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**EAGLE GOLD PROJECT**  
ICE-RICH MATERIALS MANAGEMENT PLAN

*Version 2013-01*

APRIL 2013

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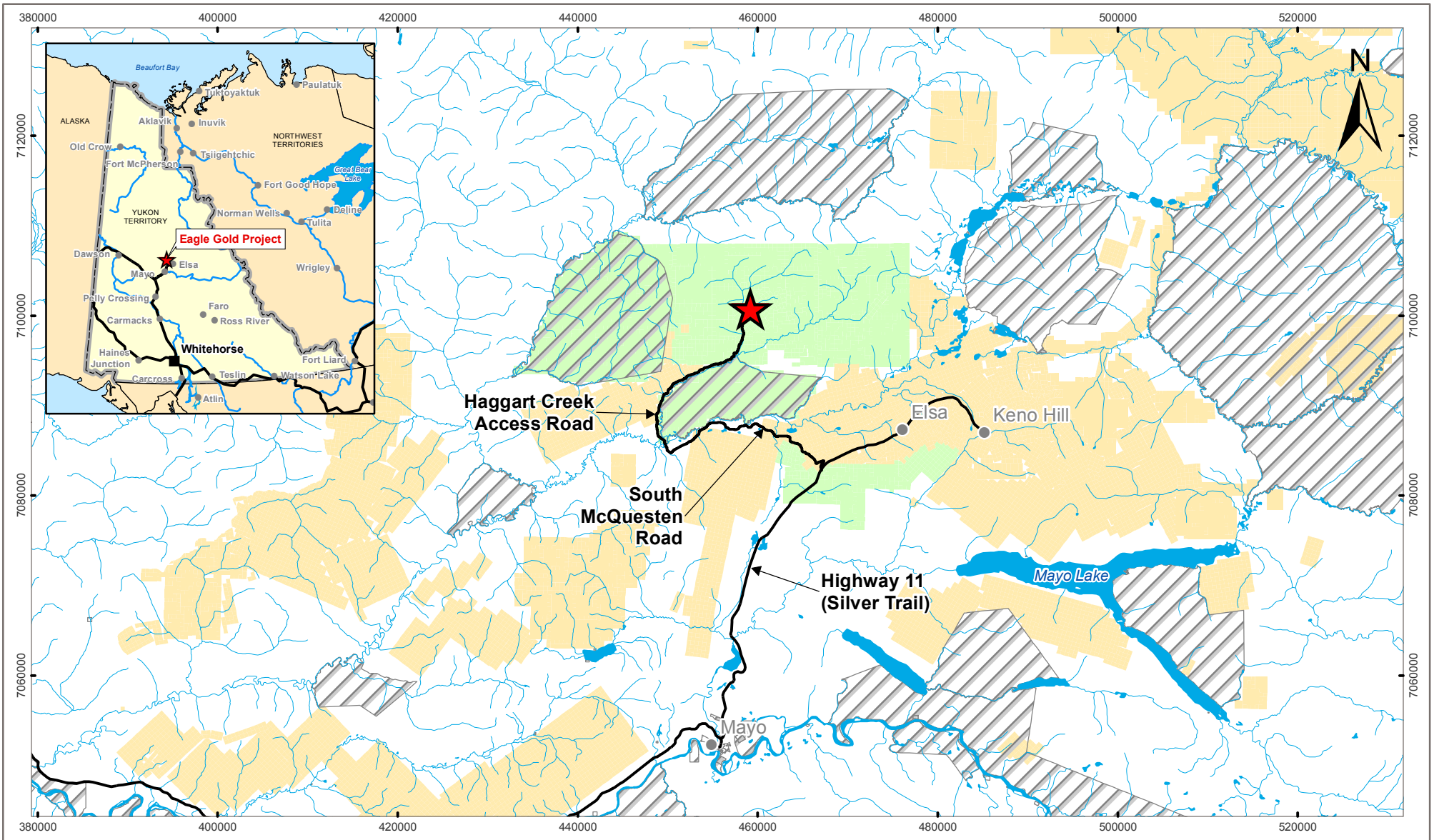
# 1 INTRODUCTION

StrataGold Corporation (SGC), a directly held, wholly owned subsidiary of Victoria Gold Corporation., has proposed to construct, operate, close, and reclaim a gold mine in central Yukon. The Eagle Gold Project (“the Project”) is located 85 km from Mayo, Yukon on existing highway and access roads (Figure 1.0-1). The Project will involve open pit mining at a production rate of approximately 10 million tonnes per year (Mt/y) ore and an average strip ratio (amount of waste: amount of ore) of 1.45:1.0 over a 9.2-year operations phase. The mine plan and production rate indicates that active mining will last over 9.2 years; however, gold extraction from the Heap Leach Facility (HLF) and active water management will continue for an additional 1-2 years upon cessation of active mining operations depending upon gold recovery rates and market conditions. Therefore a 10 year mine life has been assumed unless stipulated otherwise.

Key components of the Project include:

- Mineral Reserves of 91 Million tonnes of ore, at a grade of 0.78 grams of gold per tonne, containing 2.3 Million ounces.
- Open pit mining of a primary gold deposit using conventional blast, truck, and shovel methods.
- Two waste rock storage areas.
- A Heap Leach Facility.
- Gold extraction using a three stage crushing process, heap leaching, and a carbon adsorption, desorption, and recovery system.
- A heap leaching process using irrigation of crushed ore with sodium cyanide solution.
- A fully self-contained, on-site camp for mine personnel, with road transportation of employees to and from the site.
- Access to the site via existing highways and unpaved roads.
- Power supplied for operations by the Yukon Energy Corporation (YEC) transmission grid.

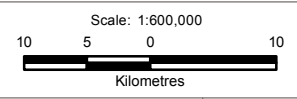
Development, operation, and closure of the Eagle Gold Project will result in disturbance of permafrost, some of which is ice-rich. These ice-rich materials will be managed separately from other waste rock and overburden. BGC Engineering Inc. (BGC) has been engaged by SGC to develop a management plan for ice-rich material at the proposed Project at Dublin Gulch, Yukon. This document presents a plan for managing ice-rich materials for the Project.



**LEGEND**

- Eagle Gold Project Site
- Victoria Gold Claims
- Other Mineral Claims
- Nacho Nyak Dun Settlement Land
- Town / Village
- Road
- Watercourse
- Waterbody

**NOTES**  
 1. Data Sources: Government of Canada, Victoria Gold Corp, Yukon Geomatics.



<b>PROJECTION</b> UTM Zone 8	<b>DATUM</b> NAD83
<b>FILE NO.</b> V23201707	
<b>CLIENT</b> 	
A TETRA TECH COMPANY	

**EAGLE GOLD PROJECT  
YUKON TERRITORY**

<b>Property Location Map</b>				<b>PROJECT</b> Eagle Gold				<b>DWN</b> SL	<b>CKD</b> IS	<b>APVD</b> IS	<b>REV</b> 0
				<b>DATE</b> EBA_VANC				<b>DATE</b> April 2013			

**STATUS**  
FINAL

**Figure 1.0-1**

## 2 SITE DESCRIPTION

### 2.1 HISTORY

Placer gold mining began in the Dublin Gulch area in 1895, and tungsten was identified in placer concentrates in 1904. In 1916, the Geological Survey of Canada discovered bedrock sources of scheelite in Dublin Gulch. Since 1970 there has been essentially continuous exploration on the Property, first for tungsten and then for gold. Approximately 110,000 oz. of placer gold has been recovered from the Dublin Gulch area since production documentation was first initiated in 1978.

The chain of tenure leading to the current ownership began in 1977, when Queenstake Resources Ltd. staked the Mar claims to cover tungsten-bearing skarns in the Ray Gulch area. Canada Tungsten Mining Corp. optioned the ground and carried out exploration for both tungsten and gold between 1977 and 1986. The Eagle Zone, the most significant of the known gold occurrences, is located approximately 3 km to the west-southwest of the tungsten occurrences and became the subject of significant exploration interest during this period.

In 1991 Ivanhoe Goldfields acquired the Dublin Gulch claims from Queenstake Resources Ltd. and commenced exploration for “Fort Knox Type” intrusive-hosted gold mineralization that continued until 1993.

In 1993 Ivanhoe Goldfields estimated “Inferred and Potential” Resources within the Eagle Zone of 98.6 Mt with an average grade of 1.19 g/t Au. This historic estimate is considered relevant, but not compliant with the prescribed guidelines of NI 43-101 and is included here for purposes of historical reference only.

In 1995 First Dynasty acquired the Property through acquisition of Ivanhoe Goldfields. In 1996 First Dynasty transferred the Property to New Millennium Mining Ltd., a wholly owned subsidiary.

In 2002 First Dynasty changed its name to Sterlite Gold Ltd. In 2004 SGC acquired the Property from Sterlite Gold Ltd. as part of a larger transaction that included the Clear Creek Property. In June 2009, through a Plan of Arrangement, SGC was acquired by Victoria Gold Corp.

### 2.2 GEOLOGY

#### 2.2.1 Surficial Geology

The surficial geology of the Dublin Gulch area has been mapped by Bond (1998). Pleistocene and Holocene colluvial deposits are abundant in the project area and generally consist of diamicton, gravel, shattered bedrock, lenses of sand and silt derived from bedrock, and surficial materials derived by a variety of chemical and physical weathering processes. Transport of surface material occurs as creep and sheetwash; mass wasting is common on certain slopes in the area.

A till blanket has been mapped along the east side of Haggart Creek south of its confluence with Dublin Gulch and into the lower Dublin Gulch valley. Glacial till occurs in patches in specific zones within the Dublin Gulch and Haggart Creek valleys due to the main flow directions of regional Cordilleran ice and the area physiography, and in most cases where present, has been disturbed by historical placer mining. Where till does occur, it is generally either a clayey or silty sand matrix with some proportion of larger clasts up to cobble size.

The Haggart Creek Valley in the area of the project site is filled with a mix of alluvial deposits and placer tailings (i.e. materials reworked by placer mining). At the valley walls, alluvium, where present, grades imperceptibly into colluvium.

### **2.2.2 Bedrock Geology**

The Eagle Gold mineral deposit is located at the narrowest extent of the Potato Hills stock which outcrops to the east above Haggart Creek and consists of a medium-grained phaneritic granodiorite intrusion dated at approximately 93 million years (Smit et al. 1995). The stock is elongated 70°E and is roughly 2 km wide by 5.5 km long (Smit et al. 1995). The host rock in the Dublin Gulch area is primarily clastic metasedimentary rock from the Upper Proterozoic to Lower Cambrian assigned to the Hyland Group. The metasedimentary clastic rocks consist of intercalated and deformed quartzites and phyllites, and to a lesser degree, schists and carbonates. A hornfels thermal aureole surrounds the intrusion within which the Hyland Group rocks have been altered and contact metamorphosed. The coarse clastic components of the Hyland Group have been altered to quartz-biotite, the argillaceous components to sericite-biotite-chlorite schist, and the carbonates to marble, wollastonite-quartz skarn and pyroxenite skarn. The aureole extends about 300 m to 1000 m outward from the intrusion along the ground surface (Stephens 2004).

## **2.3 HYDROLOGY**

The Eagle Gold Project site lies within the upper regions of the Haggart Creek drainage basin, within the Dublin Gulch and Eagle Creek sub-basins. Haggart Creek flows to the south, ultimately flowing into the South McQuesten River. Lynx Creek is the largest creek in the Haggart Creek drainage basin and joins Haggart Creek south of the Dublin Gulch confluence.

The hydrology of the region is generally characterized by large snowmelt runoffs during the freshet which quickly taper off to low summer stream flows interspersed with periodic increases in flow associated with intense rainfall events (Stantec 2012). Placer mining has been conducted in both Haggart Creek and the Dublin Gulch basins over the past century. The outcome of these operations has resulted in large placer deposits which have altered the natural drainage character of Dublin Gulch; this includes changes to channel diversions and to some sub-basin divides.

## **2.4 GENERAL ENVIRONMENTAL CONDITIONS**

### **2.4.1 Climate**

The Dublin Gulch area is characterized by a continental type climate with moderate annual precipitation and a large temperature range. Summers are short and can be hot, while winters are long and cold with moderate snowfall. Rainstorm events can occur frequently during the summer and may contribute between 30 to 40% of the annual precipitation. Lower elevations are snow free by early May while higher elevations are snow free by mid-June. Frost action may occur at any time during the summer or fall. The mean annual temperature for the area is approximately -3°C, with an annual range of 63.5°C. Due to thermal inversions, higher elevations have lower overall temperature ranges than the valley bottoms. January is the coldest month, July the warmest. Annual precipitation is greatest in higher elevations due to orographic effects and ranges from about 375 to 600 mm, 35% (valley bottoms) to 50% (upper elevations) falling as snow.



## 2.4.2 Physiography

The topography of the Project area is characterized by rolling hills and plateaus ranging in elevation from approximately 745 m asl (in Haggart Creek) to a local maximum of 1,650 m asl at the summit of Potato Hills, and these are drained by deeply incised creeks and canyons. The ground surface is covered by weathered rock, colluvium and felsenmeer (frost shattered rock). Outcrops are rare, comprising about two percent of the surface area, and are limited to ridge tops and creek valley walls.

Despite the extensive time since glaciations, evidence of glacial-ice action is still visible. This glaciation is somewhat responsible for the morphology and orientation of the tributaries of Dublin Gulch, including, from east to west: Cascallan, Bawn Boy, Olive, Stewart, Ann, Eagle Pup, Suttles, and Platinum Gulches. Within these drainages the post-glacial terrain has been modified by gravity, water, and freeze-thaw mechanics, as evidenced by headscarps associated primarily with former landslides, and rock and debris slides. Most of the slides are inferred to be ancient, but there are a few areas of ongoing rock fall that continue to modify the terrain, particularly in the Stewart, Bawn Boy, and Olive Gulches, and on the west wall of Eagle Pup valley.

## 2.4.3 Permafrost

The project site is located in a region of widespread discontinuous permafrost (Brown, 1979). On the regional scale, permafrost distribution is typically controlled by mean annual temperature and precipitation, whereas on a local scale it is controlled by vegetation, surface sediments, soil moisture, slope aspect, and snow depth. Within the project area, frozen ground occurs typically on north- and east-facing slopes at higher elevations, and within poorly drained areas lower in the valleys. The distribution of frozen ground is highly variable across the site.

Frozen ground, when observed, is generally encountered immediately below the organic cover. Ground temperatures were measured with thermistors installed on site by Knight Piésold, Sitka Corp., and BGC. The measured ground temperatures showed the frozen ground to be relatively warm when observed, typically between 0°C and -1°C. Frozen ground, where encountered, often contains excess ice, as evidenced by the generation of excess water on thawing. Such materials may be unstable on thawing, and thus require separate management from other materials excavated during site development.

## 2.4.4 Vegetation

The proposed mine site is located in the Yukon Plateau-North Ecoregion. Within this ecoregion, the Project site is situated in the Boreal Cordillera Ecozone (Smith et al. 2004). Land in the vicinity of the Project is characterized by a combination of northern boreal forest and subalpine ridges and plateaus. The majority of Project activities occur in the Forested (Boreal) zone. The Subalpine zone, which covers 1,502 ha in the regional study area, occurs on the ridge tops and high plateaus above approximately 1,225 m asl. Tree cover is discontinuous or absent at this elevation, and the vegetation is dominated by dwarf birch, willows, ericaceous shrubs, herbs, mosses, and lichens. The Forested zone (11,450 ha), which is part of the northern boreal forest (Boreal Cordillera Ecoregion), includes the valley bottoms, and the slopes of the mountains below the treeline. The elevation range of this zone is 600 m asl up to the Subalpine zone, at about 1,225 m asl. Open canopy stands of black spruce are generally present on moist sites and on the lower portions of north facing slopes. However, coniferous dominated forests consisting of white and black spruce are found along creeks and rivers and on well drained sites (Stantec 2011).

### **3 OBJECTIVES OF THE PLAN**

This document presents a plan for managing ice-rich materials during development, operation and closure of the Project. The main components of this document include:

- Description of the management challenge;
- Design methodology for material management facilities;
- Disposal area containment berm configuration and input parameters;
- Construction plan;
- Monitoring and surveillance plan;
- Contingency plans;
- Reclamation strategy; and
- Limitations of the plan.

## **4 ICE-RICH MATERIAL GENERATION AND DISPOSAL SCHEDULE**

The Project will be constructed and operated in a region of widespread discontinuous permafrost. Previous geotechnical investigations have confirmed the sporadic presence of frozen ground, some of which contains excess ice (i.e. “ice-rich”). BGC prepared an estimate of anticipated quantities of ice-rich material to be excavated and requiring management in a technical memo (BGC 2012d). This section summarizes the findings of that memo, and presents a quantity estimate and schedule for generation of ice-rich material during site development.

### **4.1 ICE-RICH FROZEN GROUND**

The term “excess ice” is used to describe ice that occupies a larger pore space in the soil than water in an unfrozen state. When this ice thaws, the resulting water exceeds the water holding capacity of the soil and excess water will be present. Frozen ground with excess ice, hereafter called “ice-rich”, may become unstable upon thawing, and will therefore generally need to be excavated to prescribed depths within the footprint of planned facilities. These materials, which could potentially be useful in closure activities (e.g. as cover for reclamation) once thawed and drained, require management during construction and operation of the mine.

Excavation of frozen ground, particularly ice-rich frozen ground, requires additional effort and care beyond that required for typical excavation of unfrozen ground, or for ice-poor frozen ground. Well-bonded, ice-rich material will be difficult to excavate and for planning purposes, may be assumed to require ripping. Further consideration needs to be given to the thaw behavior of this material, and allowances made for adequate drainage and associated erosion and sedimentation control, as well as additional time and effort for the work. Exposure of ice-rich material and the associated thaw can result in wet, muddy, soft ground, and poor trafficability, along with local slumping and other nuisance effects. Each of these effects related to exposure of ice-rich material requires consideration in the planning, design, and construction of mine site infrastructure. When ice-rich materials are excavated and stockpiled, they will become unstable while thawing, and can stand at only very gentle slopes of a few degrees. Storage of thawing ice-rich material requires a relatively large area for a given volume, and/or a high retention structure. Water draining from the thawing soil must also be managed, along with any associated sediment load.

Effective management of ice-rich material excavated during mine development can be supported through prior planning and must consider: the volume of material excavated, the schedule for material excavation, locations of sources of ice-rich material, potential locations of temporary or permanent storage facilities, design and operation of storage facilities, potential re-use of suitable thawed and drained materials, and closure of permanent storage facilities.

The excavated ice-rich materials will derive from several different lithological units, including till, colluvium, alluvium and weathered rock. These materials vary in grain size and natural moisture content, or ice content. Difficulties in handling thawing ice-rich materials will vary depending primarily on grain size and ice content. Coarser soils, like sand and gravel, will tend to drain more freely on thawing, and will thus be less difficult to handle than finer soils. Finer soils will drain more slowly, retain excess pore pressures, and have lower strength for longer periods than coarser soils. It may be advantageous to separate the ice-rich materials in the storage area on the basis of grain size, with coarser materials placed closer to the containment berm to promote

## Eagle Gold Project

### Ice-Rich Materials Management Plan

#### Section 4: Ice-Rich Material Generation and Disposal Schedule

drainage. Decisions on potential segregation of ice-rich materials on this basis will be made during site development activities when it becomes evident whether the materials can be meaningfully separated. An estimate of the expected proportion of coarse versus fine-grained ice-rich material will be made at the detailed design stage to support further planning.

## 4.2 MATERIAL VOLUME AND DISPOSAL SCHEDULE

The ice-rich material estimate (BGC 2012d) was made on the basis of functional areas within which construction activities and site conditions are expected to be relatively similar. The estimated ice-rich material volumes by functional area and construction year are summarized in Table 4.3-1. The overall quantity of ice-rich material is estimated to be approximately 769,000 m<sup>3</sup>. These materials will be generated over three years of site construction as shown in the table.

**Table 4.3-1 Ice-Rich Material Volumes (rounded to nearest thousand) and General Schedule**

Functional Area <sup>1</sup>	Volume <sup>2</sup> (1,000 m <sup>3</sup> )	Schedule
Heap Leach Pad Phase 1	67	Year 1
Heap Leach Pad Phase 2	16	Year 3
Heap Leach Pad Phase 3	0	After Year 3
Heap Embankment	26, 3	Year 1, Year 2
Upper Dublin Gulch Diversion Channel	6	Year 1
Middle Dublin Gulch Diversion Channel	105	Year 1
Lower Dublin Gulch Diversion Channel	0	Year 1
Events Ponds	0	
Eagle Pup WRSA <sup>3</sup>	104	Year 2
Open Pit	0	
Platinum Gulch WRSA <sup>3</sup>	9	Year 2
100 Day Storage Area	149	Year 3
Crushers	28	Year 1
Plant Site	6	Year 1
Truck Shop	35	Year 1
Topsoil Stockpiles	0	
Conveyors	0	
DG North Pond	0	
DG South Pond	66	Year 1
Eagle Pup Pond <sup>3</sup>	4	Year 2
Platinum Gulch Pond <sup>3</sup>	3	Year 2
Haul road truck shop to pit	13	Year 1
Secondary road to crushers	65	Year 2
Secondary road to plant site	13	Year 2
Explosive Storage	0	
Laydown Area	17, 12	Year 1, Year 2

Section 4 Ice-Rich Material Generation and Disposal Schedule

Functional Area <sup>1</sup>	Volume <sup>2</sup> (1,000 m <sup>3</sup> )	Schedule
Road to HLF (phase 1) <sup>3</sup>	22	Year 1 and 2
<b>TOTAL</b>		<b>769</b>
<b>TOTAL YEAR 1</b>		<b>369</b>
<b>TOTAL YEAR 2</b>		<b>235</b>
<b>TOTAL YEAR 3</b>		<b>165</b>

Notes:

1. Functional areas correspond to major component areas of development for the Project and have been defined in BGC (2012d).
2. All quantity estimates rely on specific simplifying assumptions which have been discussed in BGC (2012d).
3. Schedule for selected areas has been modified slightly from the one presented in BGC (2012d) based on more recent input from SGC.

The largest quantity of ice-rich material will be generated in the first year of construction, and the smallest amount will be generated in year three. It may be noted that the quantities presented in Table 4.3-1 above are in situ quantities. An allowance must be made for bulking upon excavation. Assuming a bulking factor of 1.3, the approximate quantities of ice-rich material to be managed after excavation will be 480,000, 306,000 and 215,000 m<sup>3</sup> in years 1, 2 and 3 respectively. A total quantity of approximately 1,000,000 m<sup>3</sup> of ice-rich material generated during site development will require management.

### 4.3 MANAGEMENT

The concept for management of ice-rich materials is to construct a berm to form a containment area that will prevent downslope movement of thawing ice-rich material, hereinafter referred to as the “Ice-Rich Overburden Storage Area (IOSA)”. The containment area and berm will be designed and constructed for passage of water to allow the thawing ice to drain with appropriate erosion and sedimentation controls in place. Ice-rich materials will be hauled from their source areas to the IOSA by haul truck and placed while still mainly frozen. Temporary roads will be constructed on the stacked waste as needed to allow placement of the ice-rich materials.

Accessible stored materials will be used, where feasible once thawed and drained, in reclamation activities elsewhere on site at mine closure, and in closure of the IOSA. The IOSA will be reclaimed by reshaping/regrading for effective drainage, and revegetation for control of erosion and sedimentation. Some of the material in the IOSA may be reclaimed during the construction phase creating additional storage space.

The most appropriate methods for managing ice-rich materials depend on the percentage of excess ice encountered and the type of material that is being excavated (e.g. fine grained soils versus coarser grained soils). It should be possible, with care in field classification, to segregate the excavated ice-rich materials for different disposal/management alternatives.

## 5 DESIGN BASIS AND CRITERIA

### 5.1 SITING AND ALIGNMENT SELECTION

Site selection for the IOSA was completed in three stages. During the first stage of site selection, a total of 21 potential disposal areas were identified around the general project area. Conceptual containment berms were sited, and associated storage volumes calculated. These 21 alternatives were then ranked according to storage ratio, calculated as the ratio of storage quantity to berm fill quantity. This ratio is a simple first estimate of cost effectiveness. Nine of the highest ranked alternatives were selected for further comparison.

The nine shortlisted alternatives were each rated according to 12 specific criteria in five broad categories: resource conflicts, environmental considerations, social considerations, construction and design considerations, and closure and post-closure considerations. The 12 criteria were assigned weights according to assumed importance and scores assigned by consensus between BGC and SGC.

Following completion of the initial consensus scoring, a sensitivity analysis was conducted to test the robustness of the outcome. This analysis yielded two clear favourites: existing depressions in placer tailings along Haggart Creek; and the area of Suttles Gulch above the diversion channel.

The two highest scoring alternatives are shown on Figure 5.1-1. Considerable variation in criteria weighting had negligible effect on the order and rank of the two top ranked alternatives, with Haggart Creek retaining a strong lead followed closely by Suttles Gulch; therefore, based on the multi-stage options analysis, Haggart Creek was selected as the preferred alternative, with Suttles Gulch identified as a contingency, to be developed for use if quantities of ice-rich material generated in construction are significantly greater than expected (Figure 5.1-2). The option of developing the Suttles Gulch facility provides additional flexibility for site development plans, being close to many of the sources of ice-rich material. The Haggart Creek IOSA is the primary management option for ice-rich material (Figure 5.1-3).

Following site selection, further optimization of berm and storage layout was undertaken. The Suttles Gulch IOSA will be capable of storing 263,000 m<sup>3</sup> of ice-rich material, assuming level storage, with a berm fill quantity of 310,000 m<sup>3</sup>. The Haggart Creek IOSA will be capable of storing 940,000 m<sup>3</sup> of ice-rich material, assuming level storage, with a berm fill quantity of 335,000 m<sup>3</sup>. The Haggart Creek storage volume increases to 1,170,000 m<sup>3</sup> if the ice-rich material is stacked behind the berm at a nominal grade of 15H : 1V. It is therefore expected that the Haggart Creek IOSA will receive all the ice-rich material generated during site development, and the requirement to develop the Suttles Gulch facility is considered unlikely.

The containment berm of the Haggart Creek IOSA will be located along the eastern side of Haggart Creek (Figure 5.1-3), with a berm crest elevation of 765 m asl. Within the footprint of the containment berm, existing placer tailings will be leveled in specific areas for foundation preparation and as a partial source of berm construction material (Figures 5.1-3 and 5.1-4). The downstream side of this berm approaches within a minimum of about 37 m of the creek centerline. Minor encroachment of the berm eastern toe will require minor adjustment of the road alignment in selected locations (Figure 5.1-3).

## 5.2 CONTAINMENT BERM CONCEPT

Ice-rich materials will be stacked and retained behind a containment berm constructed of coarse granular fill, to be derived from existing sand and gravel sources in placer tailings along Haggart Creek, with the deficit made up by placer tailings from Dublin Gulch and rock fill derived from open pit pre-strip activities. The containment berm and the storage area's foundation will be permeable, and thus allow drainage of the thawing stored materials. A granular filter of significant thickness (4 m), and comprised of well graded sand and gravel, will be placed on the storage side of the berm to prevent migration of fines through the berm. Filter materials will be developed by screening of existing placer tailings to meet filter criteria for separation of the typically fine-grained ice-rich materials from the coarse-grained berm fill.

The containment berm will be founded on existing placer tailings, which will be leveled where necessary. The placer tailings within and near the footprint of the containment berm will also be developed as a borrow source for berm construction, which will involve local excavation and re-grading of existing piles.

## 5.3 DESIGN CRITERIA

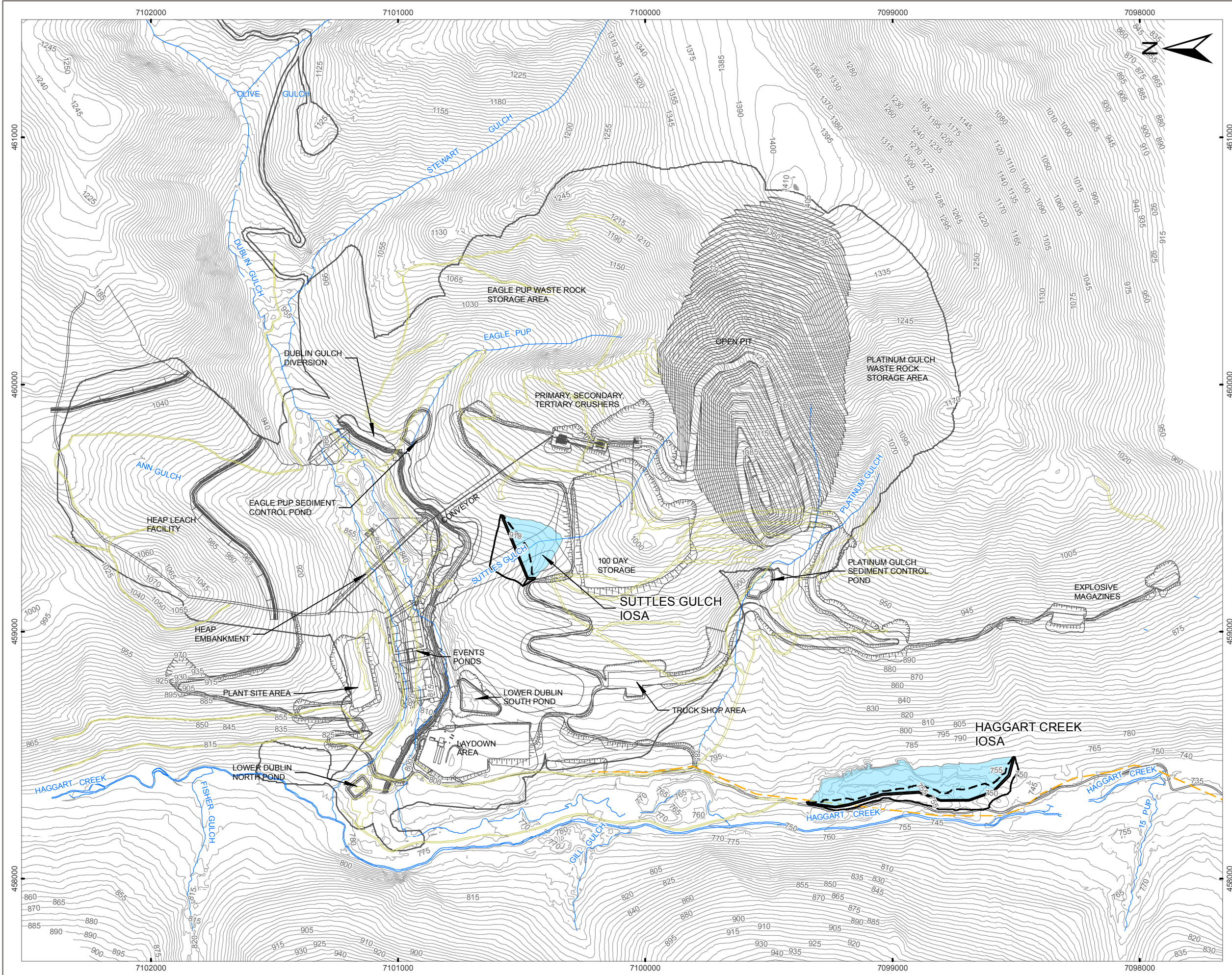
The IOSA will be designed, constructed and operated in accordance with the British Columbia Mined Rock and Overburden Piles – Investigation and Design Manual Interim Guidelines (1991). Design factors of safety for both static and pseudo-static stability of the berm slopes, shown in Table 5.2-1, have been chosen from the upper end of ranges recommended in these guidelines, primarily due to the lack of subsurface data in the berm foundation areas and limited test data on planned construction materials. The recommended safety factors will be re-examined, and potentially revised, as detailed design progresses.

**Table 5.2-1 Recommended Design Factors of Safety**

Stability Condition	Minimum Design Factor of Safety
Static stability – Short Term	1.3
Static stability – Long Term	1.5
Pseudo-Static (seismic) – Short and Long Term	1.1
Design Earthquake Return Period	1-in-475-year event



BCC - X:\Projects\0792 Victoria Gold\008\Workspace\20130108\_REPORT\_Ice\_Rich\_Materials\_Management\_Plan\fig\_5\_1-1\_General\_Site\_Plan\_FINAL.mxd



**LEGEND**

- PROJECT FOOTPRINT SUBMITTED IN PROJECT PROPOSAL
- PROPOSED POWER LINE
- PROPOSED INFRASTRUCTURE LAYOUT
- EXISTING ROADS
- STREAM
- CONTAINMENT BERMS
- POTENTIAL STORED ICE-RICH MATERIALS
- 5 m CONTOUR

**NOTES**  
 1. Proposed infrastructure layout received from Wardrop March 28, 2012.

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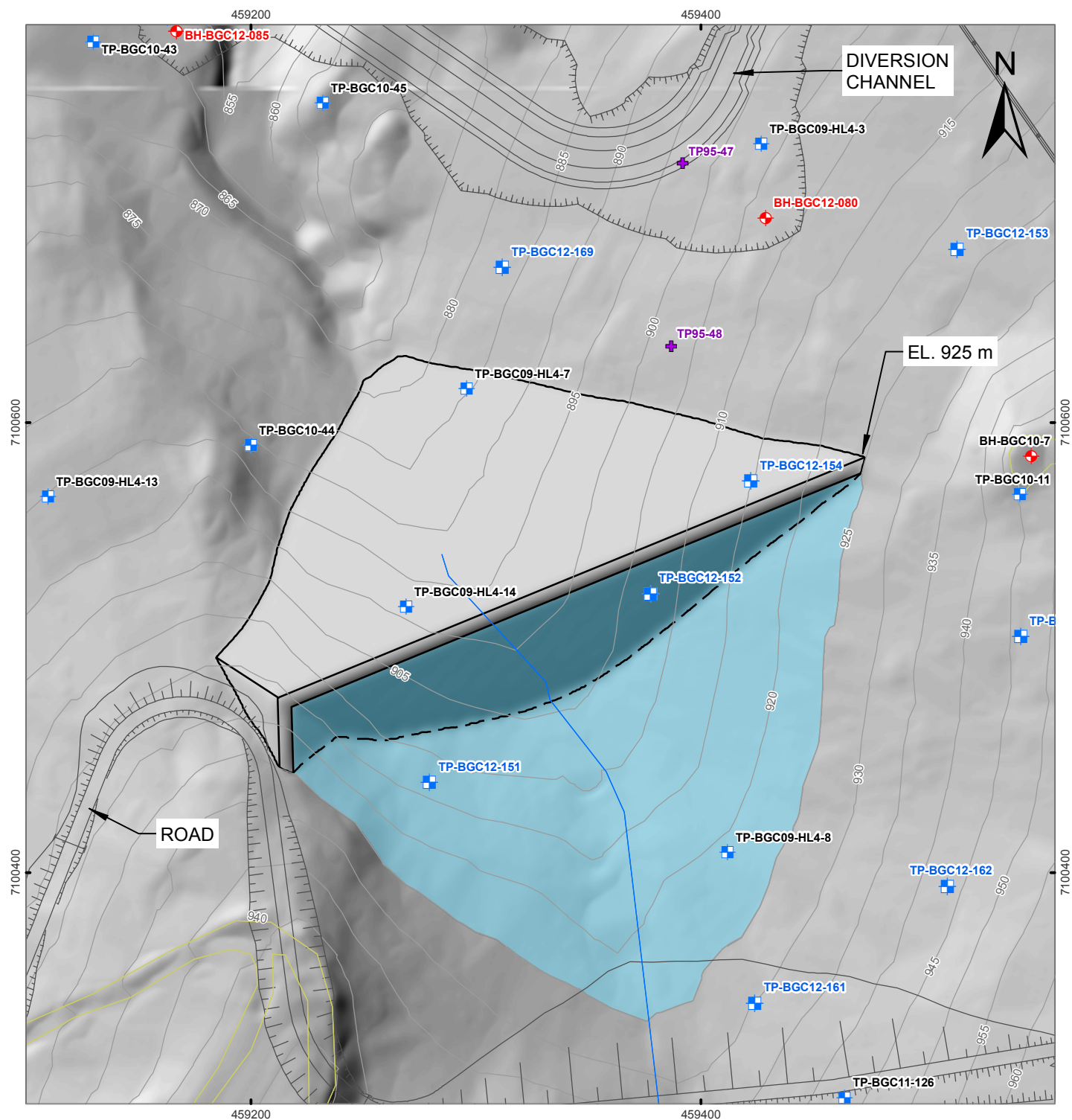
PROFESSIONAL SEAL STATUS FINAL

**EAGLE GOLD PROJECT  
 YUKON TERRITORY  
 ICE RICH MATERIALS  
 MANAGEMENT PLAN  
 GENERAL SITE PLAN**

PROJECTION UTM Zone 8	DATUM NAD83	CLIENT 
Scale: 1:15,000 100 50 0 100 Metres		
FILE NO. 0792008-03-10	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY 	
PROJECT Eagle Gold	DWN LL	CKD DW
OFFICE	APVD PQ	REV 0
DATE April 2013	<b>Figure 5.1-1</b>	



BGC: X:\Projects\0792 Victoria Gold\008\Workspace\20130108\_REPORT\_Ice\_Rich\_Materials\_Management\_Plan\fig\_5.1-2\_Suttles\_Gulch\_Option\_Location\_FINAL.mxd



### LEGEND

- PROPOSED INFRASTRUCTURE LAYOUT
- EXISTING ROAD
- STREAM
- ◆ BGC BOREHOLE
- BGC TEST PIT
- ◆ BOREHOLE BY OTHERS
- + TESTPIT BY OTHERS
- CONTAINMENT BERM
- POTENTIAL STORED ICE-RICH MATERIALS
- 5 m CONTOUR

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### NOTES

1. Proposed infrastructure layout received from Wardrop March 28, 2012.

## EAGLE GOLD PROJECT YUKON TERRITORY

### ICE-RICH MATERIALS MANAGEMENT PLAN SUTTLES GULCH IOSA

<b>PROJECTION</b> UTM Zone 8	<b>DATUM</b> NAD83
Scale: 1:2,500	

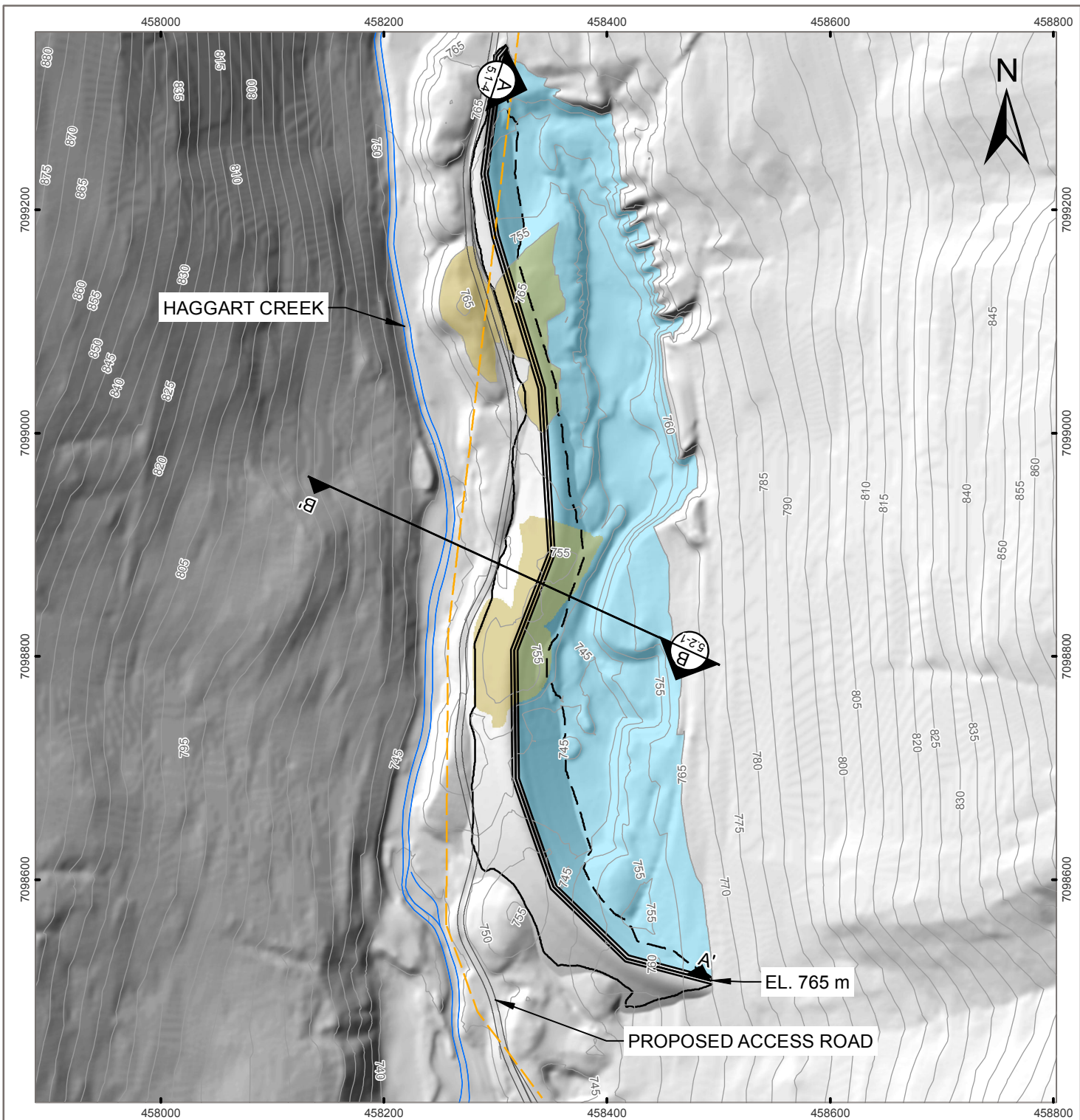


**PROFESSIONAL SEAL**  
  
**STATUS**  
FINAL

<b>FILE NO.</b> 0792008-03-10	<b>DWN</b> LL	<b>CKD</b> DW	<b>APVD</b> PQ	<b>REV</b> 0
<b>PROJECT</b> Eagle Gold	<b>DATE</b> April 2013			

Figure 5.1-2

BGC: X:\Projects\0792 Victoria Gold\008\Workspace\20130108\_REPORT\_Ice\_Rich\_Materials\_Management\_Plan\fig\_5\_1\_3\_Haggart\_Creek\_Option\_Location\_FINAL.mxd



### LEGEND

- CROSS SECTION
- PROPOSED INFRASTRUCTURE LAYOUT
- STREAM
- PROPOSED POWER LINE
- POTENTIAL STORED ICE-RICH MATERIALS
- EXISTING PLACER TAILINGS LEVELED FOR FOUNDATION AND TO PROVIDE MATERIAL FOR BERM CONSTRUCTION
- 5 m CONTOUR

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### NOTES

1. Proposed infrastructure layout received from Wardrop March 28, 2012.

PROFESSIONAL SEAL

STATUS  
FINAL

## EAGLE GOLD PROJECT YUKON TERRITORY

### ICE-RICH MATERIALS MANAGEMENT PLAN HAGGART CREEK IOSA

#### PROJECTION

UTM Zone 8

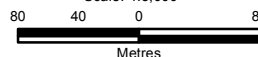
#### DATUM

NAD83

#### CLIENT



Scale: 1:5,000



FILE NO.  
0792008-03-10



PROJECT  
Eagle Gold

DWN  
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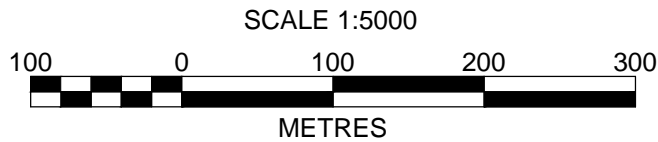
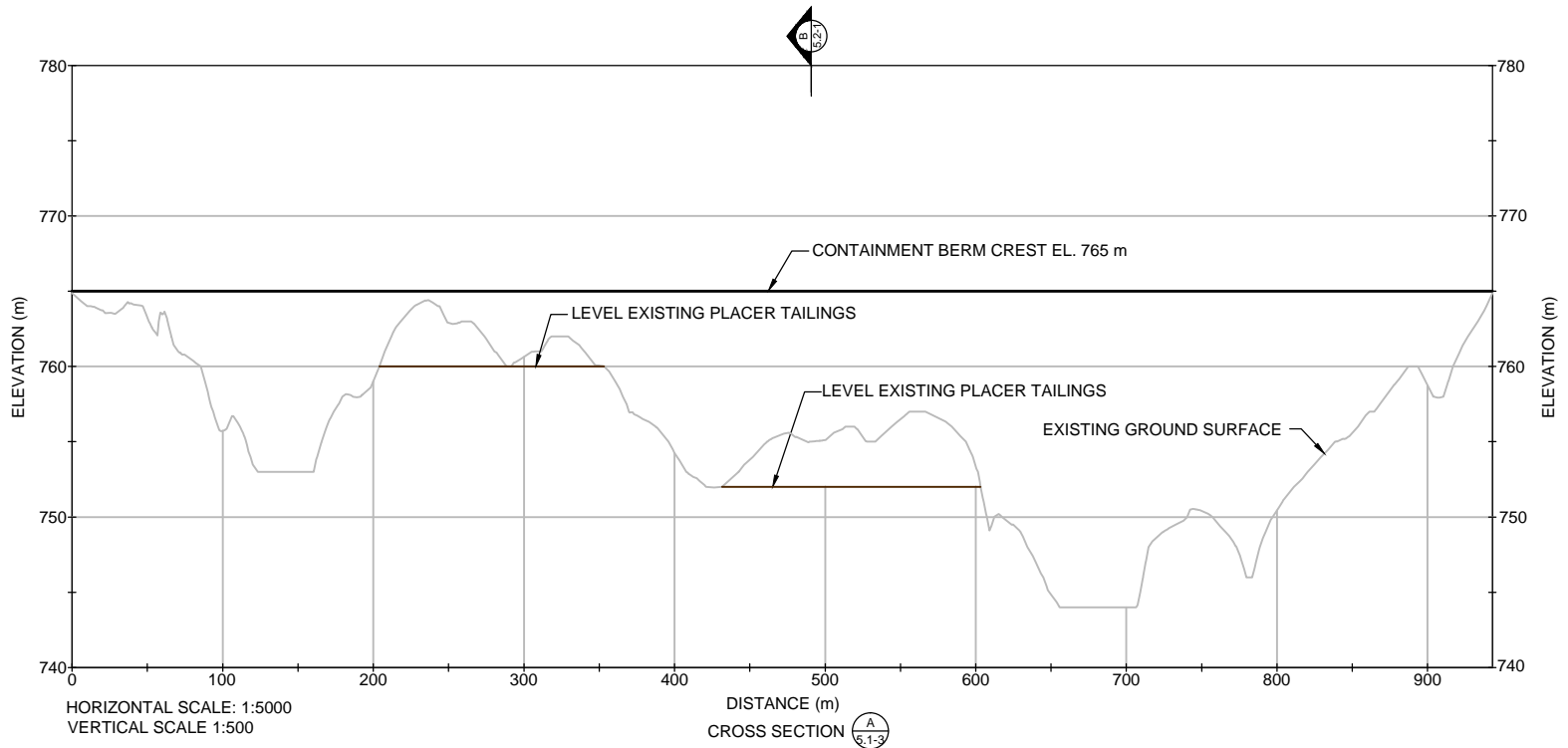
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DATE

April 2013

Figure 5.1-3

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**LEGEND**

- CONTAINMENT BERM CREST
- MODIFIED GROUND SURFACE
- EXISTING GROUND SURFACE

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**EAGLE GOLD PROJECT  
YUKON TERRITORY**

**ICE-RICH MATERIALS MANAGEMENT PLAN  
PROFILE ALONG CENTRELINE  
HAGGART CREEK IOISA**

FILE NO.  
0792008-03-10

DWN  
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CKD  
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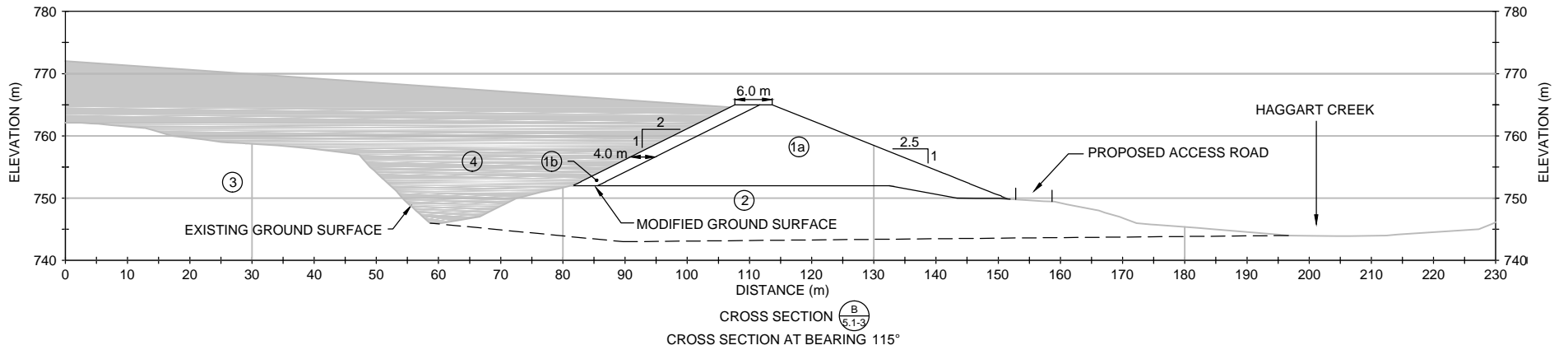
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DATE  
APRIL 2013

**Figure 5.1-4**

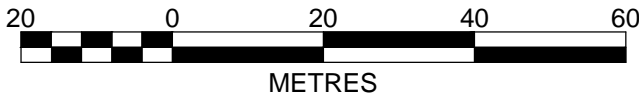
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TYPICAL CONTAINMENT BERM SECTION: HAGGART CREEK IOSA



CROSS SECTION (B) 5.1-3  
CROSS SECTION AT BEARING 115°

SCALE 1:1000



NOTE:

1. PROPOSED INFRASTRUCTURE LAYOUT RECEIVED FROM WARDROOP MARCH 28, 2012.

LEGEND

- ASSUMED BOTTOM OF PLACER TAILINGS / ALLUVIUM
- (1a) CONTAINMENT BERM FILL: SAND, GRAVEL AND COBBLES
- (1b) CONTAINMENT BERM FILL: SAND AND GRAVEL FILTER
- (2) PLACER TAILINGS / ALLUVIUM
- (3) TILL / COLLUVIUM
- (4) ICE-RICH MATERIAL

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EAGLE GOLD PROJECT  
YUKON TERRITORY

ICE-RICH MATERIALS MANAGEMENT PLAN  
TYPICAL SECTION  
HAGGART CREEK IOSA

FILE NO. 0792008-03-10	DWN SS	CKD PQ	REV 0	<b>Figure 5.2-1</b>
OFFICE	DATE APRIL 2013			

## 6 CONTAINMENT BERM CONFIGURATION AND INPUT PARAMETERS

### 6.1 BERM DESIGN

#### 6.1.1 Layout and Geometry

Three berm cross-sections were checked for stability of the ice-rich materials storage facility at Haggart Creek. The cross section yielding the lowest factors of safety has been selected for illustration and discussion in this plan. This cross section is identified in plan on Figure 5.1-3, and in section on Figure 5.2-1.

The containment berm consists of a 22 m high embankment with crest elevation 765 m, 6 m wide crest, 2.5H : 1V downstream side slope and 2H : 1V upstream (in-storage) side slope with a 4 m wide sand and gravel filter as discussed in Section 5.2. The ice-rich material is assumed to be placed at a nominal grade of 15H : 1V behind the containment berm (Figure 5.2-1).

#### 6.1.2 Input Parameters

The geological model assumed for the stability analysis was interpreted from limited information obtained from visual observations of surficial materials in previous site investigation programs conducted by BGC (2012a, 2012e), and supported by observations presented by LeBarge et al. (2002). The material properties and groundwater conditions assumed in the stability assessment were inferred from observations made elsewhere in the project footprint, given that no subsurface information is available for this area along Haggart Creek. Additional geotechnical data will be obtained in support of detailed design.

The phreatic surface was estimated at approximately 4 m below existing ground surface within the footprint of the containment berm, and approximately 2 to 3 m below ground surface at the valley sides. The foundation material was assumed to be placer tailings overlying till or colluvium, inferred from experience elsewhere on site, and in part supported by reported geological stratigraphic columns (LeBarge et al. 2002). In general, the foundation materials below loose placer tailings are assumed to be compact sand and gravel with varying proportions of silt, cobbles, and boulders.

Visual characterization of the surficial placer tailings in Haggart Creek was presented by BGC (2012a). Visual observations indicate that the near surface placer tailings consist of highly variable materials, with a wide range of grain size and density. The materials range from isolated deposits of cobbles and boulders, to gravelly sand or sandy gravel. The thickness of the placer tailings is unknown, but assumed to be at least 10 m thick.

The berm will be constructed from general fill derived from locally available placer tailings or coarse alluvium free of organic matter, vegetation and deleterious materials. Material deficits will be made up by placer tailings from Dublin Gulch or waste rock excavated during pit pre-stripping. It is estimated that approximately 335,000 m<sup>3</sup> of granular fill will be needed to construct the berm, of which 290,000 m<sup>3</sup> will need to be imported from elsewhere within the mine development area, and 45,000 m<sup>3</sup> is expected to come from local placer tailings. It may be possible to reduce the requirements for imported material by further optimizing the berm layout to make greater use of local placer tailings.

The ice-rich materials that will be stored in the containment facility mainly include low plastic silty sands and sandy silts with some to trace fine gravel. A summary of the material properties assumed for stability analysis, as presented in BGC (2012b), is provided in Table 6.1-1 below. Site-specific geotechnical investigation and testing is required in detailed design to check the validity of these assumed properties.

**Table 6.1-1 Summary of Material Properties used in Stability Analyses**

Material Type	Unit Weight (kN/m <sup>3</sup> )	Mohr-Coulomb Shear Strength	
		Friction Angle (°)	Cohesion (kPa)
Till / Colluvium	19	34	0
Placer Tailings / Alluvium	19	30	0
Berm Fill	20	35	0
Ice-Rich Material <sup>1</sup>	17	0	10

Note:

1. It was assumed that the ice-rich materials would liquefy during earthquake shaking therefore they were modeled as a dense fluid with no shear strength.

Following the British Columbia Mined Rock and Overburden Piles – Investigation and Design Manual Interim Guidelines (1991), the selected ground motion parameters were based on an exceedence probability of 10% in 50 years, which corresponds with a return period of 475 years, and a Peak Ground Acceleration (PGA) of 0.14g.

## 6.2 STABILITY ANALYSES

Stability of the berm was evaluated using limit equilibrium analyses. Analyses were conducted using commercially available two-dimensional, limit equilibrium software, Slope/W. Both static and pseudo-static analyses were completed.

The minimum factor of safety was calculated using the Morgenstern-Price method. For the pseudo-static assessment the design horizontal ground acceleration was applied to the stability model following methods suggested by Hynes-Griffin and Franklin (1984), where the applied horizontal seismic coefficient ( $k_h$ ) is equal to half the peak horizontal ground acceleration (PGA) for the design event considered.

### 6.2.1 Static Stability Analysis Results

Static analyses were completed for three trial cross sections, and results are shown for the section with the lowest factor of safety, Section B, for the Haggart Creek option (Figures 5.1-3, 5.2-1 and 6.2-1). Analyses were made using the material properties and water table inputs described above (Section 6.1.2), for three cases:

1. Upstream (in-storage) direction, prior to placement of ice-rich material within the containment area;
2. Downstream direction, prior to placement of ice-rich material within the containment area; and
3. Downstream direction, with the containment area full of thawed or thawing ice-rich material.

The first two cases are short term conditions, where the target factor of safety is 1.3 (Table 5.2-1). Shallow failures, contained mostly within the berm fill, were modeled in both the downstream and upstream directions and had calculated factors of safety of 1.8 and 1.4 respectively. Where failures impacting the foundation were considered, the calculated upstream factor of safety was 1.5 and the calculated downstream factor of safety was



1.8. Failure surfaces corresponding to the lowest calculated factors of safety are illustrated in Figure 6.2-1. In these short term cases, the calculated factors of safety all exceed the target factor of safety of 1.3.

The third case considers the worst case long term condition, with the water table assumed to be at the top of the ice-rich material surface, as described above. The target factor of safety for this case is 1.5 (Table 5.2-1). The calculated factor of safety in this case is 1.6. The failure surface corresponding to the lowest calculated factor of safety is illustrated in Figure 6.2-1. In this long term case, the calculated factor of safety exceeds the target factor of safety of 1.5. Table 6.2-1 summarizes the static stability analysis results.

### **6.2.2 Pseudo-Static Stability Results**

A pseudo-static analysis was completed for Section B (Figures 5.1-3, 5.2-1 and 6.2-2) using the material properties and seismic inputs described previously (Section 6.1.2) for the downstream direction, with a containment area full of thawed or thawing ice-rich material, with the ice-rich material modelled as a dense fluid with a level surface. The target factor of safety for the pseudo-static analysis is 1.1 (Table 5.2-1). The calculated factor of safety, considering a failure that includes the foundation material, is 1.3, which exceeds the target factor of safety. The failure surface corresponding to the lowest calculated factor of safety is illustrated in Figure 6.2-2. Table 6.2-1 summarizes the pseudo-static stability analysis results.

**Table 6.2-1 Summary of Stability Analysis Results (Haggart Creek IOSA)**

Case	Target Factor of Safety	Calculated Factor of Safety
Upstream, Empty Containment area	1.3	1.4
Downstream, Empty Containment area	1.5	1.6
Downstream, Full Containment area, Pseudo-static	1.1	1.3

The results of the static and pseudo-static stability analyses suggest that some potential exists to optimize berm slope angles on the downstream face at detailed design.

### **6.3 DRAINAGE, EROSION AND SEDIMENT CONTROL CONSIDERATIONS**

An interceptor ditch will be constructed upslope of the Haggart Creek ice-rich storage facility, at least 10 m above the elevation of the crest of the containment berm to divert non-contact runoff around the facility. Placement of the ditch at this elevation will allow for the option of placement of the ice-rich materials at a gentle slope (approximately 15H : 1V), thus increasing potential storage capacity.

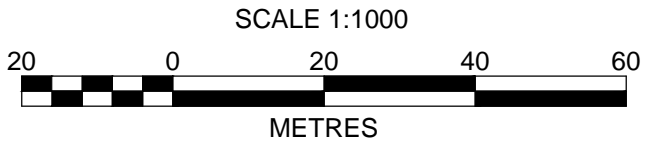
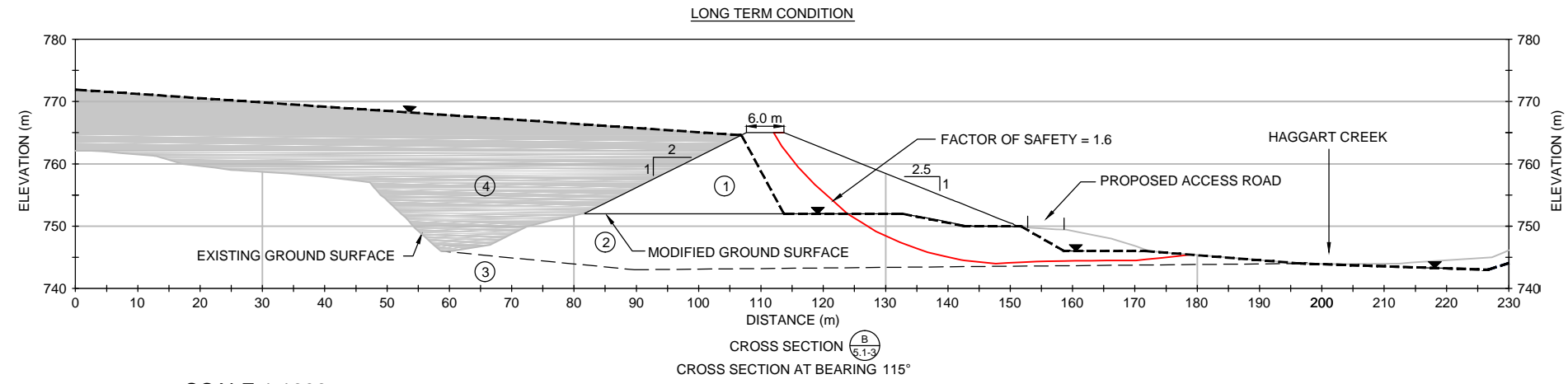
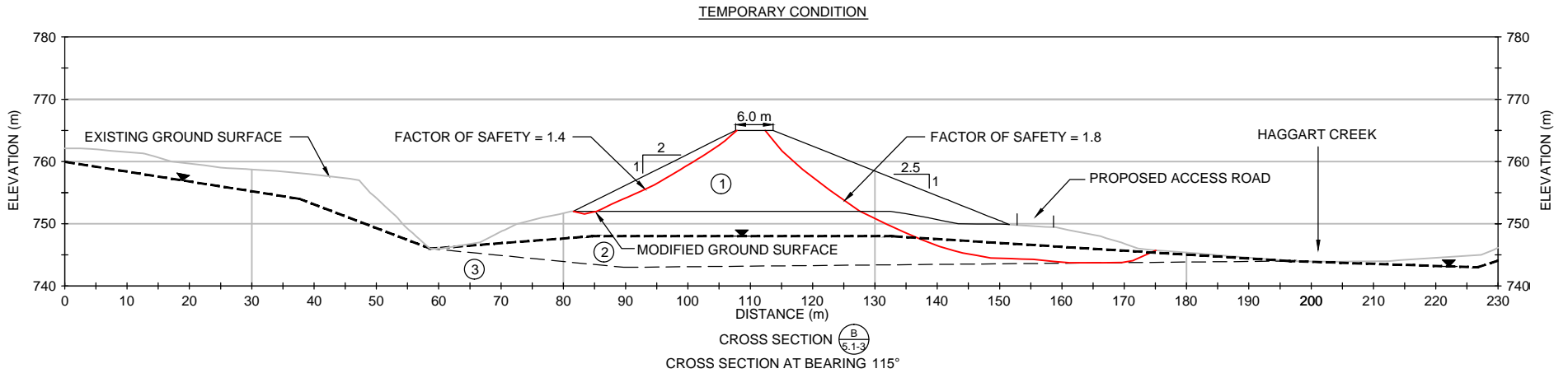
Once the ice-rich material has been placed in storage to final grade, surface erosion and sediment control will be required within the containment area. A roadside interceptor ditch and sediment control pond will be required downslope of the storage facility for collection of water flowing through the containment berm.

Details of interceptor ditches and sediment control measures will be developed at detailed design stage and are discussed in the Erosion and Sediment Control Plan.

The containment berm toe will be sited to avoid encroaching into the Haggart Creek floodplain, thus reducing the possibility of toe erosion during significant flood events. The final toe location outside the floodplain and potential need for erosion protection along the berm toe will be reviewed during detailed design.



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NOTE:  
1. PROPOSED INFRASTRUCTURE LAYOUT RECEIVED FROM WARDROOP MARCH 28, 2012.

LEGEND	
	CALCULATED FAILURE SURFACE
	ASSUMED BOTTOM OF PLACER TAILINGS / ALLUVIUM
	ESTIMATED PHREATIC SURFACE
①	CONTAINMENT BERM FILL
②	PLACER TAILINGS / ALLUVIUM
③	TILL / COLLUVIUM
④	ICE-RICH MATERIAL
PRELIMINARY DESIGN FOR INFORMATION ONLY SUBJECT TO CHANGE NOT FOR CONSTRUCTION	
STATUS FINAL	

CLIENT

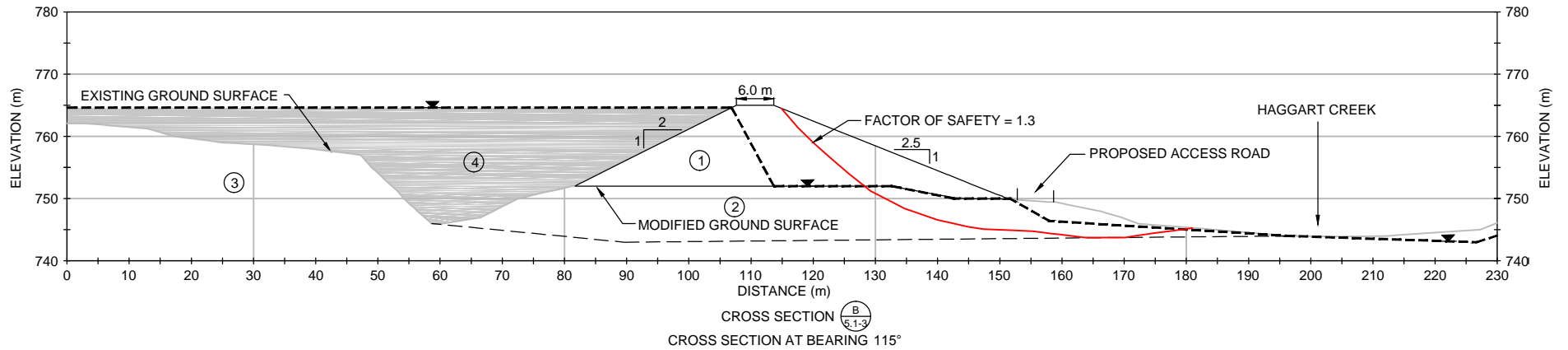
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EAGLE GOLD PROJECT YUKON TERRITORY				
<b>ICE-RICH MATERIALS MANAGEMENT PLAN STATIC STABILITY RESULTS</b>				
FILE NO. 0792008-03-10	DWN SS	CKD PQ	REV 0	<b>Figure 6.2-1</b>
OFFICE	DATE APRIL 2013			

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PSEUDO STATIC ANALYSIS; LONG TERM CONDITION



SCALE 1:1000



NOTE:

1. PROPOSED INFRASTRUCTURE LAYOUT RECEIVED FROM WARDROOP MARCH 28, 2012.

LEGEND

- CALCULATED FAILURE SURFACE
- ASSUMED BOTTOM OF PLACER TAILINGS / ALLUVIUM
- ESTIMATED PHREATIC SURFACE
- CONTAINMENT BERM FILL
- PLACER TAILINGS / ALLUVIUM
- TILL / COLLUVIUM
- ICE-RICH MATERIAL

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EAGLE GOLD PROJECT  
YUKON TERRITORY

ICE-RICH MATERIALS MANAGEMENT PLAN  
PSEUDO - STATIC STABILITY RESULTS

FILE NO. 0792008-03-10	DWN SS	CKD PQ	REV 0	<b>Figure 6.2-2</b>
OFFICE	DATE APRIL 2013			

## **7 CONSTRUCTION AND OPERATIONS PLAN**

### **7.1 CONSTRUCTION REQUIREMENTS**

The ice-rich materials containment berm will be constructed in accordance with the recommendations contained in this plan, with further detail to be developed in detailed design. This plan describes construction requirements for foundation and berm materials, foundation preparation, berm construction, ice-rich material placement and quality assurance.

### **7.2 SCHEDULE**

Development of the IOSA will consist of the following major tasks:

- Borrow development, including selection and processing of engineering materials for the berm and upstream filter zone;
- Foundation preparation, including leveling and removal of any existing organics or other unsuitable materials within the footprint of the berm foundation;
- Fill placement and compaction, including coincident placement of berm and upstream filter materials;
- Installation of survey markers for deformation monitoring; and
- Initial survey of completed berm for baseline deformation monitoring.

While each of these activities can be completed throughout most of the year, berm fill placement and compaction will be completed during summer or fall to minimize difficulties with watering and compaction.

### **7.3 MATERIALS**

Berm construction materials were described previously in Sections 5.2 and 6.1, and will consist generally of coarse grained placer tailings or waste rock for the berm, and well-graded sand and gravel for the upstream filter. It will be necessary to process the filter materials by screening placer tailings. Target grain size distributions will be developed in detailed design, to meet filter criteria for separation of the ice-rich materials from the berm material.

### **7.4 FOUNDATION PREPARATION**

#### **7.4.1 Clearing and Grubbing**

Any existing vegetation will be removed from the berm foundation area, and any topsoil stripped and placed in an Overburden Storage Area (OSA) developed elsewhere on site. Existing vegetation and topsoil are limited in the berm foundation area, which is dominated by several piles of placer tailings from historic placer mining activities.

### **7.4.2 Borrow Development**

Selected areas within the footprint of the berm foundation will be exploited to produce fill materials for the berm and/or upstream filter. This will involve excavating to produce a level surface that will serve as part of the berm foundation.

### **7.4.3 Subgrade Preparation**

The berm foundation will be graded to produce a level platform for fill placement. The foundation subgrade will be proof-rolled with fully loaded haul trucks. Observed weak zones, as evidenced by observable deflections under wheel loads, will be re-compacted to produce a stable subgrade prior to material placement.

## **7.5 BERM CONSTRUCTION**

Berm materials and upstream filter materials will be placed in up to a maximum of 1 m thick loose lifts. A method specification will be developed for lift thickness and compactive effort during detailed design when material selection is finalized. The upstream filter is to be 4 m wide to facilitate concurrent placement with the adjacent berm core materials. Both materials will be placed and compacted as single continuous lifts.

## **7.6 ICE-RICH MATERIAL PLACEMENT**

Ice-rich materials will be hauled to and placed in the IOSA by dump truck. Materials will be hauled immediately on excavation to minimize the time for thawing during handling, transport and placement, and may be stacked in 4 to 5 m high loose lifts. Lifts of waste will be graded gently toward the working edge to promote drainage away from the stacked waste into temporary in-storage water collection areas.

The stored materials will become soft on thawing. This phenomenon will be more pronounced during summer and early fall when air temperatures are highest, so where practical within the overall construction schedule, efforts will be made to schedule material placement between late fall and late spring.

Temporary access roads may be required on top of the stored waste to facilitate trucking of additional material, depending on the season of placement and the current state of previously stacked materials. Temporary roads can be constructed with a roughly 1 m thick lift of waste rock or coarse placer tailings, with the required thickness depending on current strength of the stored waste and wheel loads of the haul trucks.

Coarser ice-rich materials will be placed closer to the containment berm to facilitate drainage within the stored materials.

## **7.7 WATER CONTROL**

Melt water generated from thawing of the stored ice-rich materials, as well as precipitation within the IOSA, will result in an accumulation of surface water. Temporary interior ditches and/or sumps or collection ponds will be developed within the IOSA as needed. Melt water will also flow through the storage area and containment berm. An interceptor ditch will be required at the toe of the berm to collect any free water. The collected water will be pumped to sediment control ponds near the IOSA or returned to a soakage pit within the IOSA for subsurface drainage.

## **7.8 QUALITY ASSURANCE AND QUALITY CONTROL**

The site development contractor will prepare a construction quality control plan, and SGC will implement independent quality assurance inspection and testing, to be developed in detailed design, and to include, at a minimum, the following components:

- Inspection and approval of foundation subgrades;
- Inspection, testing and approval of selected berm and upstream filter materials;
- Regular survey control during fill placement and grading;
- Daily inspections and photographic records of construction activities;
- Oversight of installation of any required deformation monitoring targets;
- Initial baseline survey for deformation monitoring; and
- Preparation of construction record drawings as a record of initial construction.

## **8 MONITORING AND SURVEILLANCE**

The overall performance of the ice-rich storage facility will be dependent on the physical stability of the berm and the stability of the stored ice-rich materials. A monitoring program will be designed, and implemented, and will include the following:

- Regular visual inspection of the berm (crest and toe) looking for any signs of instability (cracking or differential settlement) or erosion;
- Regular visual inspection of the toe for any signs of seepage containing fine grained materials from the downstream shell;
- Installation of settlement pins for deformation monitoring after construction and initial survey of completed berm for baseline deformation monitoring;
- Monitoring of settlement pins.

The results of the visual monitoring will provide insight into the physical performance of the ice-rich storage facility over the course of operations. In the event of instability, or poor performance (e.g. slumping of the crest, bulging of toe areas, erosion), deformation monitoring of specific areas or remedial construction may be required.

Some techniques available to monitor the deformation of the containment berm include:

- Surveying of monitoring pins previously installed at the crest of the berm;
- Radar, LiDAR or photogrammetric surveying.

Visual inspections of the berm should be routinely conducted by technical personnel at the mine. More detailed visual inspections should be conducted on a monthly basis by the mine's geotechnical engineer or a competent person who has appropriate geotechnical experience and is familiar with the technical aspects of the containment berm design, construction, and monitoring.

Monitoring of settlement pins will be conducted semi-annually. Areas showing instability or poor performance will be monitored in a more frequent basis.

Data from visual inspections and monitoring pins will be collected indicating date, time and personnel responsible for data collection, accompanied by a written description of observations and a photo album. Data and findings will be presented in an annual data report, with a detailed assessment of trends and conditions observed to determine the need for either more frequent monitoring or remedial construction.

## 9 CONTINGENCY PLANS

Design of the storage facility considers the potential for increased volumes of ice-rich materials in two ways: allowance for increased volume in the Haggart Creek IOSA by leaving room for potential stacking at a nominal slope of 15H :1V behind the crest of the containment berm (increases capacity by approximately 230,000 m<sup>3</sup>); and, allowance for potential development of a second IOSA in Suttles Gulch (increases capacity by approximately 263,000 m<sup>3</sup>).

## **10 RECLAMATION**

For mine closure, the downstream slope of the containment berm will be regraded from 2.5H : 1V to 3H : 1V to minimize the potential for erosion of the berm, and will be covered with topsoil and revegetated. The regrading of the downstream toe of the containment berm to keep the creek setback will require scalping of a small amount of the berm fill and stored waste. Details of the regrading of the containment berm will be developed in the Reclamation and Closure Plan during detailed design. The upper surface of stored materials will be regraded for effective drainage.

Selected well-drained, near-surface ice-rich materials contained in the IOSA will be used as a component in cover material for closure of the IOSA and for other facilities at the mine. The final Reclamation and Closure Plan for the IOSA will be developed as part of detailed design.



## 11 LIMITATIONS

This plan includes a preliminary design for an IOSA developed on the basis of best available information at the time of its preparation. It must be noted that little geotechnical data is available in the area of the proposed Haggart Creek IOSA, with specific limitations noted as follows:

- No subsurface data are available in the surficial placer tailings or underlying natural materials;
- No lab testing has been undertaken to examine the engineering characteristics of local placer tailings for use as engineered fill; and
- Groundwater levels in the footprint of the proposed IOSA have been inferred from observed surface water, but have not been measured directly.

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## **12 CLOSURE**

BGC trusts that this management plan meets the needs of StrataGold Corporation. If there are any questions, please do not hesitate to contact the undersigned.

Yours sincerely,

**BGC ENGINEERING INC.**  
**per:**

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