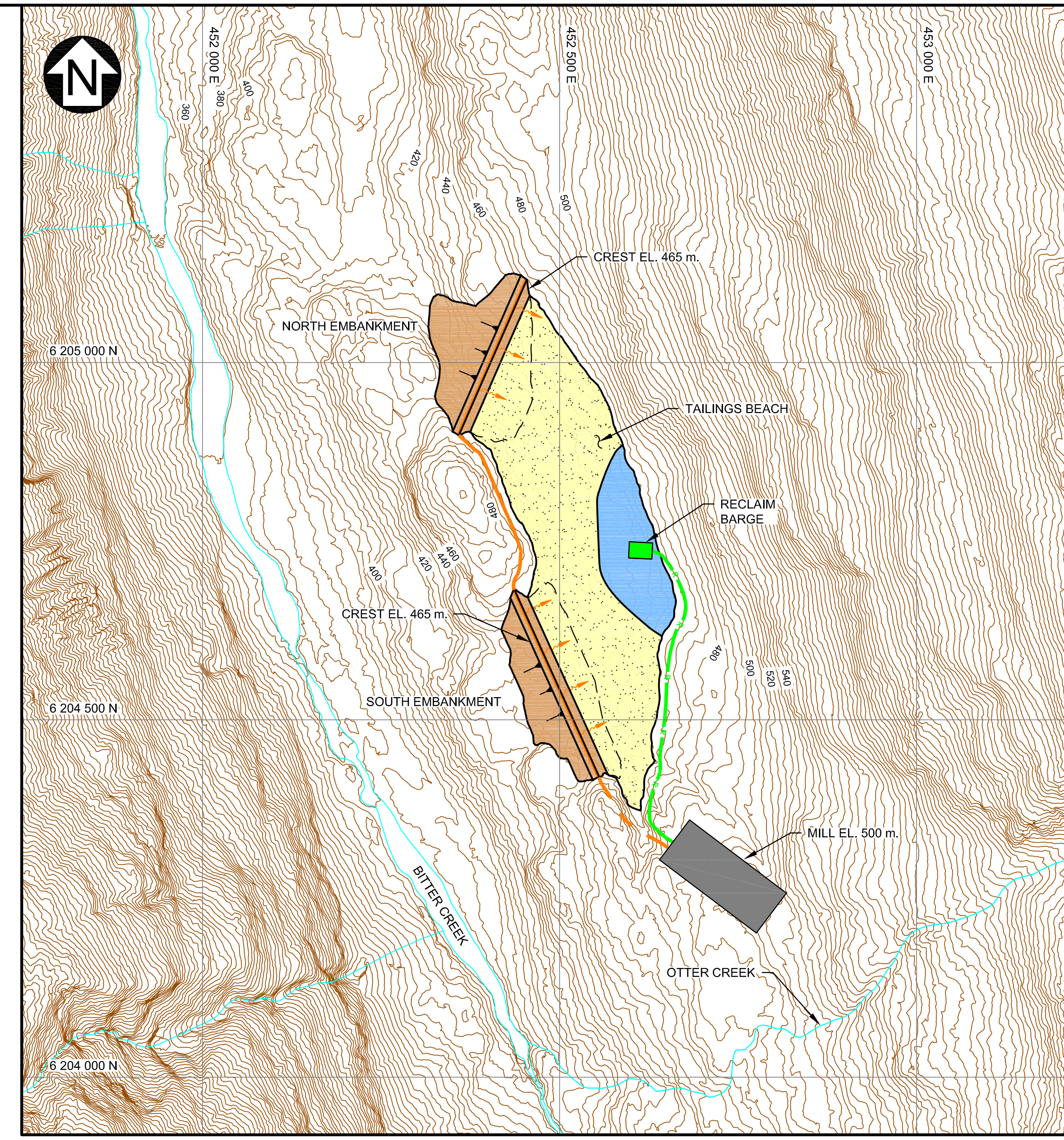
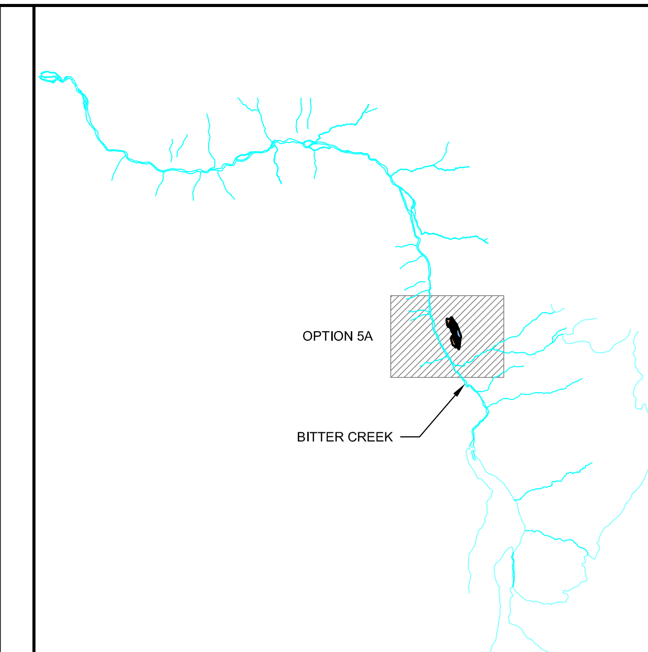
XREF FILE(S): v-TOPO-CONT-5m IMAGE FILE(S):



PLAN
STARTER TMF OPTION 5A
SCALE A

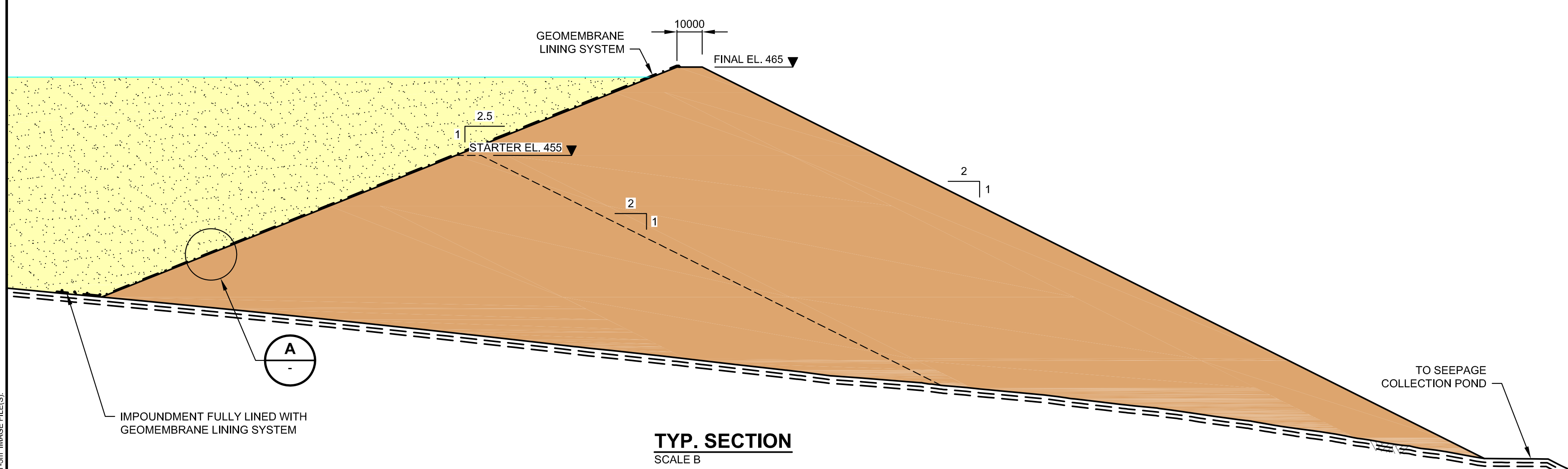


PLAN
FINAL TMF OPTION 5A
SCALE A

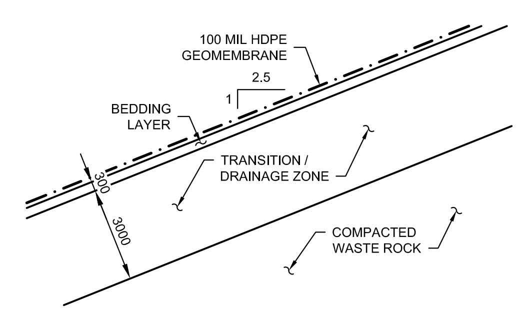


KEY PLAN
NTS

LEGEND:
- EMBANKMENT
- TAILINGS
- WATER
- RECLAIM PIPELINE
- TAILINGS PIPELINE
- EXISTING ROAD
- CREEK



TYP. SECTION
SCALE B



SECTION A
UPSTREAM LINER
NTS

NOTES:
1. COORDINATE GRID IS UTM NAD 83 ZONE 9.
2. PLAN RECEIVED BASED ON TOPO FROM JDS MINING (JANUARY 2016).
3. CONTOUR INTERVAL IS 5 METRES.
4. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
5. MILL LOCATION PROVIDED BY JDS MINING (FERUARY 2016).

SCALE B: 25 12.5 0 25 50 75 100 125 m
SCALE A: 100 50 0 100 200 300 400 500 m

IDM MINING LTD.

RED MOUNTAIN GOLD PROJECT

OPTION 5A
OTTER CREEK UPPER
CONCEPTUAL DESIGN

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-594/01	VA16-00197

FIGURE B.4 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	17FEB'16	ISSUED WITH LETTER	DMR	ELG	KDE

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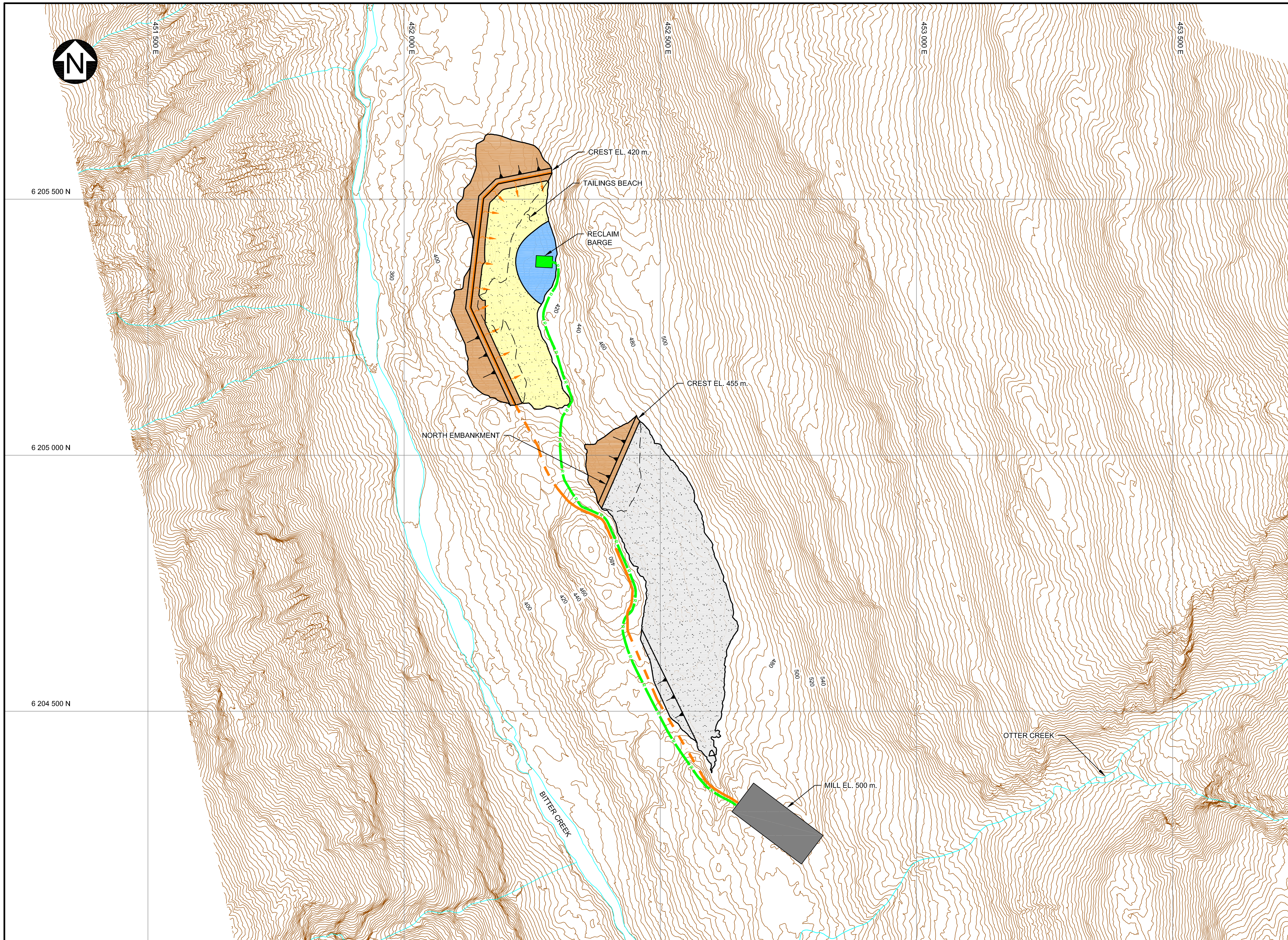
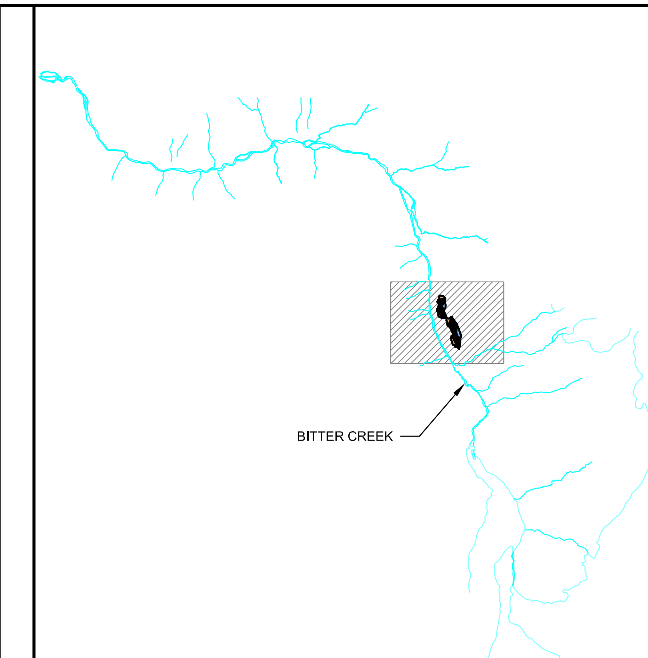


PLAN
SCALE A



KEY PLAN
NTS

LEGEND:

- EMBANKMENT
- FILTERED TAILINGS
- WATER
- RECLAIM PIPELINE
- TAILINGS PIPELINE
- EXISTING ROAD
- CREEK

NOTES:

1. COORDINATE GRID IS UTM NAD 83 ZONE 9.
2. PLAN RECEIVED BASED ON TOPO FROM JDS MINING (JANUARY 2016).
3. CONTOUR INTERVAL IS 5 METRES.
4. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
5. MILL LOCATION PROVIDED BY JDS MINING (FEBRUARY 2016).

SCALE A 80 40 0 100 200 300 400 m

IDM MINING LTD.

RED MOUNTAIN GOLD PROJECT

OTTER CREEK
SLURRY & FILTERED TAILINGS
CONCEPTUAL LAYOUT

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-594/01	VA16-00197

FIGURE B.5 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	17FEB'16	ISSUED WITH LETTER	DMR	ELG	KDE

SAVED: M:\1\01\00594\01\A\Acad\FIGS\B05, 2/17/2016 4:10:40 PM , EGUEVARRA PRINTED: 2/17/2016 4:19:41 PM, Fig. B.5, EGUEVARRA
XREF FILE(S): V-TOPO-CONT-5m IMAGE FILE(S):

APPENDIX C

OPTIONS ASSESSMENT - CONVENTIONAL SLURRY TAILINGS COST ESTIMATE TABLES

(Pages C-1 to C-6)

Knight Piésold CONSULTING

TABLE C.1

IDM MIINING INC.
RED MOUNTAIN GOLD PROJECT

CONVENTIONAL SLURRY TAILINGS
OPTION 1 - CIRQUE TMF (JDS PEA OPTION)

Print Feb/15/16 15:50:52

Item Number	Description	Units	Unit Cost	Initial Capital Quantity	Initial Capital Cost	Sustaining Capital & Operating Costs Quantity	Sustaining Capital & Operating Costs Cost	Total Life of Mine
1000	**Tailings Management Facility**							
1100	**TMF Earthworks**							
1110	Foundation Preparation							
1111	Clearing/Grubbing of TMF Footprint	m2	$ 2	105,000	$ 210,000	50,000	$ 100,000	
1112	Topsoil Stripping of TMF Footprint	m3	$ 5	52,500	$ 262,500	25,000	$ 125,000	
1120	Material Development and Fill Placement							
1121	Rockfill - Drill, Blast, Load, Haul and Place, Spread and Compact (within 500 m)	m3	$ 9	830,000	$ 7,470,000	870,000	$ 7,830,000	
1122	Transition Zone - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	65,000	$ 910,000	37,500	$ 525,000	
1123	Bedding Layer - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	21,750	$ 304,500	11,250	$ 157,500	
1130	Lining of TMF Embankment							
1131	Surface Preparation for Geomembrane Liner Installation - S/C/Moisture Condition	m2	$ 0.1	72,500	$ 7,975	37,500	$ 4,125	
1132	100 mil HDPE Liner - Supply, Deliver and Install	m2	$ 12.5	72,500	$ 906,250	37,500	$ 468,750	
1133	Non-woven 16 oz. Geotextile - Supply and Install	m2	$ 4	72,500	$ 290,000	37,500	$ 150,000	
1140	Geotechnical Instrumentation	LS	$ 50,000	1	$ 50,000	2.5	$ 125,000	
1150	Embankment Underdrain System							
1151	Perforated CPT Pipe, Fittings	m	$ 7.5	750	$ 5,625	125	$ 938	
1152	Drainage Layer - Process, Load, Haul, Place, Spread and Compact	m3	$ 14	450	$ 6,300	75	$ 1,050	
	SUB-TOTAL ITEM 1100				**$ 10,423,150**		**$ 9,487,363**	**$19,910,513**
1200	**Conventional Tailings Distribution System**							
1210	Tailings Distribution System							
1211	4" Dia. HDPE DR21 Tailings Delivery Pipeline	m	$ 50	900	$ 45,000	-	$ -	
1212	Tailings Distribution Fittings and Valves	%	20%	-	$ 9,000	-	$ -	
1220	Reclaim Water System							
1221	Reclaim Water Pumps/Barge	ea.	$ 250,000	1	$ 250,000	-	$ -	
1222	4" Dia. HDPE DR21 Reclaim Water Pipeline	m	$ 50	600	$ 30,000	-	$ -	
1223	Reclaim Water Pipeline Fittings and Valves	%	20%	-	$ 6,000	-	$ -	
	SUB-TOTAL ITEM 1200				**$ 340,000**		**$ -**	**$340,000**
1300	**TMF Water Management**							
1310	Diversion and Runoff Collection Channels	m	$ 500	1,000	$ 500,000	-	$ -	
1320	Seepage Collection Ditch	m	$ 250	600	$ 150,000	60	$ 15,000	
1330	Seepage Management Pond (Seepage recovery and recycle system)	LS	$ 250,000	1	$ 250,000	-	$ -	
1340	Construction Dewatering Allowance	LS	$ 50,000	1	$ 50,000	1	$ 50,000	
1350	Sediment & Erosion Control BMP's	ha	$ 1,000	10.5	$ 10,500	5	$ 5,000	
	SUB-TOTAL ITEM 1300				**$ 900,000**		**$ 15,000**	**$915,000**
1400	**Electrical**							
1410	Reclaim Water System							
1411	Reclaim Water System - Powerline	m	$ 100	500	$ 50,000	-	$ -	
1412	Reclaim Water System - Transformers and Switchgears	LS	$ 50,000	1	$ 50,000	-	$ -	
1413	Reclaim Water System - Electrical House with PLC & MCC	LS	$ 20,000	1	$ 20,000	-	$ -	
	SUB-TOTAL ITEM 1400				**$ 120,000**		**$ -**	**$120,000**
1500	**Operating Costs**							
1510	Tailings Distribution System							
1511	Conventional Tailings Distribution System - Pipeline Maintenance	%	2%	-		-	$ 4,500	
1520	Reclaim Water System							
1521	Reclaim Water System - Pumping Costs	MWhr	$ 40	-	$ -	655	$ 26,200	
1522	Reclaim Water System - Pipeline Maintenance	%	2%	-	$ -	-	$ 3,000	
1523	Reclaim Water System - Pump Maintenance	%	2%	-	$ -	-	$ 25,000	
	SUB-TOTAL ITEM 1400				**$ -**		**$ 58,700**	**$58,700**
	SUBTOTAL				**$ 11,783,150**		**$ 9,561,063**	**$21,344,213**
	Contingency	50%			$ 5,891,575		$ 4,780,531	$10,672,106
	TOTAL INITIAL CAPITAL				**$ 17,674,725**			**$17,674,725**
	TOTAL SUSTAINING CAPITAL						**$ 14,341,594**	**$14,341,594**
	TOTAL TMF COSTS				**$ 17,674,725**		**$ 14,341,594**	**$32,016,319**

M:\1\01\00594\01\A\Correspondence\VA16-00197\Appendix C\Excel Files\[Table C.1 - Option 1 - Preliminary Scoping Study.xlsx]Table C.1

NOTES:
1. ALL PRICES IN CAD$ (CONVERSION RATE CAD$0.75 = USD$1).
2. COST OF FUEL PROVIDED BY JDS MINING AS CAD$1.1/L.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR

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CONSULTING

TABLE C.2

IDM MIINING INC.
RED MOUNTAIN GOLD PROJECT

CONVENTIONAL SLURRY TAILINGS
OPTION 2 - TOP OF CIRQUE TMF

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Item Number	Description	Units	Unit Cost	Initial Capital		Sustaining Capital & Operating Costs		Total Life of Mine
				Quantity	Cost	Quantity	Cost	
1000	**Tailings Management Facility**							
1100	**TMF Earthworks**							
1110	Foundation Preparation							
1111	Clearing/Grubbing of TMF Footprint	m2	$ 2	118,000	$ 236,000	103,000	$ 206,000	
1112	Topsoil Stripping of TMF Footprint	m3	$ 5	59,000	$ 295,000	59,000	$ 295,000	
1120	Material Development and Fill Placement							
1121	Rockfill - Drill, Blast, Load, Haul and Place, Spread and Compact (within 500 m)	m3	$ 9	1,850,000	$ 16,650,000	3,275,000	$ 29,475,000	
1122	Transition Zone - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	76,200	$ 1,066,800	53,800	$ 753,200	
1123	Bedding Layer - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	15,300	$ 214,200	12,075	$ 169,050	
1130	Lining of TMF Embankment							
1131	Surface Preparation for Geomembrane Liner Installation - S/C/Moisture Condition	m2	$ 0.1	51,000	$ 5,610	40,250	$ 4,428	
1132	100 mil HDPE Liner - Supply, Deliver and Install	m2	$ 12.5	51,000	$ 637,500	40,250	$ 503,125	
1133	Non-woven 16 oz. Geotextile - Supply and Install	m2	$ 4	51,000	$ 204,000	40,250	$ 161,000	
1140	Geotechnical Instrumentation	LS	$ 50,000	1	$ 50,000	2.5	$ 125,000	
1150	Embankment Underdrain System							
1151	Perforated CPT Pipe, Fittings	m	$ 7.5	800	$ 6,000	250	$ 1,875	
1152	Drainage Layer - Process, Load, Haul, Place, Spread and Compact	m3	$ 14	480	$ 6,720	150	$ 2,100	
	SUB-TOTAL ITEM 1100				**$ 19,371,830**		**$ 31,695,778**	**$51,067,608**
1200	**Conventional Tailings Distribution System**							
1210	Tailings Distribution System							
1211	4" Dia. HDPE DR21 Tailings Delivery Pipeline	m	$ 50	1,600	$ 80,000	-	$ -	
1212	Tailings Distribution Fittings and Valves	%	20%	-	$ 16,000	-	$ -	
1220	Reclaim Water System							
1221	Reclaim Water Pumps/Barge	ea.	$ 250,000	1	$ 250,000	-	$ -	
1222	4" Dia. HDPE DR21 Reclaim Water Pipeline	m	$ 50	1,700	$ 85,000	-	$ -	
1223	Reclaim Water Pipeline Fittings and Valves	%	20%	-	$ 17,000	-	$ -	
	SUB-TOTAL ITEM 1200				**$ 448,000**		**$ -**	**$448,000**
1300	**TMF Water Management**							
1310	Diversion and Runoff Collection Channels	m	$ 500	600	$ 300,000	-	$ -	
1320	Seepage Collection Ditch	m	$ 250	1,025	$ 256,250	-	$ -	
1330	Seepage Management Pond (Seepage recovery and recycle system)	LS	$ 250,000	1	$ 250,000	-	$ -	
1340	Construction Dewatering Allowance	LS	$ 50,000	1	$ 50,000	1	$ 50,000	
1350	Sediment & Erosion Control BMP's	ha	$ 1,000	11.8	$ 11,800	10.3	$ 10,300	
	SUB-TOTAL ITEM 1300				**$ 806,250**		**$ -**	**$806,250**
1400	**Electrical**							
1410	Reclaim Water System							
1411	Reclaim Water System - Powerline	m	$ 100	500	$ 50,000	-	$ -	
1412	Reclaim Water System - Transformers and Switchgears	LS	$ 50,000	1	$ 50,000	-	$ -	
1413	Reclaim Water System - Electrical House with PLC & MCC	LS	$ 20,000	1	$ 20,000	-	$ -	
	SUB-TOTAL ITEM 1400				**$ 120,000**		**$ -**	**$120,000**
1500	**Operating Costs**							
1510	Tailings Distribution System							
1501	Conventional Tailings Distribution System - Pipeline Maintenance	%	2%	-	$ -	-	$ 8,000	
1520	Reclaim Water System							
1521	Reclaim Water System - Pumping Costs	MWhr	$ 40	-	$ -	655	$ 26,200	
1522	Reclaim Water System - Pipeline Maintenance	%	2%	-	$ -	-	$ 8,500	
1523	Reclaim Water System - Pump Maintenance	%	2%	-	$ -	-	$ 25,000	
	SUB-TOTAL ITEM 1400				**$ -**		**$ 67,700**	**$67,700**
	SUBTOTAL				**$ 20,746,080**		**$ 31,763,478**	**$52,509,558**
	Contingency	50%			$ 10,373,040		$ 15,881,739	$26,254,779
	TOTAL INITIAL CAPITAL				**$ 31,119,120**			**$31,119,120**
	TOTAL SUSTAINING CAPITAL						**$ 47,645,216**	**$47,645,216**
	TOTAL TMF COSTS				**$ 31,119,120**		**$ 47,645,216**	**$78,764,336**

M:\1\01\00594\01\A\Correspondence\VA16-00197\Appendix C\Excel Files\[Table C.2 - Option 2 - Preliminary Scoping Study.xlsx]Table C.2

NOTES:
1. ALL PRICES IN CAD$ (CONVERSION RATE CAD$0.75 = USD$1).
2. COST OF FUEL PROVIDED BY JDS MINING AS CAD$1.1/L.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR

Knight Piésold CONSULTING

TABLE C.3

IDM MINING INC.
RED MOUNTAIN GOLD PROJECT

CONVENTIONAL SLURRY TAILINGS
OPTION 5A - OTTER CREEK UPPER TMF

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Item Number	Description	Units	Unit Cost	Initial Capital		Sustaining Capital & Operating Costs		Total Life of Mine
				Quantity	Cost	Quantity	Cost	
1000	**Tailings Management Facility**							
1100	**TMF Earthworks**							
1110	Foundation Preparation							
1111	Clearing/Grubbing of TMF Footprint	m2	$ 2	95,000	$ 190,000	50,000	$ 100,000	
1112	Topsoil Stripping of TMF Footprint	m3	$ 5	47,500	$ 237,500	25,000	$ 125,000	
1120	Material Development and Fill Placement							
1121	Rockfill - Drill, Blast, Load, Haul and Place, Spread and Compact (within 500 m)	m3	$ 9	200,000	$ 1,800,000	375,000	$ 3,375,000	
1122	Transition Zone - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	38,000	$ 532,000	39,000	$ 546,000	
1122	Bedding Layer - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	24,600	$ 344,400	10,950	$ 153,300	
1130	Lining of TMF Embankment							
1131	Surface Preparation for Geomembrane Liner Installation - S/C/Moisture Condition	m2	$ 0.1	82,000	$ 9,020	36,500	$ 4,015	
1132	100 mil HDPE Liner - Supply, Deliver and Install	m2	$ 12.5	82,000	$ 1,025,000	36,500	$ 456,250	
1133	Non-woven 16 oz. Geotextile - Supply and Install	m2	$ 4	82,000	$ 328,000	36,500	$ 146,000	
1140	Geotechnical Instrumentation	LS	$ 50,000	1	$ 50,000	2.5	$ 125,000	
1150	Embankment Underdrain System							
1151	Perforated CPT Pipe, Fittings	m	$ 7.5	670	$ 5,025	270	$ 2,025	
1152	600 mm x 1000 mm Drainage Layer - Process, Load, Haul, Place, Spread and Compact	m3	$ 14	402	$ 5,628	162	$ 2,268	
	SUB-TOTAL ITEM 1100				**$ 4,526,573**		**$ 5,034,858**	**$9,561,431**
1200	**Conventional Tailings Distribution System**							
1210	Tailings Distribution System							
1211	4" Dia. HDPE DR21 Tailings Delivery Pipeline	m	$ 50	1,000	$ 50,000	-	$ -	
1212	Tailings Distribution Fittings and Valves	%	20%	-	$ 10,000	-	$ -	
1220	Reclaim Water System							
1221	Reclaim Water Pumps/Barge	ea.	$ 250,000	1	$ 250,000	-	$ -	
1222	4" Dia. HDPE DR21 Reclaim Water Pipeline	m	$ 50	500	$ 25,000	-	$ -	
1223	Reclaim Water Pipeline Fittings and Valves	%	20%	-	$ 5,000	-	$ -	
	SUB-TOTAL ITEM 1200				**$ 340,000**		**$ -**	**$340,000**
1300	**TMF Water Management**							
1310	Diversion and Runoff Collection Channels	m	$ 500	500	$ 250,000	-	$ -	
1320	Seepage Collection Ditch	m	$ 250	720	$ 180,000	-	$ -	
1330	Seepage Management Pond (Seepage recovery and recycle system)	LS	$ 250,000	2	$ 500,000	-	$ -	
1340	Construction Dewatering Allowance	LS	$ 50,000	1	$ 50,000	1	$ 50,000	
1350	Sediment & Erosion Control BMP's	ha	$ 1,000	9.5	$ 9,500	5	$ 5,000	
	SUB-TOTAL ITEM 1300				**$ 930,000**		**$ -**	**$930,000**
1400	**Electrical**							
1410	Reclaim Water System							
1411	Reclaim Water System - Powerline	m	$ 100	500	$ 50,000	-	$ -	
1412	Reclaim Water System - Transformers and Switchgears	LS	$ 50,000	1	$ 50,000	-	$ -	
1413	Reclaim Water System - Electrical House with PLC & MCC	LS	$ 20,000	1	$ 20,000	-	$ -	
	SUB-TOTAL ITEM 1400				**$ 120,000**		**$ -**	**$120,000**
1500	**Operating Costs**							
1510	Tailings Distribution System							
1511	Conventional Tailings Distribution System - Pipeline Maintenance	%	2%	-	$ -	-	$ 5,000	
1520	Reclaim Water System							
1521	Reclaim Water System - Pumping Costs	MWhr	$ 40	-	$ -	655	$ 26,200	
1522	Reclaim Water System - Pipeline Maintenance	%	2%	-	$ -	-	$ 2,500	
1523	Reclaim Water System - Pump Maintenance	%	2%	-	$ -	-	$ 25,000	
	SUB-TOTAL ITEM 1400				**$ -**		**$ 58,700**	**$58,700**
	SUBTOTAL				**$ 5,916,573**		**$ 5,093,558**	**$11,010,131**
	Contingency	50%			$ 2,958,287		$ 2,546,779	$5,505,066
	TOTAL INITIAL CAPITAL				**$ 8,874,860**			**$8,874,860**
	TOTAL SUSTAINING CAPITAL						**$ 7,640,337**	**$7,640,337**
	TOTAL TMF COSTS				**$ 8,874,860**		**$ 7,640,337**	**$16,515,197**

M:\1\01\00594\01\A\Correspondence\VA16-00197\Appendix C\Excel Files\[Table C.3 - Option 5A - Preliminary Scoping Study.xlsx]Table C.3

NOTES:
1. ALL PRICES IN CAD$ (CONVERSION RATE CAD$0.75 = USD$1).
2. COST OF FUEL PROVIDED BY JDS MINING AS CAD$1.1/L.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR

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TABLE C.4

IDM MINING INC.
RED MOUNTAIN GOLD PROJECT

CONVENTIONAL SLURRY TAILINGS
OPTION 5B - OTTER CREEK LOWER TMF

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Item Number	Description	Units	Unit Cost	Initial Capital		Sustaining Capital & Operating Costs		Total Life of Mine
				Quantity	Cost	Quantity	Cost	
1000	**Tailings Management Facility**							
1100	**TMF Earthworks**							
1110	Foundation Preparation							
1111	Clearing/Grubbing of TMF Footprint	m2	$ 2	86,500	$ 173,000	-	$ -	
1112	Topsoil Stripping of TMF Footprint	m3	$ 5	43,250	$ 216,250	-	$ -	
1120	Material Development and Fill Placement							
1121	Rockfill - Drill, Blast, Load, Haul and Place, Spread and Compact (within 500 m)	m3	$ 9	480,000	$ 4,320,000	-	$ -	
1122	Transition Zone - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	80,000	$ 1,120,000	-	$ -	
1123	Bedding Layer - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	20,400	$ 285,600	-	$ -	
1130	Lining of TMF Embankment							
1131	Surface Preparation for Geomembrane Liner Installation - S/C/Moisture Condition	m2	$ 0.1	68,000	$ 7,480	-	$ -	
1132	100 mil HDPE Liner - Supply, Deliver and Install	m2	$ 13	68,000	$ 850,000	-	$ -	
1133	Non-woven 16 oz. Geotextile - Supply and Install	m2	$ 4	68,000	$ 272,000	-	$ -	
1140	Geotechnical Instrumentation	LS	$ 50,000	1	$ 50,000	1	$ 52,083	
1150	Embankment Underdrain System							
1151	Perforated CPT Pipe, Fittings	m	$ 8	875	$ 6,563	-	$ -	
1152	600 mm x 1000 mm Drainage Layer - Process, Load, Haul, Place, Spread and Compact	m3	$ 14	525	$ 7,350	-	$ -	
	SUB-TOTAL ITEM 1100				**$ 7,308,243**		**$ 52,083**	**$7,360,326**
1200	**Conventional Tailings Distribution System**							
1210	Tailings Distribution System							
1211	4" Dia. HDPE DR21 Tailings Delivery Pipeline	m	$ 75	1,600	$ 120,000	-	$ -	
1212	Tailings Distribution Fittings and Valves	%	20%	-	$ 24,000	-	$ -	
1220	Reclaim Water System							
1221	Reclaim Water Pumps/Barge	ea.	$ 250,000	1	$ 250,000	-	$ -	
1222	4" Dia. HDPE DR21 Reclaim Water Pipeline	m	$ 75	1,300	$ 97,500	-	$ -	
1223	Reclaim Water Pipeline Fittings and Valves	%	20%	-	$ 19,500	-	$ -	
	SUB-TOTAL ITEM 1200				**$ 511,000**		**$ -**	**$511,000**
1300	**TMF Water Management**							
1310	Diversion and Runoff Collection Channels	m	$ 500	-	$ -	-	$ -	
1320	Seepage Collection Ditch	m	$ 250	830	$ 207,500	-	$ -	
1330	Seepage Management Pond (Seepage recovery and recycle system)	LS	$ 250,000	2	$ 500,000	-	$ -	
1340	Construction Dewatering Allowance	LS	$ 50,000	1	$ 50,000	-	$ -	
1350	Sediment & Erosion Control BMP's	ha	$ 1,000	8.65	$ 8,650	-	$ -	
	SUB-TOTAL ITEM 1300				**$ 707,500**		**$ -**	**$707,500**
1400	**Electrical**							
1410	Reclaim Water System							
1411	Reclaim Water System - Powerline	m	$ 100	500	$ 50,000	-	$ -	
1412	Reclaim Water System - Transformers and Switchgears	LS	$ 50,000	1	$ 50,000	-	$ -	
1413	Reclaim Water System - Electrical House with PLC & MCC	LS	$ 20,000	1	$ 20,000	-	$ -	
	SUB-TOTAL ITEM 1400				**$ 120,000**		**$ -**	**$120,000**
1500	**Operating Costs**							
1510	Tailings Distribution System							
1511	Conventional Tailings Distribution System - Pipeline Maintenance	%	2%	-	$ -	-	$ 5,000	
1520	Reclaim Water System							
1521	Reclaim Water System - Pumping Costs	MWhr	$ 40	-	$ -	273	$ 10,917	
1522	Reclaim Water System - Pipeline Maintenance	%	2%	-	$ -	-	$ 4,063	
1523	Reclaim Water System - Pump Maintenance	%	2%	-	$ -	-	$ 10,417	
	SUB-TOTAL ITEM 1400				**$ -**		**$ 30,396**	**$30,396**
	SUBTOTAL				**$ 8,646,743**		**$ 82,479**	
	Contingency	50%			$ 4,323,371		$ 41,240	$4,364,611
	TOTAL INITIAL CAPITAL				**$ 12,970,114**			**$12,970,114**
	TOTAL SUSTAINING CAPITAL						**$ 123,719**	**$123,719**
	TOTAL TMF COSTS				**$ 12,970,114**		**$ 123,719**	**$13,093,833**

M:\1\01\00594\01\A\Correspondence\VA16-00197\Appendix C\Excel Files\[Table C.4 - Option 5B - Preliminary Scoping Study.xlsx]Table C.4

NOTES:
1. ALL PRICES IN CAD$ (CONVERSION RATE CAD$0.75 = USD$1).
2. COST OF FUEL PROVIDED BY JDS MINING AS CAD$1.1/L.
3. OPTION 5B INCLUDED AS AN EXPANSION OPTION AND DOES NOT PROVIDE SUFFICENT STORAGE FOR THE DESIGN STORAGE OF 1.4 MTONNES OF TAILINGS

0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR
REV	DATE	DESCRIPTION	PREP'D	RVW'D

Knight Piésold CONSULTING

TABLE C.5

IDM MINING INC.
RED MOUNTAIN GOLD PROJECT

CONVENTIONAL SLURRY TAILINGS
OPTION 6 - ROOSEVELT CREEK TMF

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Item Number	Description	Units	Unit Cost	Initial Capital		Sustaining Capital & Operating Costs		Total Life of Mine
				Quantity	Cost	Quantity	Cost	
1000	**Tailings Management Facility**							
1100	**TMF Earthworks**							
1110	Foundation Preparation							
1111	Clearing/Grubbing of TMF Footprint	m2	$ 2	215,000	$ 430,000	-	$ -	
1112	Topsoil Stripping of TMF Footprint	m3	$ 5	107,500	$ 537,500	-	$ -	
1120	Material Development and Fill Placement							
1121	Rockfill - Drill, Blast, Load, Haul and Place, Spread and Compact (within 500 m)	m3	$ 9	1,841,000	$ 16,569,000	-	$ -	
1122	Transition Zone - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	125,000	$ 1,750,000	-	$ -	
1123	Bedding Layer - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	41,310	$ 578,340	-	$ -	
1130	Lining of TMF Embankment							
1131	Surface Preparation for Geomembrane Liner Installation - S/C/Moisture Condition	m2	$ 0.1	137,700	$ 15,147	-	$ -	
1132	100 mil HDPE Liner - Supply, Deliver and Install	m2	$ 13	137,700	$ 1,721,250	-	$ -	
1133	Non-woven 16 oz. Geotextile - Supply and Install	m2	$ 4	137,700	$ 550,800	-	$ -	
1140	Geotechnical Instrumentation	LS	$ 50,000	1	$ 50,000	2.5	$ 125,000	
1150	Embankment Underdrain System							
1151	Perforated CPT Pipe, Fittings	m	$ 8	1,175	$ 8,813	-	$ -	
1152	Process, Load, Haul, Place, Spread and Compact	m3	$ 14	705	$ 9,870	-	$ -	
	SUB-TOTAL ITEM 1100				**$ 22,220,720**		**$ 125,000**	**$22,345,720**
1200	**Conventional Tailings Distribution System**							
1210	Tailings Distribution System							
1211	4" Dia. HDPE DR21 Tailings Delivery Pipeline	m	$ 50	1,200	$ 60,000	-	$ -	
1212	Tailings Distribution Fittings and Valves	%	20%	-	$ 12,000	-	$ -	
1220	Reclaim Water System							
1221	Reclaim Water Pumps/Barge	ea.	$ 250,000	1	$ 250,000	-	$ -	
1222	4" Dia. HDPE DR21 Reclaim Water Pipeline	m	$ 50	300	$ 15,000	-	$ -	
1223	Reclaim Water Pipeline Fittings and Valves	%	20%	-	$ 3,000	-	$ -	
	SUB-TOTAL ITEM 1200				**$ 340,000**		**$ -**	**$340,000**
1300	**TMF Water Management**							
1310	Diversion and Runoff Collection Channels	m	$ 500	800	$ 400,000	-	$ -	
1320	Seepage Collection Ditch	m	$ 250	1,205	$ 301,250	-	$ -	
1330	Seepage Management Pond (Seepage recovery and recycle system)	LS	$ 250,000	1	$ 250,000	-	$ -	
1340	Construction Dewatering Allowance	LS	$ 50,000	1	$ 50,000	-	$ -	
1350	Sediment & Erosion Control BMP's	ha	$ 1,000	21.5	$ 21,500	-	$ -	
	SUB-TOTAL ITEM 1300				**$ 1,001,250**		**$ -**	**$1,001,250**
1400	**Electrical**							
1410	Reclaim Water System							
1411	Reclaim Water System - Powerline	m	$ 100	500	$ 50,000	-	$ -	
1412	Reclaim Water System - Transformers and Switchgears	LS	$ 50,000	1	$ 50,000	-	$ -	
1413	Reclaim Water System - Electrical House with PLC & MCC	LS	$ 20,000	1	$ 20,000	-	$ -	
	SUB-TOTAL ITEM 1400				**$ 120,000**		**$ -**	**$120,000**
1500	**Operating Costs**							
1510	Tailings Distribution System							
1511	Conventional Tailings Distribution System - Pipeline Maintenance	%	2%	-	$ -	-	$ 6,000	
1520	Reclaim Water System							
1521	Reclaim Water System - Pumping Costs	MWhr	$ 40	-	$ -	655	$ 26,200	
1522	Reclaim Water System - Pipeline Maintenance	%	2%	-	$ -	-	$ 1,500	
1523	Reclaim Water System - Pump Maintenance	%	2%	-	$ -	-	$ 25,000	
	SUB-TOTAL ITEM 1400				**$ -**		**$ 58,700**	**$58,700**
	SUBTOTAL				**$ 23,681,970**		**$ 183,700**	
	Contingency	50%			$ 11,840,985		$ 91,850	$11,932,835
	TOTAL INITIAL CAPITAL				**$ 35,522,954**			**$35,522,954**
	TOTAL SUSTAINING CAPITAL						**$ 275,550**	**$275,550**
	TOTAL TMF COSTS				**$ 35,522,954**		**$ 275,550**	**$35,798,504**

M:\1\01\00594\01\A\Correspondence\VA16-00197\Appendix C\Excel Files\[Table C.5 - Option 6 - Preliminary Scoping Study.xlsx]Table C.5

NOTES:
1. ALL PRICES IN CAD$ (CONVERSION RATE CAD$0.75 = USD$1).
2. COST OF FUEL PROVIDED BY JDS MINING AS CAD$1.1/L.

0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR
REV	DATE	DESCRIPTION	PREP'D	RVW'D

TABLE C.6

IDM MINING INC.
RED MOUNTAIN GOLD PROJECT

CONVENTIONAL SLURRY TAILINGS
OPTION 7 - HIGHWAY TMF

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Item Number	Description	Units	Unit Cost	Initial Capital		Sustaining Capital & Operating Costs		Total Life of Mine
				Quantity	Cost	Quantity	Cost	
1000	**Tailings Management Facility**							
1100	**TMF Earthworks**							
1110	Foundation Preparation							
1111	Clearing/Grubbing of TMF Footprint	m2	$ 2	90,000	$ 180,000	76,250	$ 152,500	
1112	Topsoil Stripping of TMF Footprint	m3	$ 5	45,000	$ 225,000	38,125	$ 190,625	
1120	Material Development and Fill Placement							
1121	Rockfill - Drill, Blast, Load, Haul and Place, Spread and Compact (within 500 m)	m3	$ 9	740,000	$ 6,660,000	1,730,000	$ 15,570,000	
1122	Transition Zone - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	96,000	$ 1,344,000	91,000	$ 1,274,000	
1123	Bedding Layer - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	16,875	$ 236,250	11,805	$ 165,270	
1130	Lining of TMF Embankment							
1131	Surface Preparation for Geomembrane Liner Installation - S/C/Moisture Condition	m2	$ 0.1	56,250	$ 6,188	39,350	$ 4,329	
1132	100 mil HDPE Liner - Supply, Deliver and Install	m2	$ 12.5	56,250	$ 703,125	39,350	$ 491,875	
1133	Non-woven 16 oz. Geotextile - Supply and Install	m2	$ 4	56,250	$ 225,000	39,350	$ 157,400	
1140	Geotechnical Instrumentation	LS	$ 50,000	1	$ 50,000	2.5	$ 125,000	
1150	Embankment Underdrain System							
1151	Perforated CPT Pipe, Fittings	m	$ 7.5	800	$ 6,000	200	$ 1,500	
1152	Drainage Layer - Process, Load, Haul, Place, Spread and Compact	m3	$ 14	480	$ 6,720	120	$ 1,680	
	SUB-TOTAL ITEM 1100				**$ 9,642,283**		**$ 18,134,179**	**$27,776,461**
1200	**Conventional Tailings Distribution System**							
1210	Tailings Distribution System							
1211	4" Dia. HDPE DR21 Tailings Delivery Pipeline	m	$ 50	1,000	$ 50,000	-	$ -	
1212	Tailings Distribution Fittings and Valves	%	20%	-	$ 10,000	-	$ -	
1220	Reclaim Water System							
1221	Reclaim Water Pumps/Barge	ea.	$ 250,000	1	$ 250,000	-	$ -	
1222	4" Dia. HDPE DR21 Reclaim Water Pipeline	m	$ 50	400	$ 20,000	-	$ -	
1223	Reclaim Water Pipeline Fittings and Valves	%	20%	-	$ 4,000	-	$ -	
	SUB-TOTAL ITEM 1200				**$ 334,000**		**$ -**	**$334,000**
1300	**TMF Water Management**							
1310	Diversion and Runoff Collection Channels	m	$ 500	725	$ 362,500	-	$ -	
1320	Seepage Collection Ditch	m	$ 250	1,065	$ 266,250	-	$ -	
1330	Seepage Management Pond (Seepage recovery and recycle system)	LS	$ 250,000	1	$ 250,000	-	$ -	
1340	Construction Dewatering Allowance	LS	$ 50,000	1	$ 50,000	1	$ 50,000	
1350	Sediment & Erosion Control BMP's	ha	$ 1,000	9	$ 9,000	7.625	$ 7,625	
	SUB-TOTAL ITEM 1300				**$ 878,750**		**$ -**	**$878,750**
1400	**Electrical**							
1410	Reclaim Water System							
1411	Reclaim Water System - Powerline	m	$ 100	500	$ 50,000	-	$ -	
1412	Reclaim Water System - Transformers and Switchgears	LS	$ 50,000	1	$ 50,000	-	$ -	
1413	Reclaim Water System - Electrical House with PLC & MCC	LS	$ 20,000	1	$ 20,000	-	$ -	
	SUB-TOTAL ITEM 1400				**$ 120,000**		**$ -**	**$120,000**
1500	**Operating Costs**							
1510	Tailings Distribution System							
1511	Conventional Tailings Distribution System - Pipeline Maintenance	%	2%	-	$ -	-	$ 5,000	
1520	Reclaim Water System							
1521	Reclaim Water System - Pumping Costs	MWhr	$ 40	-	$ -	655	$ 26,200	
1522	Reclaim Water System - Pipeline Maintenance	%	2%	-	$ -	-	$ 2,000	
1523	Reclaim Water System - Pump Maintenance	%	2%	-	$ -	-	$ 25,000	
	SUB-TOTAL ITEM 1400				**$ -**		**$ 58,200**	**$58,200**
	SUBTOTAL				**$ 10,975,033**		**$ 18,192,379**	
	Contingency	50%			$ 5,487,516		$ 9,096,189	$14,583,706
	TOTAL INITIAL CAPITAL				**$ 16,462,549**			**$16,462,549**
	TOTAL SUSTAINING CAPITAL						**$ 27,288,568**	**$27,288,568**
	TOTAL TMF COSTS				**$ 16,462,549**		**$ 27,288,568**	**$43,751,117**

M:\1\01\00594\01\A\Correspondence\VA16-00197\Appendix C\Excel Files\[Table C.6 - Option 7 - Preliminary Scoping Study.xlsx]Table C.6

NOTES:
1. ALL PRICES IN CAD$ (CONVERSION RATE CAD$0.75 = USD$1).
2. COST OF FUEL PROVIDED BY JDS MINING AS CAD$1.1/L.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR

APPENDIX D

SLURRY AND FILTERED TAILINGS COST ESTIMATE TABLES

(Pages D-1 to D-3)

Knight Piésold CONSULTING

TABLE D.1

IDM MINING INC.
RED MOUNTAIN GOLD PROJECT

OTTER CREEK
SLURRY & FILTERED TAILINGS COMBINATION
PRELIMINARY COST ESTIMATE SUMMARY - 50% CONTINGENCY

Description	Initial Capital Costs	Sustaining Capital	Total
Option 5B - 30% PAG Slurry Tailings	$11,891,000	$124,000	$12,015,000
Option 5A - 70% NAG Filtered Tailings	$2,726,000	$1,685,000	$4,411,000
TOTAL	$14,617,000	$1,809,000	$16,426,000

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0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR
REV	DATE	DESCRIPTION	PREP'D	RVW'D

Knight Piésold CONSULTING

TABLE D.2

IDM MINING INC.
RED MOUNTAIN GOLD PROJECT

30 % PAG CONVENTIONAL SLURRY TAILINGS
OPTION 5B - OTTER CREEK LOWER TMF

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Item Number	Description	Units	Unit Cost	Initial Capital		Sustaining Capital & Operating Costs		Total Life of Mine
				Quantity	Cost	Quantity	Cost	
1000	**Tailings Management Facility**							
1100	**TMF Earthworks**							
1110	Foundation Preparation							
1111	Clearing/Grubbing of TMF Footprint	m2	$ 2	86,500	$ 173,000	-	$ -	
1112	Topsoil Stripping of TMF Footprint	m3	$ 5	43,250	$ 216,250	-	$ -	
1120	Material Development and Fill Placement							
1121	Rockfill - Drill, Blast, Load, Haul and Place, Spread and Compact (within 500 m)	m3	$ 9	400,000	$ 3,600,000	-	$ -	
1122	Transition Zone - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	80,000	$ 1,120,000	-	$ -	
1123	Bedding Layer - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	20,400	$ 285,600	-	$ -	
1130	Lining of TMF Embankment							
1131	Surface Preparation for Geomembrane Liner Installation - S/C/Moisture Condition	m2	$ 0.1	68,000	$ 7,480	-	$ -	
1132	100 mil HDPE Liner - Supply, Deliver and Install	m2	$ 13	68,000	$ 850,000	-	$ -	
1133	Non-woven 16 oz. Geotextile - Supply and Install	m2	$ 4	68,000	$ 272,000	-	$ -	
1140	Geotechnical Instrumentation	LS	$ 50,000	1	$ 50,000	1	$ 52,083	
1150	Embankment Underdrain System							
1151	Perforated CPT Pipe, Fittings	m	$ 8	875	$ 6,563	-	$ -	
1152	600 mm x 1000 mm Drainage Layer - Process, Load, Haul, Place, Spread and Compact	m3	$ 14	525	$ 7,350	-	$ -	
	SUB-TOTAL ITEM 1100				**$ 6,588,243**		**$ 52,083**	**$6,640,326**
1200	**Conventional Tailings Distribution System**							
1210	Tailings Distribution System							
1211	4" Dia. HDPE DR21 Tailings Delivery Pipeline	m	$ 75	1,600	$ 120,000	-	$ -	
1212	Tailings Distribution Fittings and Valves	%	20%	-	$ 24,000	-	$ -	
1220	Reclaim Water System							
1221	Reclaim Water Pumps/Barge	ea.	$ 250,000	1	$ 250,000	-	$ -	
1222	4" Dia. HDPE DR21 Reclaim Water Pipeline	m	$ 75	1,300	$ 97,500	-	$ -	
1223	Reclaim Water Pipeline Fittings and Valves	%	20%	-	$ 19,500	-	$ -	
	SUB-TOTAL ITEM 1200				**$ 511,000**		**$ -**	**$511,000**
1300	**TMF Water Management**							
1310	Diversion and Runoff Collection Channels	m	$ 500	-	$ -	-	$ -	
1320	Seepage Collection Ditch	m	$ 250	830	$ 207,500	-	$ -	
1330	Seepage Management Pond (Seepage recovery and recycle system)	LS	$ 250,000	2	$ 500,000	-	$ -	
1340	Construction Dewatering Allowance	LS	$ 50,000	1	$ 50,000	-	$ -	
1350	Sediment & Erosion Control BMP's	ha	$ 1,000	8.65	$ 8,650	-	$ -	
	SUB-TOTAL ITEM 1300				**$ 707,500**		**$ -**	**$707,500**
1400	**Electrical**							
1410	Reclaim Water System							
1411	Reclaim Water System - Powerline	m	$ 100	500	$ 50,000	-	$ -	
1412	Reclaim Water System - Transformers and Switchgears	LS	$ 50,000	1	$ 50,000	-	$ -	
1413	Reclaim Water System - Electrical House with PLC & MCC	LS	$ 20,000	1	$ 20,000	-	$ -	
	SUB-TOTAL ITEM 1400				**$ 120,000**		**$ -**	**$120,000**
1500	**Operating Costs**							
1510	Tailings Distribution System							
1511	Conventional Tailings Distribution System - Pipeline Maintenance	%	2%	-	$ -	-	$ 5,000	
1520	Reclaim Water System							
1521	Reclaim Water System - Pumping Costs	MWhr	$ 40	-	$ -	273	$ 10,917	
1522	Reclaim Water System - Pipeline Maintenance	%	2%	-	$ -	-	$ 4,063	
1523	Reclaim Water System - Pump Maintenance	%	2%	-	$ -	-	$ 10,417	
	SUB-TOTAL ITEM 1400				**$ -**		**$ 30,396**	**$30,396**
	SUBTOTAL				**$ 7,926,743**		**$ 82,479**	$8,009,222
	Contingency	50%			$ 3,963,371		$ 41,240	$4,004,611
	TOTAL INITIAL CAPITAL				**$ 11,890,114**			**$11,890,114**
	TOTAL SUSTAINING CAPITAL						**$ 123,719**	**$123,719**
	TOTAL TMF COSTS				**$ 11,890,114**		**$ 123,719**	**$12,013,833**

M:\1\01\00594\01\A\Correspondence\VA16-00197\Appendix D\Excel Files\[Option 5B - Preliminary Scoping Study.xlsx]Table D.2

NOTES:
1. ALL PRICES IN CAD$ (CONVERSION RATE CAD$0.75 = USD$1).
2. COST OF FUEL PROVIDED BY JDS MINING AS CAD$1.1/L.
3. OPTION 5B INCLUDED AS AN EXPANSION OPTION AND DOES NOT PROVIDE SUFFICENT STORAGE FOR THE DESIGN STORAGE OF 1.4 MTONNES OF TAILINGS

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR

Knight Piésold CONSULTING

TABLE D.3

IDM MINING INC.
RED MOUNTAIN GOLD PROJECT

70% NAG FILTERED TAILINGS
OPTION 5A - OTTER CREEK Upper TMF

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Item Number	Description	Units	Unit Cost	Initial Capital		Sustaining Capital & Operating Costs		Total Life of Mine
				Quantity	Cost	Quantity	Cost	
1000	**Tailings Management Facility**							
1100	**TMF Earthworks**							
1110	Foundation Preparation							
1111	Clearing/Grubbing of TMF Footprint	m2	$ 2	86,500	$ 173,000	-	$ -	
1112	Topsoil Stripping of TMF Footprint	m3	$ 5	43,250	$ 216,250	-	$ -	
1120	Material Development and Fill Placement							
1121	Rockfill - Drill, Blast, Load, Haul and Place, Spread and Compact (within 500 m)	m3	$ 9	145,000	$ 1,305,000	-	$ -	
1122	Transition Zone - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	-	$ -	-	$ -	
1123	Bedding Layer - Process, Load, Haul, Place, Spread and Compact (within 500 m)	m3	$ 14	-	$ -	-	$ -	
1130	Lining of TMF Embankment							
1131	Surface Preparation for Geomembrane Liner Installation - S/C/Moisture Condition	m2	$ 0.1	-	$ -	-	$ -	
1132	100 mil HDPE Liner - Supply, Deliver and Install	m2	$ 13	-	$ -	-	$ -	
1133	Non-woven 16 oz. Geotextile - Supply and Install	m2	$ 4	-	$ -	-	$ -	
1140	Geotechnical Instrumentation	LS	$ 50,000	1	$ 50,000	2	$ 100,000	
1150	Embankment Underdrain System							
1151	Perforated CPT Pipe, Fittings	m	$ 8	875	$ 6,563	-	$ -	
1152	600 mm x 1000 mm Drainage Layer - Process, Load, Haul, Place, Spread and Compact	m3	$ 14	525	$ 7,350	-	$ -	
	SUB-TOTAL ITEM 1100				**$ 1,758,163**		**$ 100,000**	**$1,858,163**
1200	**Filtered Tailings Distribution System**							
1210	Filtered Tailings Delivery (Haul/Place/Spread/Compact/Grade)	m3	$ 2		$ -	620,000	$ 1,023,000	
	SUB-TOTAL ITEM 1200				**$ -**		**$ 1,023,000**	**$1,023,000**
1300	**TMF Water Management**							
1310	Diversion and Runoff Collection Channels	m	$ 500		$ -	-	$ -	
1340	Construction Dewatering Allowance	LS	$ 50,000	1	$ 50,000	-	$ -	
1350	Sediment & Erosion Control BMP's	ha	$ 1,000	8.65	$ 8,650	-	$ -	
1360	Water Polishing Pond	LS	$ 250,000	2	$ 500,000	-	$ -	
	SUB-TOTAL ITEM 1300				**$ 58,650**		**$ -**	**$58,650**
	SUBTOTAL				**$ 1,816,813**		**$ 1,123,000**	$2,939,813
	Contingency	50%			$ 908,406		$ 561,500	$1,469,906
	TOTAL INITIAL CAPITAL				**$ 2,725,219**			**$2,725,219**
	TOTAL SUSTAINING CAPITAL & OPERATING COSTS						**$ 1,684,500**	**$1,684,500**
	TOTAL TMF COSTS				**$ 2,725,219**		**$ 1,684,500**	**$4,409,719**

M:\1\01\00594\01\A\Correspondence\VA16-00197\Appendix D\Excel Files\[Option 5B - Preliminary Scoping Study.xlsx]Table D.3

NOTES:
1. ALL PRICES IN CAD$ (CONVERSION RATE CAD$0.75 = USD$1).
2. COST OF FUEL PROVIDED BY JDS MINING AS CAD$1.1/L.

0	16FEB'16	ISSUED WITH LETTER VA16-00197	JEF	DMR
REV	DATE	DESCRIPTION	PREP'D	RVW'D

APPENDIX B

BAT ASSESSMENT TABLES AND FIGURES

(Pages B-1 to B-10)

Knight Piésold CONSULTING

TABLE B.1

IDM MINING LTD.
RED MOUNTAIN UNDERGROUND GOLD PROJECT

TAILINGS BEST AVAILABLE TECHNOLOGY ASSESSMENT
CATEGORY, SUB-CATEGORY AND CRITERIA WEIGHTS

Print Aug/29/17 10:07:10

Category	Sub-Category	Criteria	Category Weight	Sub-Category Weight	Criteria Weight
Environmental	Surface and Ground Water	Chemical Stability	5	5	5
		Groundwater Quality			2
		Surface Water Quality			2
	Environmental Impacts	Physical Properties of Proposed TMF		5	5
		Closure			2
		Flora & Fauna & Land Use			1
Technical	Construction and Operation Considerations	Constructability	3	5	5
		Complexity of Operation			5
		Containment Design			4
		Complexity of Water Management			4
		Average Annual Water Balance Impacts			3
	Optimization and Permitting Considerations	Future Expansion Potential		4	5
		Proven Technology			3
Social	Health and Safety	Safety Considerations	1	5	5
	Effect on Existing Community	Public Acceptance		5	5
		Cultural Heritage			5
Economic	Cost	Schedule	1	5	5
		Capital Costs			5
		Operating and Maintenance Costs			3
		Closure and Reclamation Costs			3

\\KPL\VA-Prj$\1\01\00594\04\A\Report\1 - Tailings BAT Alternatives Assessment\Rev 1\Appendix B - Tables B1-B4\[Tables B1-B4_RevB (KP Methodology).xlsx]Table B1 Weights

NOTE(S):

1. GREATER WEIGHTS INDICATE GREATER RELATIVE IMPORTANCE.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	30JUN'17	ISSUED WITH REPORT VA101-594/4-1	JEF	KDE

Knight Piésold CONSULTING

TABLE B.2

IDM MINING LTD.
RED MOUNTAIN UNDERGROUND GOLD PROJECT

TAILINGS BEST AVAILABLE TECHNOLOGY ASSESSMENT
HIGH-LEVEL RATING

Print Aug-29-17 8:54:56

Criteria	Candidate 1 Thickened Tailings		Candidate 2 Ultra-thickened Cemented Tailings		Candidate 3 Filtered Tailings	
	Description	Rating	Description	Rating	Description	Rating
Enviromental						
Chemical Stability of PAG Tailings	● 100% of tailings is considered PAG. ● Water cover on potentially acid generating tailings tailings will mitigate ARD. ● Tailings mass is fully saturated due to lined facility. ● Tailings is anticipated to be metal leaching (ML) after 20 years if exposed to oxidation. ● Low permeability cover included in closure plan.	***Acceptable***	● 100% of tailings is considered PAG. ● Water cover on potentially acid generating tailings tailings will mitigate ARD. ● Tailings mass is fully saturated due to lined facility. ● Tailings is anticipated to be metal leaching (ML) after 20 years if exposed to oxidation. ● Low permeability cover included in closure plan.	***Acceptable***	● 100% of tailings is considered PAG. ● Tailings mass maintained in unsaturated condition, increasing oxidation and ARD generation. ● Low permeability cover included in closure plan. ● Tailings is anticipated to be metal leaching (ML) after 20 years.	***Least Preferred***
Groundwater Quality	● Low permeability liner will limit seepage to the downstream environment.	***Acceptable***	● Low permeability liner will limit seepage to the downstream environment.	***Acceptable***	● Filtered tailings stack will include low permeability liner to limit seepage to the downstream environment. ● Unsaturated tailings will also limit seepage to downstream environment. ● Unsaturated tailings increase the risk of ML/ARD from tailings mass.	***Acceptable***
Surface Water Quality	● Site water to be managed within slurry TMF, low risk of impact to surface water quality.	***Acceptable***	● Site water to be managed within TMF, low risk of impact to surface water quality. ● Separate pond for water management potentially required.	***Least Preferred***	● Separate pond for water management of filtered tailings required. ● No supernatant water stored on TMF, although confining embankments for tailings may store some water under high precipitation conditions.	***Preferred***
Physical Properties of Proposed TMF	● Slurry tailings material can be mobilized in the event of a dam failure.	***Least Preferred***	● Cement addition provides more stable tailings mass, less susceptible to liquefaction and unlikely to mobilize in the event of a dam failure (non-flowable and non-segregating).	***Preferred***	● Filtered tailings behaves in a soil-like behavior enabling stacking of tailings in an unsaturated, stable state.	***Preferred***
Closure	● Constructing closure cover on the thickened tailings facility is feasible but challenging.	***Least Preferred***	● Constructing closure cover on the cemented facility is feasible.	***Acceptable***	● Constructing closure cover on the filtered facility is feasible. ● Progressive reclamation of the filtered tailings stack may be possible.	***Preferred***
Flora, Fauna & Land Use	● All tailings contained within single TMF. ● Process water reclaimed from TMF supernatant pond.	***Preferred***	● All tailings contained within single TMF. ● Additional process water pond may be required.	***Acceptable***	● Separate pond for water management of filtered tailings. ● Separate process water pond may be required for make-up water.	***Least Preferred***

TABLE B.2

IDM MINING LTD.
RED MOUNTAIN UNDERGROUND GOLD PROJECT

TAILINGS BEST AVAILABLE TECHNOLOGY ASSESSMENT
HIGH-LEVEL RATING

Print Aug-29-17 8:54:56

Criteria	Candidate 1 Thickened Tailings		Candidate 2 Ultra-thickened Cemented Tailings		Candidate 3 Filtered Tailings	
	Description	Rating	Description	Rating	Description	Rating
Technical						
Constructability	• Single TMF required. • No additional process water pond required. • More challenging closure cover construction.	***Preferred***	• Single TMF required. • Cemented tailings will allow easier closure cover construction. • Separate process water pond may be required.	***Acceptable***	• Separate process water pond may be required. • PAG nature of tailings requires lining of TMF regardless of filtered tailngs. • Low angle of repose due to fine grind size requires confining embankments.	***Least Preferred***
Complexity of Operation	• Thickener underflow required for tailings production.. • Gravity discharge potential for tailings distribution, short distance from Process Plant.	***Preferred***	• Thickener and cement addition required to produce tailings. • Positive Displacement pumps required to pump tailings from Process Plant to TMF.	***Acceptable***	• Thickener and filter presses required to produce filtered tailings. • Low angle of repose of filtered tailings require confining embankments • Filtered tailings transported by trucks, placed and compacted.	***Least Preferred***
Containment Design	• Requires two embankments.	***Preferred***	• Requires two embankments. • Separate process water pond may be required.	***Acceptable***	• Requires two embankments for filtered tailings facility. • Additional facility required for process water.	***Least Preferred***
Water Management Complexity	• System of ditches to route non-contact water around TMF. • System of ditches and ponds with pump back systems to collect seepage and surface runoff water back to TMF supernatant pond. • Process water reclaimed from TMF supernatant pond.	***Preferred***	• System of ditches to route non-contact water around TMF. • System of ditches and ponds with pump back systems to collect seepage and surface runoff water back to TMF supernatant pond. • Process water reclaimed from TMF supernatant pond to maximum extent possible, but separate process water pond may be required to provide sufficient water for use in process.	***Acceptable***	• System of ditches to route non-contact water around TMF. • Separate water management system required to manage runoff from filtered tailings stack. • Separate process water pond may be required to provide sufficient water for use in process.	***Least Preferred***
Average Annual Water Balance	• Average annual water surplus is similar for all options.	***Acceptable***	• Average annual water surplus is similar for all options. • Reduced water in tailings as a result of higher solids content has negligible impact to overall inputs to TMF due to high precipitation in area.	***Acceptable***	• Smaller process water pond for just PAG tailings not expected to provide sufficient reclaim water for use in process.	***Least Preferred***
Future Expansion Potential	• Downstream Option 5B from KP Options Assessment may be used as an expansion cell.	***Least Preferred***	• Embankment crests may be raised to provide additional capacity. • Downstream Option 5B from Options Assessment may be used as an expansion cell.	***Acceptable***	• Increased tailings density from compacted tailings results in more expansion potential within facility footprint. • Downstream Option 5B from Options Assessment may be used as an expansion cell (depending on process water pond location).	***Preferred***
Proven Technology	• Thickened tailings a proven technology for most operational mine sites.	***Preferred***	• Cemented tailings relatively new technology but becoming more common. • Limited success in application of ultra-thickened tailings in the past.	***Least Preferred***	• Filtered tailings proven technology for low throughput operations, concerns remain about suitability for wetter climates.	***Acceptable***

TABLE B.2

IDM MINING LTD.
RED MOUNTAIN UNDERGROUND GOLD PROJECT

TAILINGS BEST AVAILABLE TECHNOLOGY ASSESSMENT
HIGH-LEVEL RATING

Print Aug-29-17 8:54:56

Criteria	Candidate 1 Thickened Tailings		Candidate 2 Ultra-thickened Cemented Tailings		Candidate 3 Filtered Tailings	
	Description	Rating	Description	Rating	Description	Rating
Social						
Health and Safety Considerations	• Relatively straightforward process and deposition strategy with thickener underflow and centrifugal pumping. • No high-pressure pipelines required or dangerous inhalant substances to be added by workers during process.	***Preferred***	• High pressure pipelines required to pump cemented tailings is a potential worker hazard. • Cement addition is a potential hazard to workers.	***Least Preferred***	• Increased mine haul truck traffic to construct filtered tailings facility is a potential worker hazard. • Dust generation potential from unsaturated filtered tailings is a potential hazard.	***Acceptable***
Public Acceptance	• Recent mine failures have led to uncertainties surrounding suitability of slurry tailings impoundments. • Thickened tailings may alleviate concerns over conventional slurry tailings.	***Least Preferred***	• Cemented tailings perceived as more stable than slurry tailings (conventional or thickened). • Relatively unknown technology.	***Acceptable***	• Filtered tailings considered most stable tailings technology.	***Preferred***
Cultural Heritage	• Single facility footprint reduces risk of impacting culturally significant areas within project footprint.	***Preferred***	• Single facility footprint reduces risk of impacting culturally significant areas within project footprint. • Separate process water pond may be required which could impact culturally significant areas within project footprint.	***Acceptable***	• Tailings facilities and separate process water pond facility increases risk of impacting culturally significant areas within project footprint.	***Least Preferred***
Economic						
Mining Schedule	• Thickened tailings disposal unlikely to impact project schedule.	***Preferred***	• Operational unavailability of paste plant or cement during maintenance or downtime may impact project schedule.	***Acceptable***	• Operational unavailability of filter plant during maintenance or downtime may impact project schedule. • Inefficiency of filter plant may impact project schedule. • Challenges posed by periods of high precipitation (wet climate) which may affect deposition of filtered tailings. • Challenges with filtered tailings deposition during winter months may include requirements for snow removal, potential for ice lenses to form in the tailings mass.	***Least Preferred***
Capital Cost	• Slurry tailings do not require any additional processing. • Potential for gravity discharge of tailings, particularly in early years of operations means tailings pump system can be deferred to sustaining capital, reducing initial capital. • Cost associated with starter dam construction.	***Preferred***	• Cemented tailings require tailings paste plant, positive displacement pumps and cement thickening plant to produce ultra-thickened cement tailings. • Potential for additional costs relating to construction of process water pond (if required). • Cost associated with starter dam construction.	***Acceptable***	• Filtered tailings require construction of filter plant in addition to regular ore processing. • Reduced embankment construction costs for anticipated smaller TMFembankments for filtered tailings containment. • Additional costs for construction of process water pond.	***Least Preferred***

TABLE B.2

IDM MINING LTD.
RED MOUNTAIN UNDERGROUND GOLD PROJECT

TAILINGS BEST AVAILABLE TECHNOLOGY ASSESSMENT
HIGH-LEVEL RATING

Print Aug-29-17 8:54:56

Criteria	Candidate 1 Thickened Tailings		Candidate 2 Ultra-thickened Cemented Tailings		Candidate 3 Filtered Tailings	
	Description	**Rating**	**Description**	**Rating**	**Description**	**Rating**
Operating Cost	• Thickened tailings can potentially be gravity discharged a short distance to the TMF directly after processing at the Process Plant, particularly during earlier years of operation, resulting in negligible cost.	***Preferred***	• Higher pumping costs associated with use of PD pumps and paste plant to produce cemented tailings, however Process Plant is a short distance to TMF.	***Acceptable***	• Operating costs associated with operation of filter plant. • Operating costs associated with haul and placement of non-PAG tailings in filtered tailings stack. • Higher reclaim costs due to distance between process water pond (downstream of TMF) and Process Plant Site.	***Least Preferred***
Closure Cost	• Trafficability and construction of the closure cover on the slurry tailings impoundment will be more challenging.	***Least Preferred***	• Improved trafficability expected for construction of closure cover on cemented tailings TMF.	***Acceptable***	• Improved trafficability expected for construction of closure cover on filtered tailings TMF. • No waste rock cover required for placement as mass is considered stable.	***Preferred***

M:\1\01\00594\04\A\Report\1 - Tailings BAT Alternatives Assessment\Rev 1\Appendix B - Tables B1-B4\[Tables B1-B4_RevB (KP Methodology).xlsx]Table B2 High-Level Rating

NOTES:

1. ALL FACILITIES ARE ASSUMED TO BE LINED WITH A LOW PERMEABILITY GEOSYNTHETIC LINER.

1	29AUG'17	ISSUED WITH REPORT VA101-594/4-1	JEF	KDE
REV	DATE	DESCRIPTION	PREP'D	RVW'D

Knight Piésold CONSULTING

TABLE B.3

IDM MINING LTD.
RED MOUNTAIN UNDERGROUND GOLD PROJECT

TAILINGS BEST AVAILABLE TECHNOLOGY ASSESSMENT
NUMERICAL RESULTS OF HIGH-LEVEL RATING (UNWEIGHTED)

Print Aug/29/17 10:04:28

Categories and Criteria	Candidates		
	Candidate 1 *Conventional Thickened Tailings*	**Candidate 2** *Ultra-thickened Cemented Tailings*	**Candidate 3** *Filtered Tailings*
Environmental			
Chemical Stability	2	2	1
Groundwater Quality	2	2	2
Surface Water Quality	2	1	3
Physical Characteristics and Impacts	1	3	3
Closure	1	2	3
Flora, Fauna & Land Use	3	2	1
TOTAL ENVIRONMENTAL	**11**	**12**	**13**
Technical			
Constructability	3	2	1
Complexity of Operation	3	2	1
Containment Design	3	2	1
Water Management Complexity	3	2	1
Average Annual Water Balance Impacts	2	2	1
Future Expansion Potential	1	2	3
Proven Technology	3	1	2
TOTAL TECHNICAL	**18**	**13**	**10**
Social			
Health and Safety Considerations	3	1	2
Public Acceptance	1	2	3
Cultural Heritage	3	2	1
TOTAL SOCIAL	**7**	**5**	**6**
Economic			
Schedule	3	2	1
Capital Cost	3	2	1
Operating Cost	3	2	1
Closure Cost	1	2	3
TOTAL ECONOMIC	**10**	**8**	**6**
UNWEIGHTED RESULTS	**46**	**38**	**35**

\\KPL\VA-Prj$\1\01\00594\04\A\Report\1 - Tailings BAT Alternatives Assessment\Rev 1\Appendix B - Tables B1-B4\[Tables B1-B4_RevB (KP Methodology).xlsx]Table B3 High-

NOTES:

1. THE MAXIMUM POSSIBLE SCORE FOR EACH CRITERIA IS 3 AND THE MINIMUM POSSIBLE SCORE IS 1.

0	30JUN'17	ISSUED WITH REPORT VA101-594/4-1	JEF	KDE
REV	DATE	DESCRIPTION	PREP'D	RVW'D

Knight Piésold CONSULTING

TABLE B.4

IDM MINING LTD.
RED MOUNTAIN UNDERGROUND GOLD PROJECT

TAILINGS BEST AVAILABLE TECHNOLOGY ASSESSMENT
WEIGHTED SCORING SUMMARY

Print Aug/29/17 10:04:28

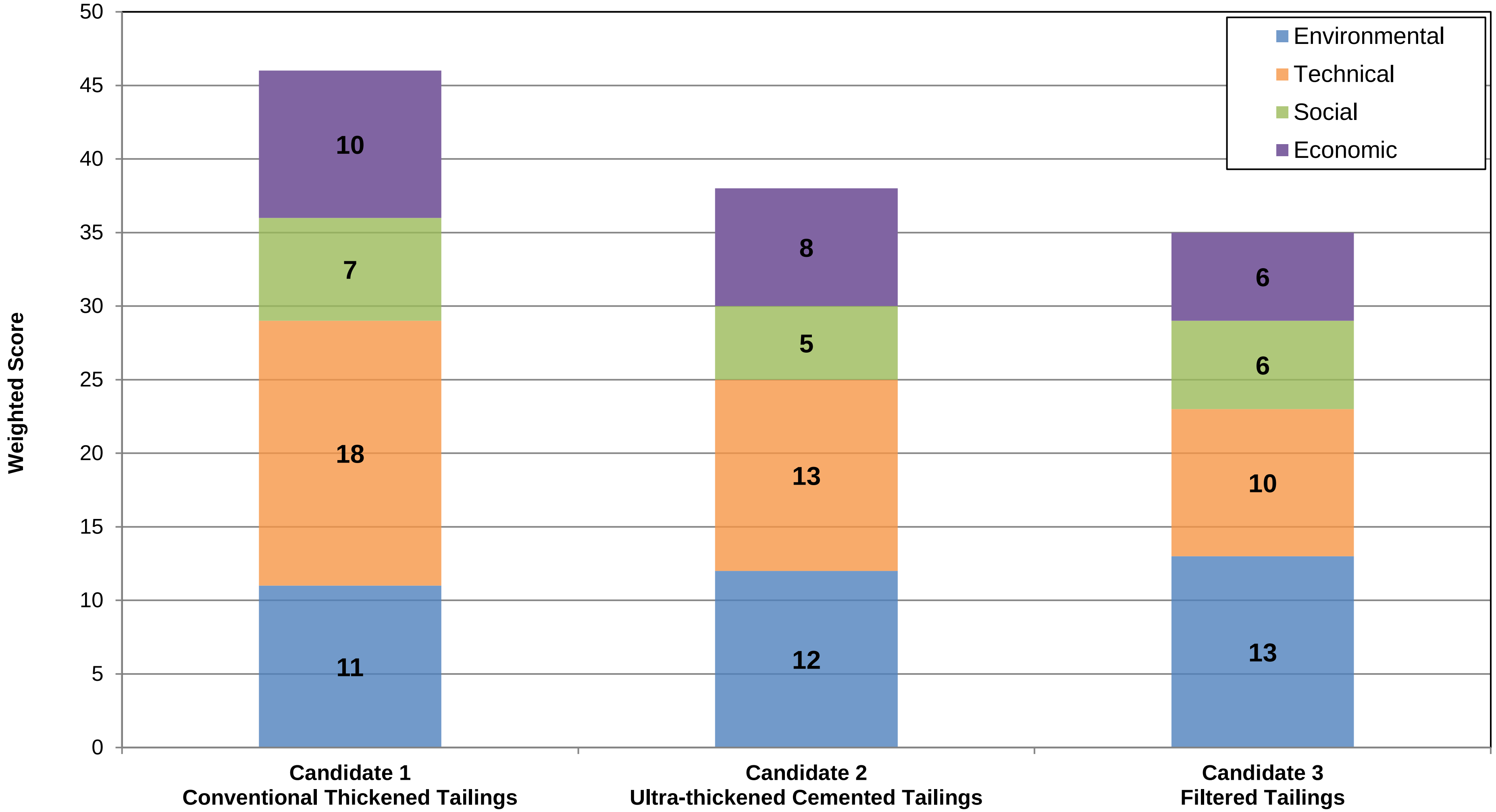
Category	Sub-Category	Criteria	Candidate 1 *Conventional Thickened Tailings*			Candidate 2 *Ultra-thickened Cemented Tailings*			Candidate 3 *Filtered Tailings*		
Environmental	Surface and Ground Water	Chemical Stability	2.00	1.63	1.39	1.78	1.76	1.30	1.67	1.71	1.26
		Groundwater Quality									
		Surface Water Quality									
	Environmental Impacts	Physical Characteristics and Impacts	1.25			1.75			1.75		
		Closure									
		Flora, Fauna & Land Use									
Technical	Construction and Operation Considerations	Constructability	1.33	1.19		0.95	0.86		0.48	0.82	
		Complexity of Operation									
		Containment Design									
		Complexity of Water Management									
		Average Annual Water Balance Impacts									
	Optimization and Permitting Considerations	Future Expansion Potential	1.00			0.75			1.25		
		Proven Technology									
Social	Health and Safety	Health and Safety Considerations	1.20	1.00		0.40	0.60		0.80	0.80	
	Effect on Existing Community	Public Acceptance	0.80			0.80			0.80		
		Cultural Heritage									
Economic	Cost	Schedule	1.25	1.25		1.00	1.00		0.75	0.75	
		Capital Costs									
		Operating and Maintenance Costs									
		Closure and Reclamation Costs									

\\KPL\VA-Prj$\1\01\00594\04\A\Report\1 - Tailings BAT Alternatives Assessment\Rev 1\Appendix B - Tables B1-B4\[Tables B1-B4_RevB (KP Methodology).xlsx]Figure B.3

NOTES:

1. RESULTS REFLECT WEIGHTING OF CRITERIA, SUB-CATEGORIES AND CATEGORIES.
2. THE MAXIMUM POSSIBLE SCORE IS 3 AND THE MINIMUM POSSIBLE SCORE IS 1.

0	30JUN'17	ISSUED WITH REPORT VA101-594/4-1	JEF	KDE
REV	DATE	DESCRIPTION	PREP'D	RVW'D



1	29AUG'17	ISSUED WITH REPORT VA101-594/4-1	JEF	KDE
REV	DATE	DESCRIPTION	PREP'D	RVW'D

IDM MINING LTD.

RED MOUNTAIN UNDERGROUND GOLD

TAILINGS BEST AVAILABLE TECHNOLOGY RESULTS OF HIGH-LEVEL ASSESSMENT UNWEIGHTED ASSESSMENT

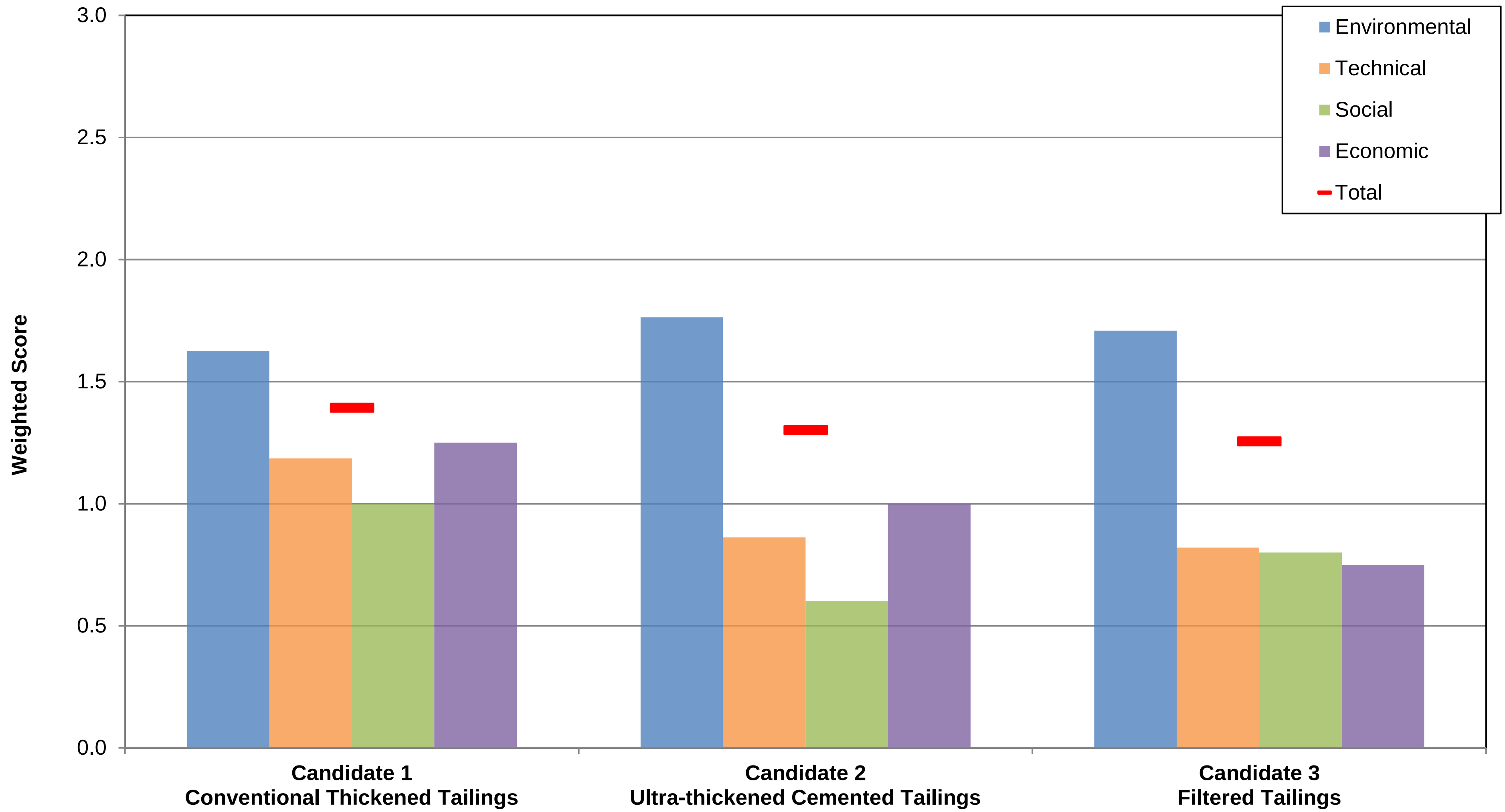
Knight Piésold CONSULTING

P/A NO. VA101-594/4

REF. NO. 1

FIGURE B.1

REV 1



IDM MINING LTD.

RED MOUNTAIN UNDERGROUND GOLD

TAILINGS BEST AVAILABLE TECHNOLOGY RESULTS OF HIGH-LEVEL ASSESSMENT

Knight Piésold CONSULTING

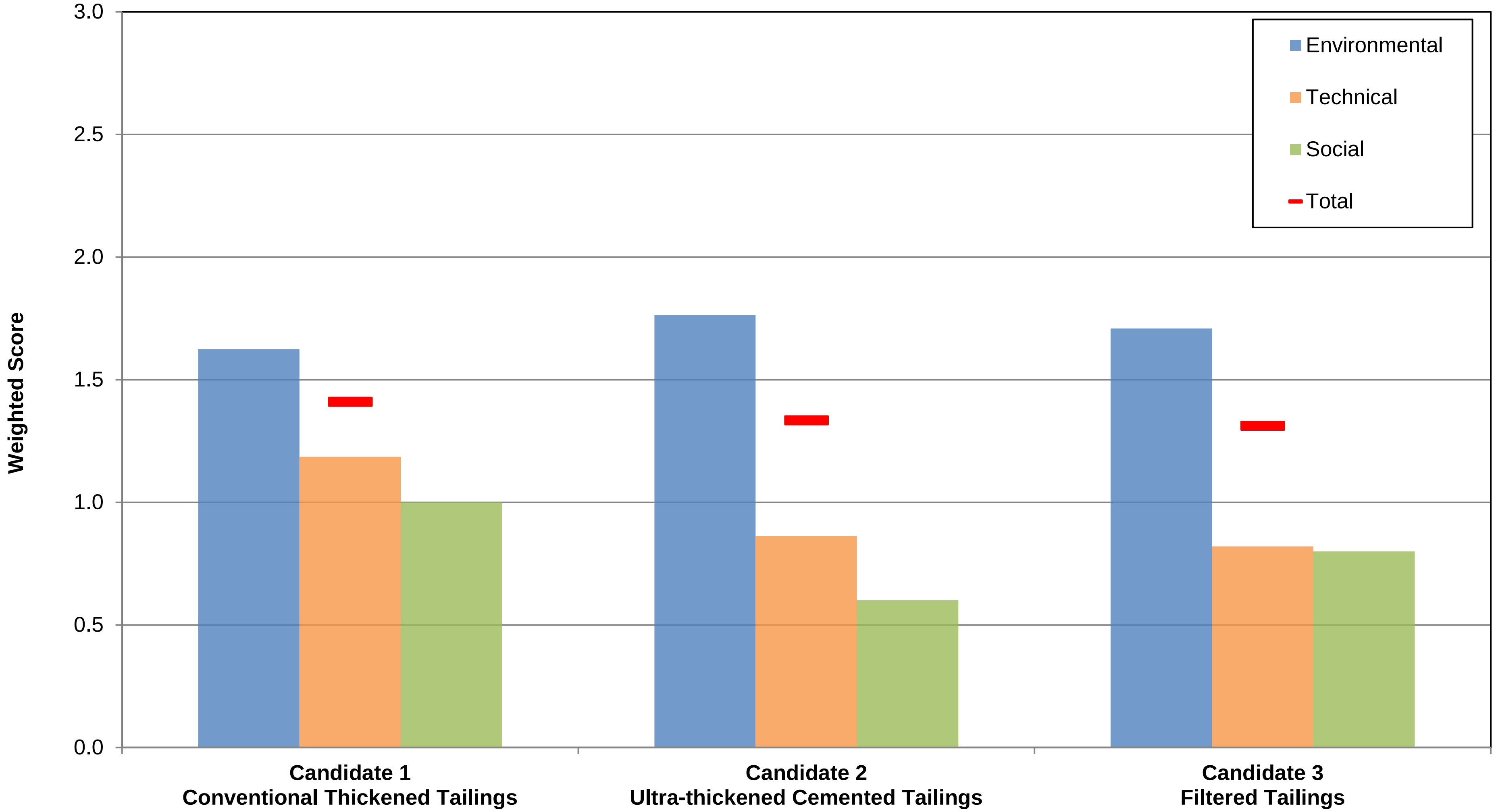
P/A NO. VA101-594/4

REF. NO. 1

FIGURE B.2

REV 1

REV	DATE	DESCRIPTION	PREP'D	RVW'D
1	29AUG'17	ISSUED WITH REPORT VA101-594/4-1	JEF	KDE



IDM MINING LTD.

RED MOUNTAIN UNDERGROUND GOLD

TAILINGS BEST AVAILABLE TECHNOLOGY RESULTS OF HIGH-LEVEL ASSESSMENT ECONOMIC CATEGORY EXCLUDED

Knight Piésold CONSULTING

P/A NO. VA101-594/4 | REF. NO. 1

FIGURE B.3 | REV 1

1	29AUG'17	ISSUED WITH REPORT VA101-594/4-1	JEF	KDE
REV	DATE	DESCRIPTION	PREP'D	RVW'D

APPENDIX C

TAILINGS FILTRATION TESTWORK RESULTS

(Pages C-1 to C-23)

Customer	**Knight Piésold Ltd.**
Contact Details	**Jim Fogarty,** P.Eng , Project Engineer jfogarty@knightpiesold.com
Place	Suite 1400, 750 West Pender St. Vancouver, BC, Canada V6C 2T8 D: 604.685.0543
Category	Mining
Application	Pre-Leach Thickening and Tailings Disposal
Project No. or Name	Red Mountain
Test Unit	Thickening & F.A.S.T Filter Press
Test Location	TAKRAF Canada Inc. 6929 Royal Oak Avenue, Burnaby, BC V5J 4J3 Canada P+1 604 451 7767
Test work Date	May , 2017
Test Engineer	Joey De Guzman

CONTENTS

1. INTRODUCTION

Knight Piésold Ltd. through the coordination with JDS Mining has awarded TAKRAF Canada Inc. to conduct the solid-liquid separation testing for Red Mountain project. For the purpose of this study and the availability of sample, the client had requested Base Met Labs to prepare samples for this study. Three (3) slurry samples were received by TAKRAF staff.

2. OBJECTIVE & SCOPE OF TEST WORK

The objective of the test work is to determine the Pre-Leach thickener operating parameters and to determine whether the tailings material is suitable for filtration. The scope of the test programme includes flocculant selection, settling tests, optimum dilution tests, flocculant dose tests, compaction tests, rheology, and rise rate or thickener loading selection. It includes the selection filter press operating parameters and equipment design.

3. TEST SUMMARY AND CONCLUSION

a. Pre-Leach Thickening

We selected an **18m** Pre-Leach Thickener with 3m tank wall and a floor slope of 9 degrees. The final underflow density of 55% solids is achievable in two (2) hours retention time. To maintain a stable thickener operation we recommend a feed dilution of 8% solids, a flocculent dose of 20 to 25 g/t AF304HH or its equivalent and a rise rate of 2.1 to 2.3 $m^3/m^2/h$ and a solids loading of 0.19 to 0.23 TPH/m^2.

b. Pressure Filtration

We investigated the possibility of producing a 'dry stackable' tailings product using one (1) unit of Fluid Actuated Screw Technology (F.A.S.T.) Filter presses model **F.A.S.T. FP 1500/99/40/10/R/A** (1500mm plate, 99 chambers, 40mm chamber depth, 10 bar feeding pressure, Recessed Plate, Opening all at once). The achievable cake moisture is 16.5% to 18.5%. The estimated total cycle time is 16 minutes.

4. CLIENT PROCESS DATA & REQUIREMENTS

Table 1: Process Data and Requirements

	Description	**Sample**
Process Data	Solid SG	2.82
	Liquid SG	1.00
	Slurry pH	7.0
	Slurry Temperature	ambient
	P_{80}	25 microns
Thickener Process	Solid Flow (TPH)	45
	Slurry Flow (m^3/h)	541
	Slurry SG	1.23877
	Slurry % Solids	40 %
	Overflow	<200 ppm
	Underflow	55% solids
Filter Press Feed	Thickener Underflow	55% or more
Filter Press Cake	Cake Moisture	Dry Stackable

SETTLING AND THICKENING

Static and Dynamic Tests

5. GENERAL PROCEDURES (SETTLING AND THICKENING)

SAMPLE PREPARATION

Normally the samples are received as slurries with separate process water for dilution. In some cases the samples are received as wet or partially dried cake; in this case tap water is used for dilution if process water is not available. Homogenized slurry (50 to 60% solids (w/w)) is prepared as the main stock sample for flocculant selection, settling and compaction. The pH and temperature are adjusted according to the process condition.

FLOCCULANT PREPARATION AND SCREENING

The flocculants used throughout the test program are prepared by dissolving 0.30 g flocculant in 300 mL of tap water giving a stock solution of 1.0 g/L. Then a fresh 0.5 g/L solution of flocculant is prepared each day for testing by further diluting a portion of the stock sample with additional tap water. Flocculant screening is performed for different flocculants preferably the client's recommendation as well as non-ionic flocculants and anionic flocculants.

Test samples are prepared as 500 mL samples containing 15% w/w solids by diluting the stock slurry with process water. The slurry is homogenized with a plunger and 15 g/t of flocculant is added via syringe. The slurry is mixed with four strokes of the plunger and the settling rate recorded. The turbidity (in NTU) of the overflow liquor for each test is taken 10 min. after flocculant addition and measured using an Oakton T-100 Turbid meter. Flocculant selection is based on fast settling rate and low turbidity of overflow.

SETTLING TESTS

Representative samples are prepared in 1000 mL graduated cylinders at different percent solids (i.e. 10%, 12.5%, and 15% solids (w/w)) by diluting the appropriate volume of the concentrated stock sample with process water. These samples are tested for settling with the addition of the selected flocculant at various flocculant doses. Once prepared the samples are homogenized with a plastic plunger. The flocculant is then added via syringe and mixed into the slurry with four strokes of the plunger.

The settling rate is recorded and the Total Suspended Solids or TSS (in ppm) in the overflow is measured; this is done by collecting approximately 120 mL of the liquor from a depth of 8-10 cm below the liquor-air interface with a tube-fitted pipette after 10 min. of settling and filtering through a Whatman #5 (2.5 µm) filter paper. In some cases the turbidity is measured instead of TSS. Graphs from tests data are generated to show the effect of flocculant dose on the settling rate and overflow clarity at differing feed dilutions.

COMPACTION TESTS

Compaction tests are performed using 2000 mL samples containing 20% to 30% w/w solids. Two tests are performed over a 24 hour period, one with rakes and one without, with the addition of flocculant to both.

RHEOLOGY

The liquor from the raked compaction test is removed and the compacted slurry is collected in a 500 mL beaker. The slurry is homogenized by stirring and then tested for rheology (Sheared). The remaining sample is then diluted with approximately 5-15 mL of process water, homogenized by stirring, and the Yield Stress measured. This rheology (Sheared) step is repeated 7 to 8 times to obtain yield stress and % solid data.

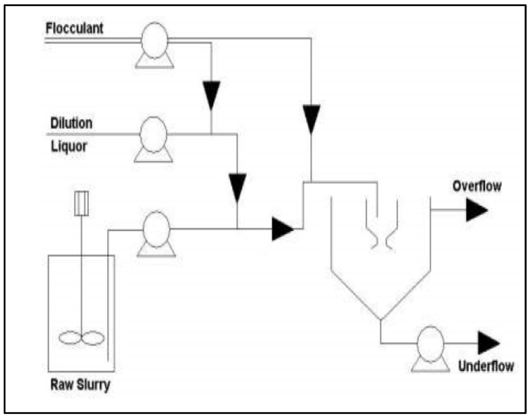
The liquor from the un-raked compaction test is removed and the compacted slurry is collected in a 500 ml beaker. The liquid is allowed to drain through a filter by gravity and then the slurry or paste is tested for rheology (un-sheared). The remaining sample is then diluted with approximately 5-15 mL of process water, homogenized by gentle stirring, and the Yield Stress measured. This rheology (un-sheared) step is repeated 7 to 8 times to obtain yield stress and % solid data.

Yield Stress determination is performed using a HAAKE Viscometer 550 fitted with a FL-100 vane starting from this high solids concentration. Once the Yield Stress is recorded small amount of sample (30-50 g) is dried to confirm the % solid concentration.

DYNAMIC THICKENING TESTS

The starting parameters for dynamic test work are selected based on the results of the static thickening test work. The liquor rise rates for the dynamic test are selected and calculated from these data; then the feed pump is then set as per estimated flow. Feed slurry is drawn from an agitated container using a peristaltic pump and is fed into the feedwell of the test unit; the flocculant is injected into the feed line prior to its delivery into the test unit.

The main variables during these tests are flocculant addition rate and solids loading or rise rate. A bed of solids is allowed to build until it reaches the bottom of the feedwell; an overflow sample is collected before it reaches this limit. At the completion of this test, the feed slurry is turned off, and then the flocculant pump, and finally the dilution liquor pump. The solids bed is allowed to compress under raked conditions for a predetermined amount of time before starting the underflow pump. A representative sample from the underflow discharge is taken for analysis.



6. STATIC THICKENING – FLOCCULANT SCREENING

c. Sample Preparation

Three (3) slurry samples were received; JW Master, AV Master and Marc Master. A composite sample was prepared from these samples for Settling and Filtration tests.

Table 2: Settling & Thickening Tests Parameters

DESCRIPTION		COMMENTS
Sample Received	Wet Slurry	Prepared by Base Met Labs
Process Liquid	Process Water	pH 7.0
Temperature / pH	25-30 / 7	
Flocculants	polyacrylamide	
SG Solids / SG Liquid	2.82 / 1.0	
P80	25 microns	

d. Initial Flocculant Screening

Homogenized slurry was prepared from slurry using tap water as process liquid. Samples were prepared at 18% solids in 500mL cylinders by diluting the stock slurry with process water. Flocculants were added via syringe at a dose of 20 g/t. Sample pulps were mixed using a plunger and the settling rates recorded. We selected AF 304HH as it gave a clear overflow.

Table 3: Initial Flocculant Screening Tests Data

Project Name	Red Mountain
Company Name	
Test Performed By	JDG
Test Date	
Sample	

Sample Data	Stock Sample
Sample Nº	1
Slurry R.D.	1.4343
Solids S.G.	2.8160
Liquid S.G.	1
% Solids	46.95%
Slurry Temperature	
Slurry pH	7

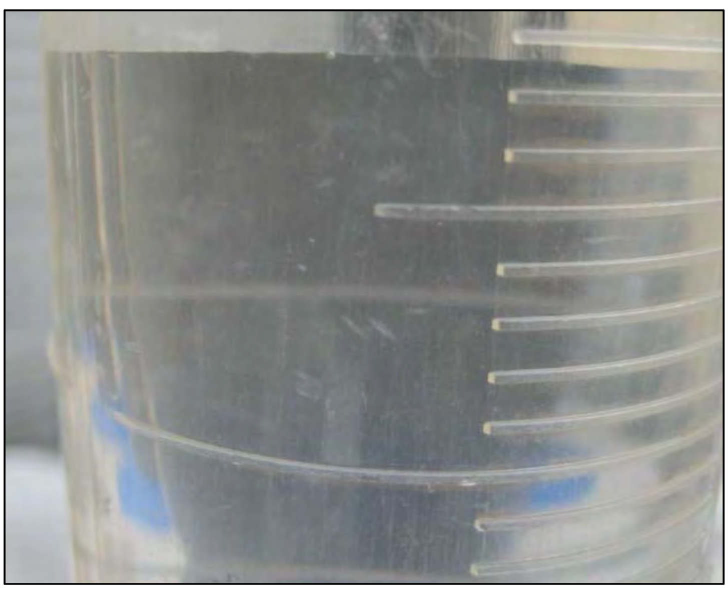
Sample N°								
Test N°		T1	T2	T3	T4	T5	T6	T7
Pulp Mass	(gr)	564	564	566	566	566	564	566
Pulp Vol.	(ml)	500	500	500	500	500	500	500
Pulp Density	(gr/ml)	1.128	1.128	1.132	1.132	1.132	1.128	1.132
% Solids	(%)	17.6%	17.6%	18.1%	18.1%	18.1%	17.6%	18.1%
Mass of Solids	(gr)	99	99	102	102	102	99	102
Floc. Name		MF 10	MF156	AF 304	AF 304HH	MF 333	MF 351	MF 1011
Floc. Conc.	(g/l)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Floc.Dose	(g/ton)	20	20	20	20	20	20	20
Floc. Vol.	(ml)	4.0	4.0	4.1	4.1	4.1	4.0	4.1
Settling Rate	(m/h)							
Clarity	(ppm)							
Turbidity	(NTU)	NC	NC	NC	Clear	NC	NC	NC

e. Initial Flocculant Screening – Overflow Quality

Below is the comparison of the overflow of samples as stated in Table 3.

NOT CLEAR

SLIGHTLY TURBID



CLEAR

Figure 1: Initial Flocculant Screening Overflow Quality

7. STATIC THICKENING – FLOCCULANT DOSE AND DILUTION

a. Settling Tests

Settling tests were done at 8%, 10%, 14% and 15% solids dilution in 500mL cylinders by diluting the stock slurry containing 47% solids with process water. Tests were done at different flocculants dose between 15 to 25 g/ton of AF304HH. Sample pulps were mixed using a plunger after flocculant addition and the settling rates were recorded. Based on the visual quality of the overflow samples the feed dilution should be about 8% solids.

Table 4: Flocculant Dose at Different Dilution

Project Name	Red Mountain
Company Name	0
Test Performed By	JDG
Test Date	
Sample	0

Sample Data	Stock Sample
Sample N°	1
Slurry R.D.	1.4343
Solids S.G.	2.8160
Liquid S.G.	1
% Solids	47.0%
Slurry Temperature	
Slurry pH	
Chosen Floc	AF304HH
Sample N°	

Test N°		T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19
Pulp Mass	(gr)	524	526	528	536	534	532	550	550	550	556	554	552
Pulp Vol.	(ml)	500	500	500	500	500	500	500	500	500	500	500	500
Pulp Density	(gr/ml)	1.048	1.052	1.056	1.072	1.068	1.064	1.1	1.1	1.1	1.112	1.108	1.104
% Solids	(%)	7.1%	7.7%	8.2%	10.4%	9.9%	9.3%	14.1%	14.1%	14.1%	15.6%	15.1%	14.6%
Mass of Solids	(gr)	37	40	43	56	53	50	78	78	78	87	84	81
Floc. Conc.	(g/l)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Floc.Dose	(g/ton)	15	20	25	15	20	25	15	20	25	15	20	25
Floc. Vol.	(ml)	1.1	1.6	2.2	1.7	2.1	2.5	2.3	3.1	3.9	2.6	3.3	4.0
Settling Rate	(m/h)	2.12	2.21	2.3	1.4	1.58	1.94	1.04	1.04	1.04	0.68	0.95	0.77
Clarity	(ppm)												
Turbidity	(NTU)	NC	C	C	ST	ST	NC	NC	NC	NC	NC	NC	NC

b. Settling Tests - Overflow Quality and Flocculant Dose

The overflow samples below were clearer from the tests with 20 to 25 g/t AF304HH flocculant. We also observed that samples with 8% solids generated better overflow quality.

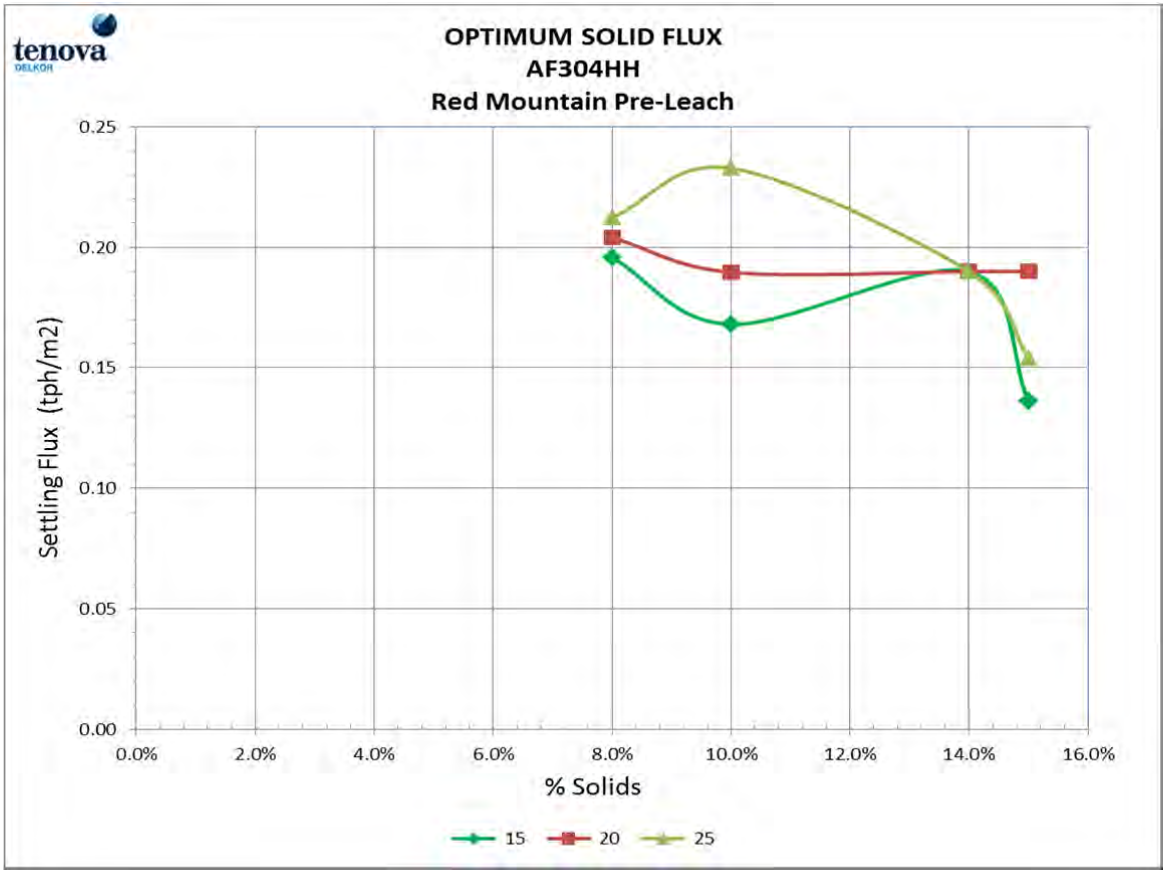
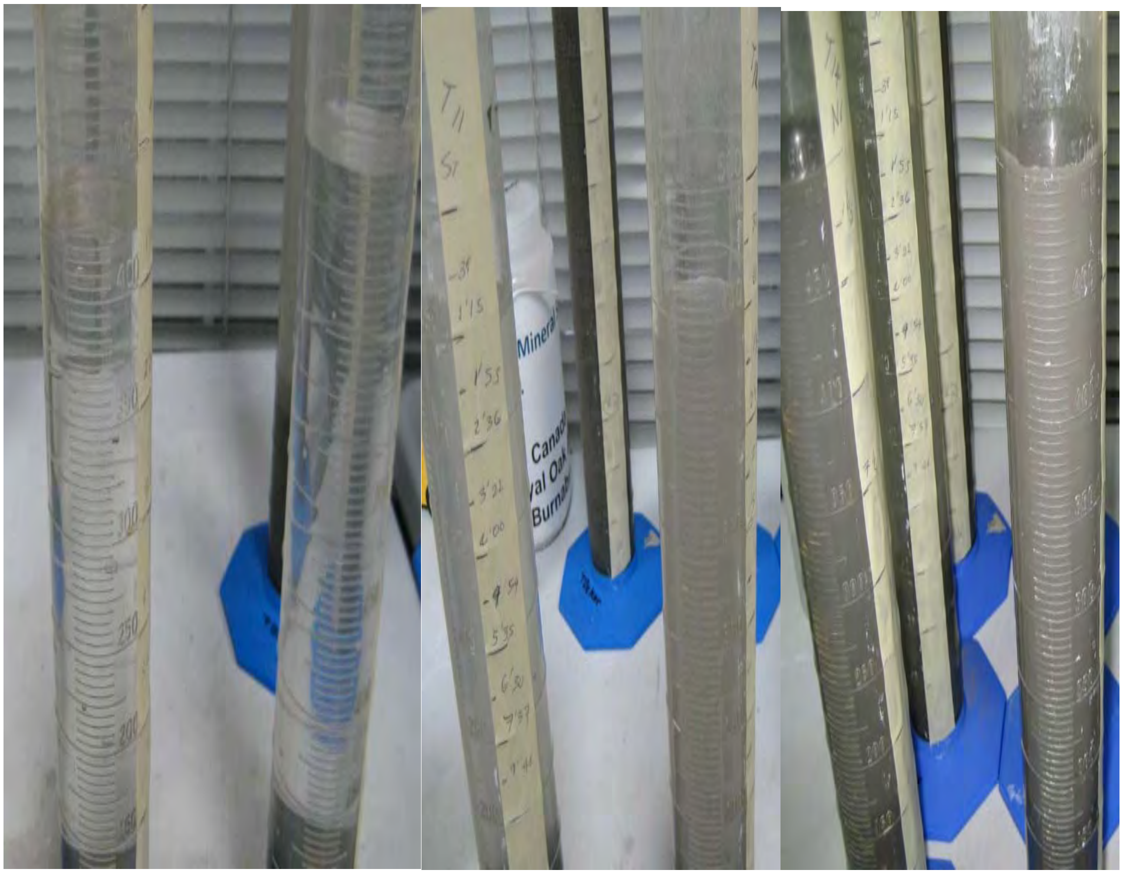


Figure 2: Settling Rate Curves



Tests 9 & 10 Tests 11 & 12 Tests 13 & 14

Figure 3: Overflow Clarity Comparison

c. Optimum Dilution

The optimum dilution is between 8 to 10% solids as shown below. However, considering the overflow clarity we recommend 8% solids Feedwell dilution.

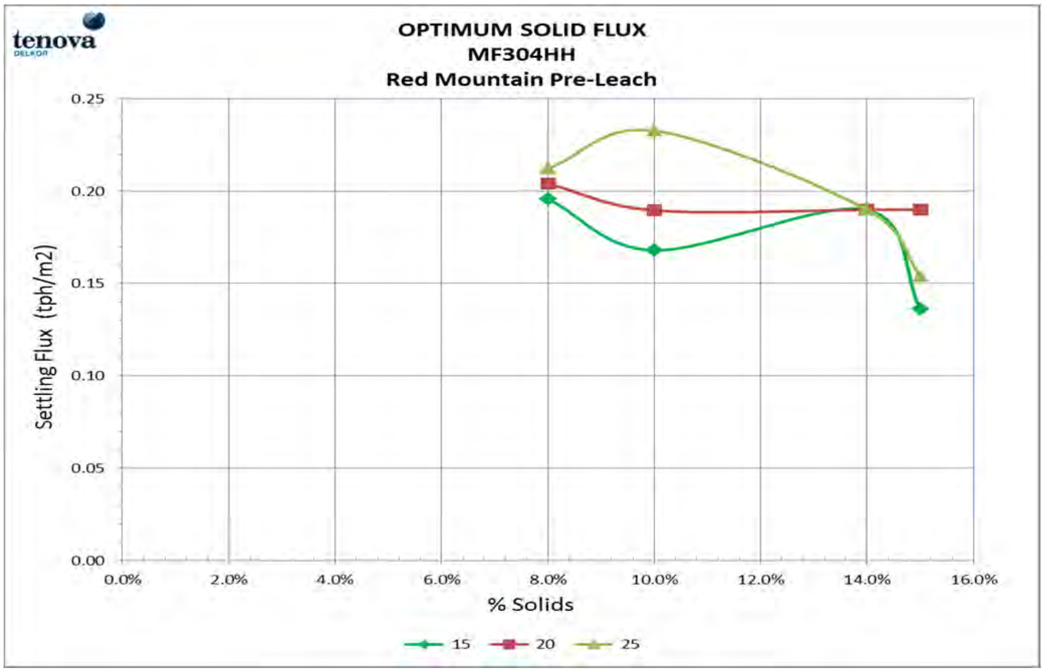


Figure 4: Optimum Dilution Curves

8. STATIC THICKENING – COMPACTION TESTS

a. Underflow Density

Compaction test was performed using 2000 mL samples containing 20% w/w solids over a 3-hour period. AF304HH flocculant (0.5 g/L concentration) was added at 25 g/t dose. The pulp was mixed well with the flocculant using a plunger and the compaction tests were done using rakes. The expected underflow density of 55% solids was achieved in two (2) hours.

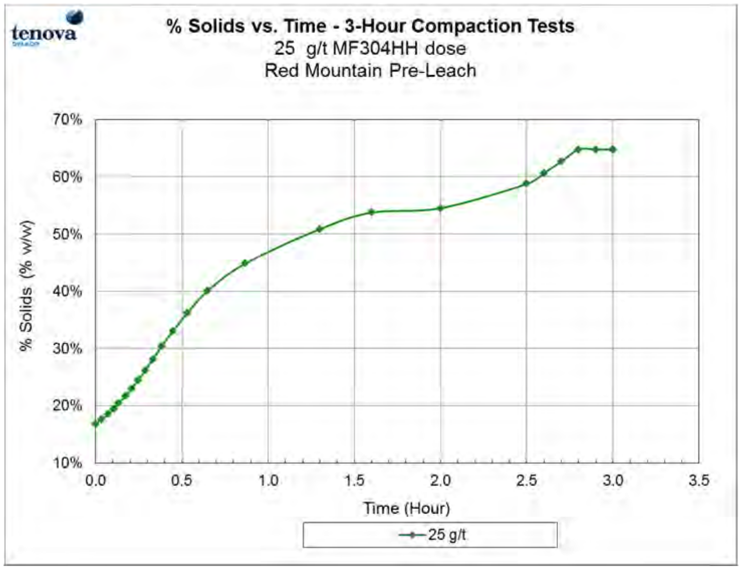


Figure 5: Compaction Tests Curves

b. Rheology

The thickener underflow density of 55% solids is expected to have a yield stress of 20 Pa.

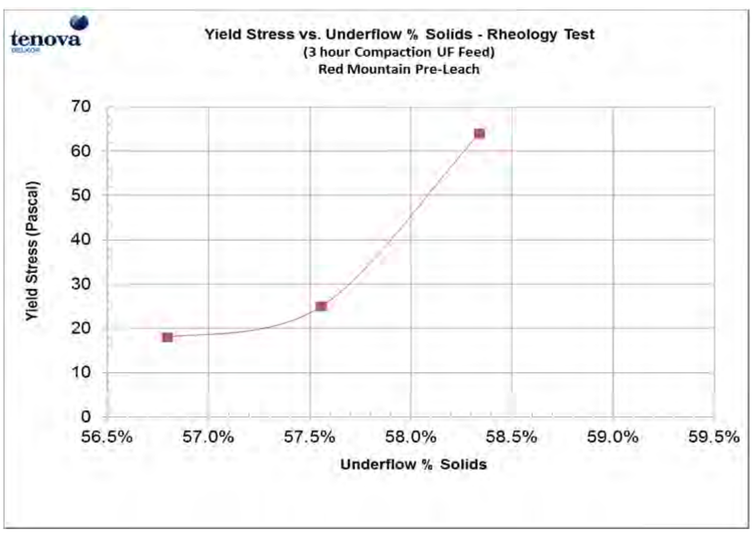


Figure 6: Yield Stress Curves

9. CONCLUSION & EQUIPMENT SIZING – PRELEACH THICKENER

Delkor methodology for thickener selection considers that there are three zones operating in a thickener:

- The Clarified Liquor Zone, where clarified liquor rises to the overflow launder and leaves the thickener, and
- The Settling Zone, comprised of Free Settling and Hindered Settling Zones, where the design constraint is that the solid free settling rate must be greater than that of the rising volume of liquid in the tank, and
- The Compaction Zone, where the rate of compaction of flocculated solid is the design constraint, accompanied by and associated with the maximum achievable compaction.

Below are the details of the process parameters for thickening and our equipment selection.

Table 5: Equipment Selection

PROCESS PARAMETERS	DETAILS
Feed Solids / % Solids in Feed	45 TPH / 40%
SG Solids / Liquid	2.82 / 1.0
pH / Temperature ^{O}C	7 / ambient
P_{80}	25 microns
Feed Dilution	8% Solids
Flocculant	AF304HH
Flocculant Dose	20 to 25 g/t
Thickener Overflow	<200 ppm
Rise Rate	2.1 to 2.3 $m^3/m^2/h$
Solids Loading	0.19 to 0.23 TPH/m^2
Retention Time	2 hours
Thickener Underflow	55% Solids
Yield Stress	20 Pa (min)
PRELEACH THICKENER DESIGN	
Thickener Diameter	**18m**
No. of Units	1
Tank Wall / Slope	3m / 9 degrees

PRESSURE FILTRATION

F.A.S.T FILTER PRESS

(Fluid Actuated Screw Technology)

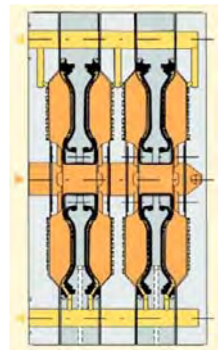
10. GENERAL DESCRIPTION OF PRESSURE FILTRATION-PROCESS FLOW DIAGRAM

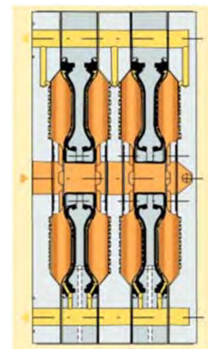
The filtration steps in a filter press are shown in the below schematic. Cake washing is an optional and is not described in this case.

Filling/Dewatering stage:

For straightforward dewatering applications the feed slurry is introduced into the Filter Press by the feed pump.

The solids are trapped by the filter cloth and the filtrate is discharged via the plate drainage grid which is connected to the corner ports. The driving force for filtration is generated by the Filter Press feed pump and filtration rates or final moistures can be improved by increasing the feed pressure.

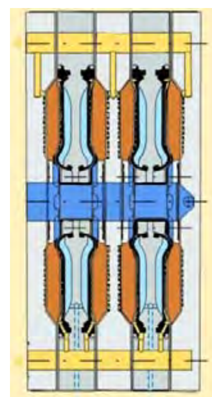




Membrane Squeezing (Membrane Filter Press)

This Option is available in Membrane Type Filter Press. Membrane Squeezing is a mechanical squeezing of the filter cake formed inside the chamber by means of air or Water. Cake is compressed when rubber membrane bulges with water/air and pressed against cake. This reduces the cake volume inside the chamber giving space for air drying/blowing operation

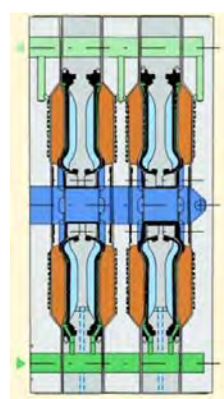
Filter cakes are squeezed up to 16 bar pressure based on application.



Air Blowing through the cake:

The final stage of dewatering is done by blowing the air through the cake. The water between the interstitial particles is entrained and cannot be removed by mechanical squeezing. The configuration of the corner port valves ensures a plug-flow through the filter cake.

Compressed air will be blown through the cake through the filtrate channel. Regulation of blowing medium is done by blowing pressure and time. During the blowing cake is kept compressed by membranes to avoid cracks in filter cake.



11. TEST UNIT & PFD

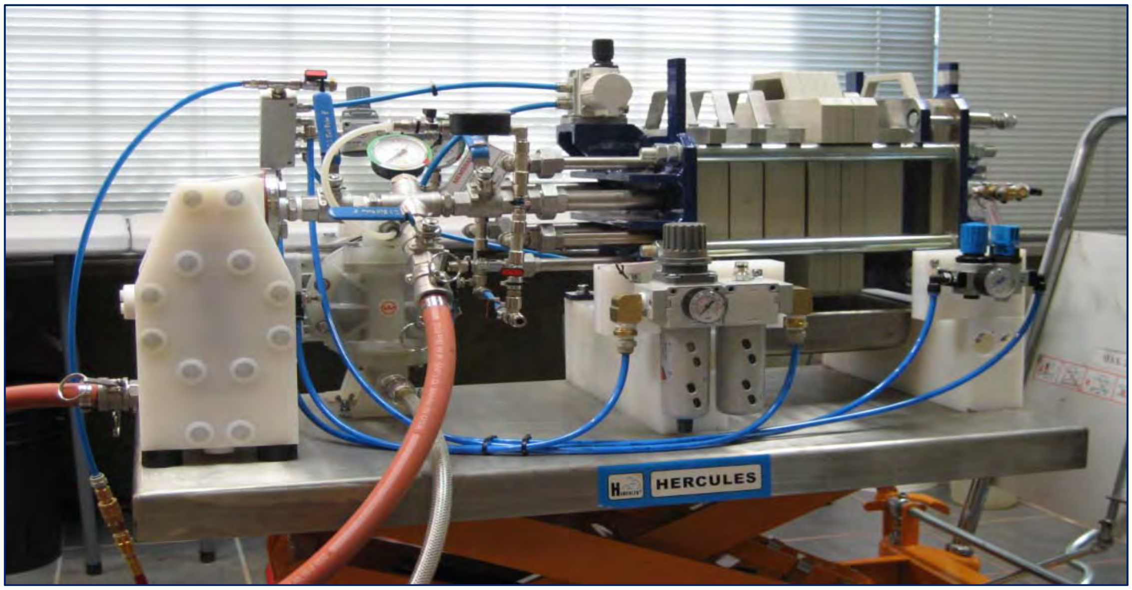


Figure 7: F.A.S.T. Filter Press

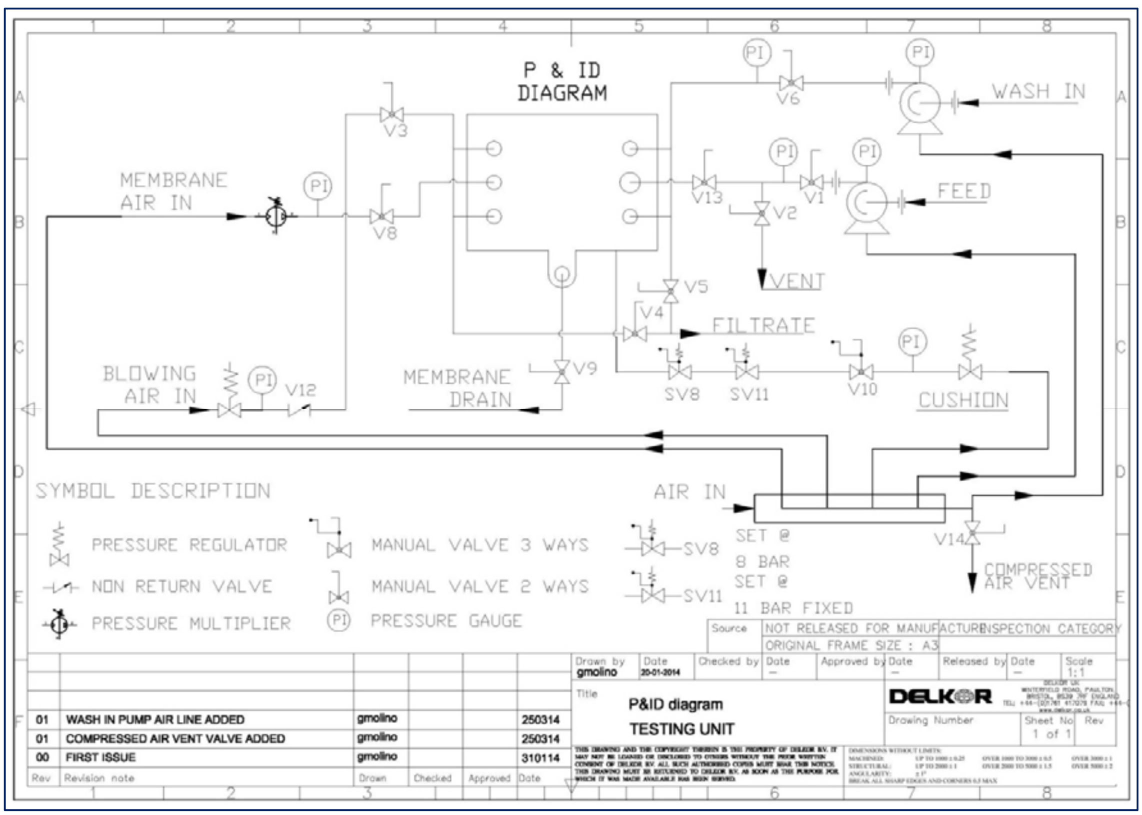


Figure 8: F.A.S.T. Filter Press P&ID

12. TEST RESULTS & DESCRIPTION – FINAL TAILINGS

Table 6: Final Tailings Feed

Process Data	**Tailings**
Solid SG / Liquid SG	2.82 kg/l / 1.00 kg/l
Slurry SG	1.707 kg/l
% Solids	65.78 %
Slurry pH / Temperature	9.5 / ambient
Filter Cloth	0083-T50 (Polypropylene)
Air Permeability (CFM/ft^2) / (l/dm^2/min)	(1) / (5)
Filter Area – 2 sides (m^2)	0.015707963
Feed & Filtration Pressure	10 bars

Table 7: Test Data – Final Tailings

Description	**T1**	**T2**	**T3**	**T4**	**T5**
Chamber Depth (mm)	**60**	**60**	**60**	**30**	**60**
Fill Time (minutes)	0.35	0.22	0.22	0.33	0.35
Fill + Filtration Time - minutes	4.0	5.1	4.95	3.63	5.0
Pre-Squeeze Pressure / Time	NA	10 / 1.15	NA	10 / 1	NA
Air Blow Pressure (Bar) / Time	NA	10 / 5.43	NA	10 / 4	10 / 5
Final Squeeze Pressure / Time	NA	12 /1	12 / 3	12 /1	NA
Final Cake Thickness (mm)	**60**	**60**	**60**	**30**	**60**
Final Cake Moisture	21.97%	18.91%	20.35%	16.21%	18.40%
Cake Wet Weight (g)	1038	994	1022	506	1000
Cake Wet bulk Density	2.20	2.11	2.17	2.15	2.12
Cake Dry Bulk Density	1.72	1.71	1.73	1.8	1.73
Overall Filter Time (minutes)	5.8	12.7	8.0	9.5	10.1
Overall Filtration Rate (kg/m^2.h)	538.08	242.74	391.10	170.48	307.59

Notes:

1. **Cake Properties** – each test was evaluated for 'dry stackable' properties by visual inspection.
2. **Overall Filtration Rates –** Actual equipment sizing will include technical times (i.e. press open/close, plate shaking, etc.)

a. Filtration curve- Filtration Rate versus Filtration Time

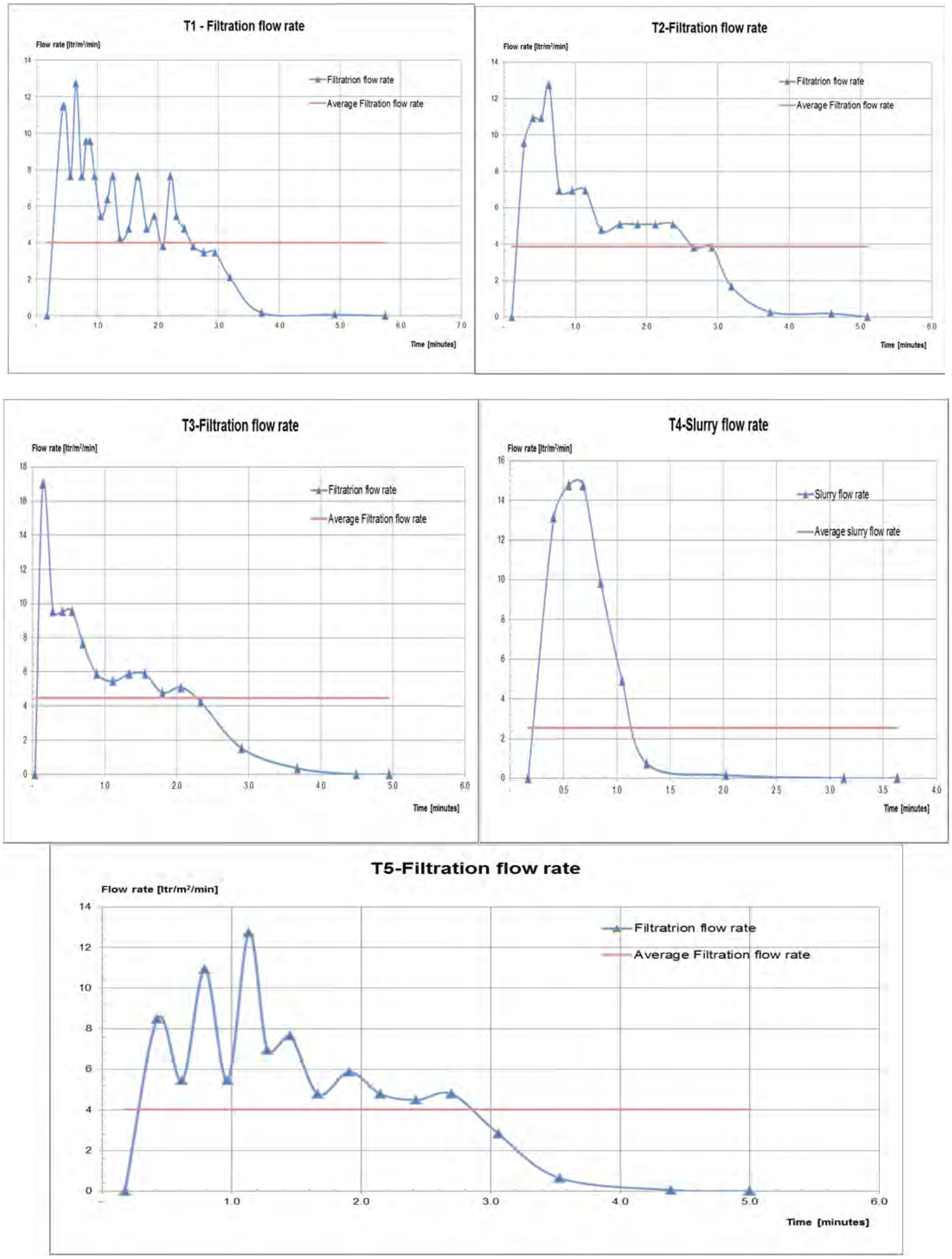


Figure 9: Filtration Curves

b. Filter Cake

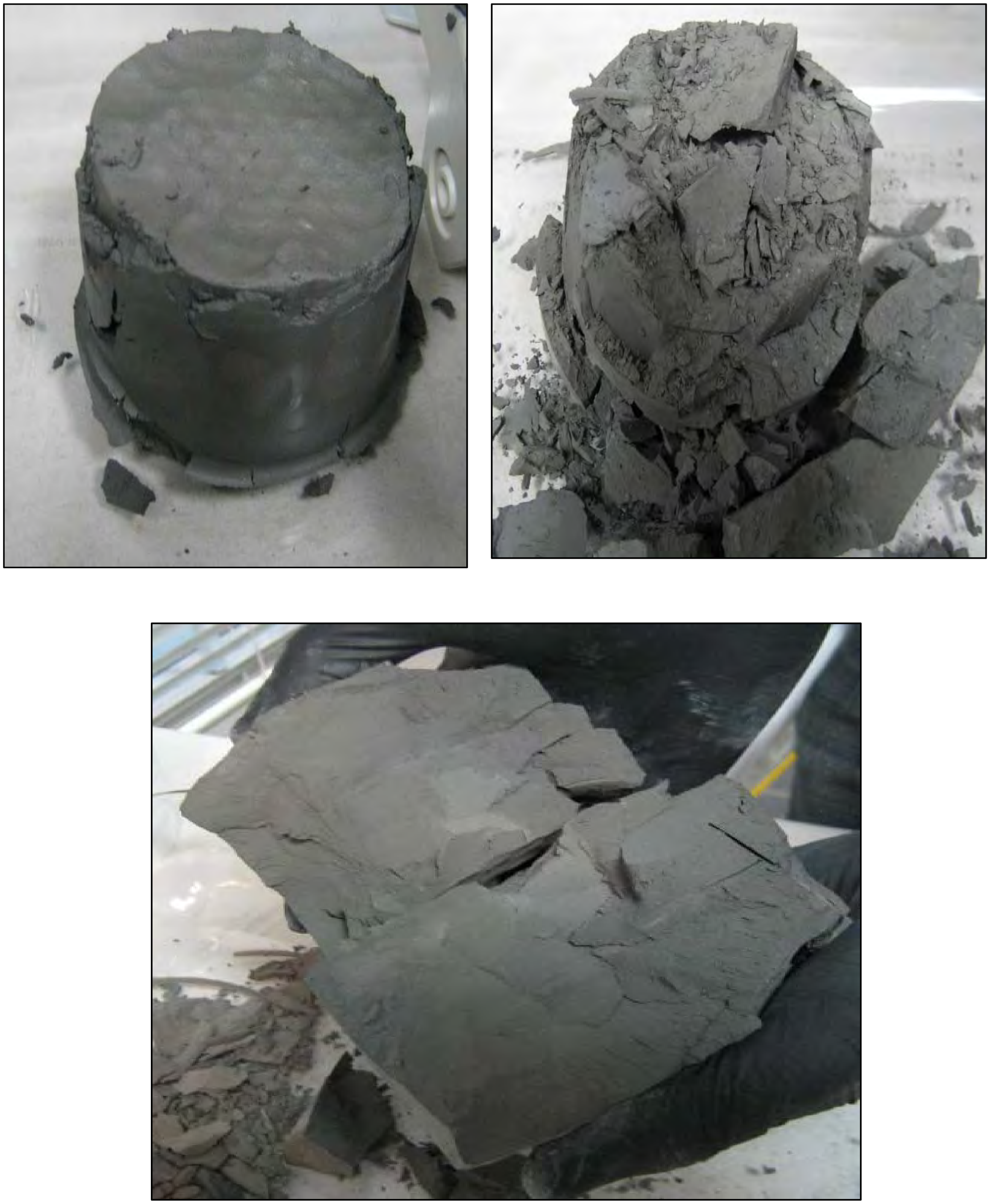
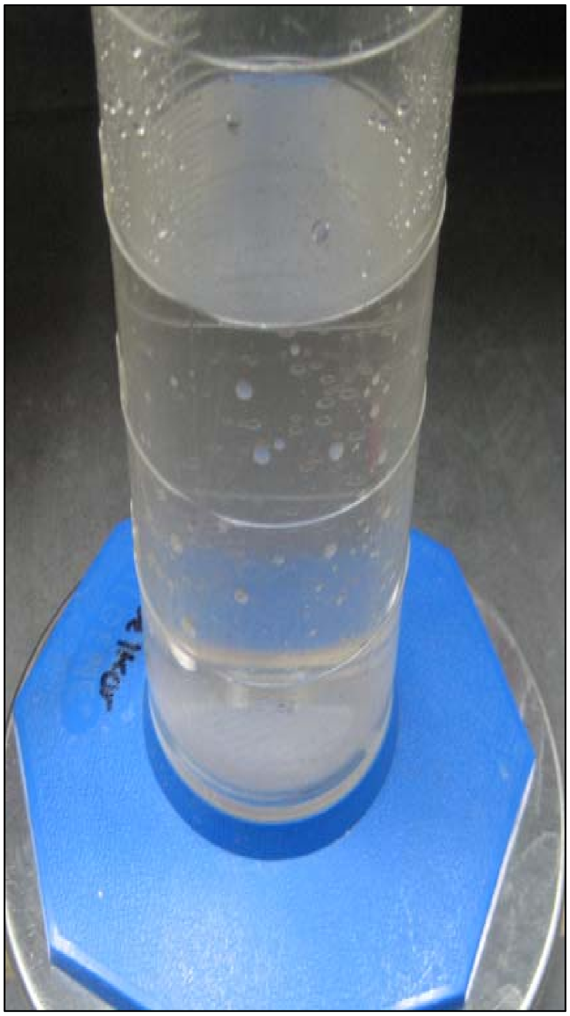


Figure 10: Filter Cakes

c. Filtrate & Filter Cloth



FILTRATE

FILTER CLOTH

Figure 11: Filtrate & Filter Cakes

13. DATA ANALYSIS – PRESSURE FILTRATION

Table 8: Design Consideration

ITEM	Parameters	Design Consideration
1	Feed Pressure	The Filter Press can be designed at low Feed Pressure if other parameters are considered to reduce the final cake moisture such as membrane squeeze and air blowing
		Designing the Filter Press at high Feed Pressure (>10 bar) is an option if a recessed type is offered and eliminating other parameters such as membrane squeeze and air blowing. This will save the cost of CAPEX and OPEX.
2	High Feed Pressure versus Air Blowing	A difference of 3.57% cake moisture if air blowing is applied
3	High Feed Pressure versus Membrane Squeeze	A difference of 1.62% cake moisture if membrane squeeze is applied.
4	60mm versus 30mm Chamber depth	A difference of 2.70% cake moisture using thinner chamber

14. CONCLUSION & EQUIPMENT SIZING – PRESSURE FILTRATION

The objective to generate 'dry-stackable' tailings material for Red Mountain project was achieved considering our initial evaluation. We selected a Recessed plate filter press design for this application.

Table 9: Equipment Selection

PROCESS PARAMETERS	DETAILS
Feed Solids / % solids	45 TPH / 55 to 60% THK UF
SG Solids / Liquid / P_{80}	2.82 / 1.0 / 25 microns
pH / Temperature ^{O}C	7 to 8 / ambient
Cake Moisture	16.5% - 18.5%
EQUIPMENT DESIGN	
Filter type	**RECESSED PLATE**
No. of Units / Equipment Model	One (1) - FP1500/99/40/10/R/A
Plate / No. of Chambers / Depth	1500mm / 99 / 40mm
DESIGN PARAMETERS	
Cake Dry Bulk Density	1.72
Closing and Opening Times	Design driven
Feed Filling Pressure	6 to 10 bars
Filling Time	Design driven
Filtration Pressure	> 10 bars
Filtration Time	6 minutes including fill time
Air Blow Pressure	10 bars (initial)
Air Blow Time	4 minutes
Core Blowing, Cushion Deflation, Shaking, cloth Washing Time	Design driven
Estimated Cycle Time	15.57 minutes

APPENDIX D

PASTE BACKFILL AS A TAILINGS DISPOSAL ALTERNATIVE

(Pages D-1 to D-3)

MEMORANDUM

To:	Mr. Ryan Weymark	Date:	August 24, 2017
Copy To:	Max Brownhill (BCS)	File No.:	VA101-00594/07-A.01
From:	Greg Magoon	Cont. No.:	VA17-01312
Re:	Paste Backfill as a Tailings Disposal Alternative		

1 – INTRODUCTION

IDM Mining Ltd. (IDM) recently submitted an Environmental Assessment (EA) application for the Red Mountain Underground Gold Project (the Project). During the screening process of the application, a comment was provided to IDM from a representative of the BC Ministry of Energy and Mines (MEM) relating to an apparent lack of documentation to support the exclusion of paste backfill to the underground mine as a tailings disposal alternative. This memo has been provided to IDM to address this perceived information gap.

2 – PASTE TAILINGS BACKGROUND

Paste tailings technology requires additional thickening or additives to increase the solids content of the tailings slurry to approx. 70% to 80% (by mass). This results in additional process water recovery in the thickeners and less process water delivered to the tailings management facility (TMF) in the slurry. When compared to conventional slurry for the same mill throughout, the tailings stream is smaller because less process water is transferred. Consequently, the tailings delivery pipeline would be somewhat smaller. However greater pumping pressure is developed and increased pumping capacity is needed.

Paste tailings disposal is most appropriate for sites that operate in a significant water deficit and require a high level of water conservation. Water can be recovered at the plant site during thickening and reused immediately, reducing potential losses within the tailings delivery and storage systems (evaporation and seepage). This level of water conservation in the plant may not be warranted at wet sites that operate in a water surplus.

3 – PASTE BACKFILL AT RED MOUNTAIN

The use of paste tailings to backfill the mine workings at Red Mountain is constrained by the mine backfill schedule as the PAG waste rock generated during initial will be stored underground for geochemical stability. Paste backfill could only commence in Year 2 of operations and a total of 825 ktonnes of tailings would be available for backfill (equivalent to the volume of talus that will be sourced from an external quarry to complete backfilling of the underground). This is approx. 40% of the total tailings throughput, with the remaining 60% requiring surface disposal in an engineered facility.

A reduction in the volume of tailings requiring surface storage would result in a smaller TMF for the project. The Bromley Humps TMF embankment crest elevation could be reduced by approximately 4-6 m (from 470 m to 464-466 m) to store 60% of the total tailings, which reduces the embankment fill from approximately 1,000,000 m^3 to 600,000 m^3 (based on the TMF footprint and Depth-Area-Capacity relationship presented in the feasibility design report KP Report No. VA101-594/4-4 Rev 1, August 2017).

If incorporated, paste tailings would be generated by a paste plant located at the Plant Site at the Bromley Humps. Paste tailings would have to be delivered to the underground mine through a single overland pipeline, with a system of positive displacement pumps. A booster station would be required to maintain the dynamic head and the flowrate of the paste tailings within the pipeline due to the very large distance between Plant Site and underground portal (approx. 15 km) and very large elevation increase (portals are approx. 1,000 m higher than the Plant Site).

4 – CONCEPTUAL LEVEL COSTS

The management of two tailings disposal systems (paste backfill and surface disposal) will significantly increase the capital costs due to the additional paste tailings infrastructure. Paste tailings require positive displacement pumps for delivery, which are significantly more expensive to purchase and operate in comparison to the centrifugal pumps typically used for conventional slurry or thickened tailings. A booster pump station will also be required along the paste pipeline route back to the underground mine in order to maintain the necessary flow rates over the large distance (approx. 15 km) and very large elevation increase (approx. 1,000 m).

Total estimated capital costs for the paste pumping system (pump, booster pump, pipelines and fittings) are in the order of $8M CAD. This will be in addition to the $0.15M CAD estimated CAPEX for the tailings delivery system (pumps, pipelines, spigots, and fittings) for surface storage of tailings. This estimate does not considered the costs for the tailings thickening systems, flocculants, or other ancillary structures.

Operating costs will be significantly higher for a paste tailings system as the tailings will need to be pumped approx. 15 km with an elevation rise of approx. 1,000 m. Power requirements for a paste pumping system are estimated to be in the order of 500 KWhr, or approximately 1,600 MWhr/year (assuming 40% of tailings will be used as backfill). This is in addition to the power requirements to pump thickened tailings to the TMF, which are estimated at 20 KWhr, or approximately 100 MWhr/year.

Table 1 presents a cost comparison of the pumps system capital costs and annual operating costs for surface storage of tailings and a paste backfilling system. The comparison excludes the surface storage facility, as it is required for both cases.

Table 1 Preliminary Cost Comparison

Item	No Backfilling	With Paste Backfilling	
	Surface Storage (100% of tailings to TMF)	Surface Storage (60% of tailings to TMF)	Paste Storage (40% of tailings to mine for backfilling)
Tailings Delivery System (Pumps, pipelines, fittings, spigots)	$150,000 CAD[1]	$150,000 CAD	$8,000,000 CAD
Annual Power Requirements[2]	$6,440 CAD	$4,000 CAD	$64,000 CAD

NOTES:
1. CAPEX costs for surface storage of tailings from KP Report "Tailings and Water Management Feasibility Study Design" VA101-596/4-4, Rev 1, August 2017
2. OPEX costs assume a power cost of $40 CAD per MWhr, taken from KP Report "Tailings and Water Management Feasibility Study Design" VA101-596/4-4, Rev 1, August 2017 .

5 – SUMMARY

A summary of the advantages and disadvantages of paste tailings backfill with respect to Red Mountain is provided below.

Advantages of paste tailings backfill include:
- Geochemical stability of paste tailings in the underground mine (tailings would be fully saturated).
- Slightly reduced environmental risk for the surface tailings facility due to a slightly smaller facility.

- Less embankment construction material would be required from Borrow Pits and Quarries in the Bromley Humps for smaller TMF embankments.
- Less disturbance at the Mine Site area if Talus Backfill Quarries are not required.
- Increased expansion potential for the Bromley Humps TMF.

Disadvantages of paste tailings backfill include:

- Backfilling of mine workings would not available until Year 2 of operations.
- A surface TMF would still be required due to insufficient capacity in underground workings to store all tailings (60% of tailings still require surface storage).
- Increased complexity in mill process for separate tailings disposal systems for surface and underground.
- Significant technical challenges to pump paste tailings from the Process Plant (El. 490 m) to the Mine Site Area (El. 1,500 m), an elevation increase of over 1 km, in a high pressure pipeline.
- The impact of a pipeline breach will affect a much greater area due to the longer pipeline required.
- The long pipeline (15 km) would need to be constructed and maintained in a challenging environment that includes steep slopes, and higher rainfall and snowfall leading to greater run-off events.
- Positive displacement pumps would be required for paste tailings, as well as a booster pump station along pipeline alignment.
- Significantly higher capital costs due to requirement for the long pipeline, booster pump station, and spill containment ponds, in addition to the surface storage facility.
- Energy requirements (and therefore operating costs) to overcome the 1,000 m static head differential are an order of magnitude higher than requirements for thickened tailings pumped to a surface facility.

6 – CONCLUSION

Paste backfill at the Red Mountain Underground Gold Project is not recommended for tailings disposal. The main reasons include the need for an additional surface storage facility, technical challenges and environmental risks associated with constructing and maintaining a paste tailings pipeline over the 15 km distance and 1 km elevation difference between the plant site and mine workings, and the significantly increased capital and operating expenses involved with operating a paste backfill system.

We trust that the information contained within this memorandum satisfies your requirements at this time. If you have any questions or concerns, please do not hesitate to contact the undersigned.

<Original signed by>

<Original signed by>

Prepared: ______________________ Reviewed: ______________________

Greg Magoon, P.Eng.
Project Engineer

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Managing Principal

Approval that this document adheres to Knight Piésold Quality Systems: <Original signed by>

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