BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

VICTORIA GOLD CORPORATION

EAGLE GOLD PROJECT FEASIBILITY STUDY
DUBLIN GULCH, YUKON

GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS

FINAL

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February 23, 2012
Project No: 0792-006

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Dear Mr. Padula,

Re: Eagle Gold Project Feasibility Study. Geotechnical Assessment and Design of the Waste Rock Storage Areas – FINAL Report

Please find attached the above referenced FINAL report, dated February 23, 2011. Thank you for the continued opportunity to work on this interesting and technically challenging mine development project. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Yours sincerely,

BGC ENGINEERING INC.
per:

Warren Newcomen, M.S., P.Eng., P.E.
Senior Geotechnical Engineer

EXECUTIVE SUMMARY

General

The Eagle Gold project is a proposed gold mine located in the Dublin Gulch area of central Yukon approximately 40 km north-northeast of Mayo and 350 km north of Whitehorse. Waste rock generated from mining activities will be placed in two waste rock storage areas (WRSAs): the Eagle Pup WRSA located to the north of the open pit; and the Platinum Gulch WRSA located to the south of the open pit.

The Eagle Pup WRSA will be developed as a valley fill using haul trucks and will contain the majority of the waste rock generated by the open pit. At its ultimate configuration the Eagle Pup WRSA will cover an area of approximately 94 ha and will contain approximately 118.7 million tonnes of waste rock and overburden. The WRSA will be constructed in 45 m lift heights from an elevation of approximately 935 m above sea level (asl) to 1,298 m asl, resulting in an overall height of approximately 363 m and a maximum vertical thickness of approximately 140 m. At the end of the mine life the waste rock pile will have an overall angle of approximately 2.5H:1V.

The Platinum Gulch WRSA will be used to store waste rock early in the mine life and will also be developed as a valley fill using haul trucks. At its ultimate configuration the Platinum Gulch WRSA will cover an area of approximately 38 ha and will contain approximately 13.7 million tonnes of waste rock and overburden. The Platinum Gulch WRSA will be constructed in 45 m lift heights from an elevation of approximately 1,020 m asl to 1,388 m asl, resulting in an overall height of approximately 368 m and a maximum vertical thickness of 40 m. At the end of the mine life the waste rock pile will have and overall angle of approximately 2.4H:1V.

Foundation and Waste Rock Characterization

Excavated rock placed in the Eagle Pup and Platinum Gulch WRSAs will be primarily composed of a mixture of metasediments from the Hyland Group and intrusives related to the Dublin Gulch granodiorite stock. The strengths of the two primary waste rock types have been quantified from open pit geotechnical investigations. Based on laboratory testing and index testing the average uniaxial compressive strength (UCS) of the metasediments and the intrusives are estimated to be 80 MPa and 135 MPa, respectively. The strength of the waste rock has the potential to vary significantly during development of the waste rock piles, particularly in the early years of their development. Placement and quality of waste rock and overburden will have to be closely monitored in critical areas, such as the foundation of the WRSAs, final and interim toes, and in areas that require engineered fills.

In general, the WRSAs will be founded on overburden composed of colluvium and completely weathered bedrock. The overburden is moderately thick (typically 0 to 10 m) but highly variable and predominantly consists of soils ranging from boulders and cobbles with some silt and sand, to silty sand with gravel and some cobbles. Frozen ground, often

containing excess ice, was encountered in the footprints of the WRSAs. Depending on the thickness, initial temperature, and timing of the waste rock placement, the thermal regime of the initially frozen foundation may be altered during construction. The rate of thaw will dictate the ability of the soils to dissipate the water generated.

Stability Analyses

Geotechnical design criteria selected for the Eagle Pup and Platinum Gulch WRSAs are generally based on those recommended by the Yukon Water Board (2009) and the British Columbia Mine Waste Rock Pile Research Committee (1991). It is recommended that under static loading conditions a minimum factor of safety of 1.3 be achieved to short term developments (e.g. during mine operations) and that a minimum factor of safety of 1.5 be applied to the long term (e.g. closure) stability of the WRSAs. Under pseudo-static seismic loading conditions it is recommended that a minimum factor of safety of 1.1 be achieved. Based on an evaluation of the potential seismic activity for the project site the recommended seismic design event for the WRSAs is an earthquake with a 1-in-475-year return period that generates a peak horizontal ground acceleration (PGA) of 0.14 g (BGC, 2011b).

Excess pore pressures could be generated in areas of the foundation containing excess ice when the foundation materials thaw, reducing the effective shear strength of the foundation soils; however, the distribution of excess ice cannot be confidently determined with the data currently available. Therefore, for the purposes of evaluating a range of scenarios during waste placement, the following two pore pressure scenarios (cases) were considered for the stability analyses:

1. No excess pore pressures are generated in the overburden.
2. Excess pore pressures are generated in the upper 3 m of the overburden throughout the entire footprints of the WRSAs.

Case 1 is considered appropriate for both short term (e.g. during mine operations) and long term (e.g. post-closure) timeframes. Case 2, however, is only considered appropriate for short term timeframes as it is estimated that pore pressures generated by excess ice thawing from waste rock placement will have dissipated well before the end of the mine life. Applying Case 2 to evaluations of the overall stability of the WRSAs is also considered to be a conservative approach given that it is unlikely that excess ice is pervasive throughout the WRSA footprints

The proposed Eagle Pup WRSA meets the recommended factors of safety for most of the cases considered. The exception is for the scenario where a slip surface initiates along the crest of the lowest lift. For this specific scenario the lowest lift could become unstable if excess pore pressures are generated in the foundation as a result of excess ice thawing. Therefore, it is recommended that additional investigations be undertaken to delineate and characterize soils containing excess ice in areas where final and interim toes of the WRSAs will be located. If it is determined that excess ice is pervasive throughout these areas then mitigative measures of the lower lift may be required such as re-grading the face of the lift to a shallower angle or excavating the ice-rich material and replacing it with coarse, durable and free-draining waste rock. Alternatively the area could be pre-loaded with waste rock to allow time for the ice to thaw and the pore pressures to dissipate prior to constructing the full height of the lift.

The stability analyses indicate that the overall stability of the Platinum Gulch WRSA meets the recommended factors of safety for the case where excess pore pressures are not generated in the overburden. However, potential slip surfaces initiating along the crest of individual lifts that toe out on native ground do not meet the recommended factors of safety under static or pseudo-static loading for this case. Therefore, it will be necessary to re-grade or re-slope lifts that toe out on native ground (i.e. final or interim toes, or isolated lifts) to flatter angles achieve an acceptable level of stability. This could be implemented in the reclamation plan for the Platinum Gulch WRSA, as this is planned to occur early in the mine life.

The recommended factors of safety are not met for any of the scenarios considered in Platinum Gulch when excess pore pressures are generated in the foundation. Although it is considered unlikely that excess ice is pervasive throughout Platinum Gulch, based on the information available, there is currently insufficient data to complete a thorough assessment. Therefore, it is recommended that additional investigations be undertaken to delineate and characterize soils containing excess ice throughout the footprint of the Platinum Gulch WRSA. If excess ice is found to be pervasive then mitigative measures may be required such as excavating the ice-rich material from areas critical for stability and replacing it with coarse, durable waste rock and/or utilizing bottom-up construction. Depending on where the excess ice is located (e.g. near the toes of individual lifts), waste rock placement procedures may need to be implemented to allow pore pressures generated adequate time to dissipate prior to constructing each lift of the WRSA. These procedures could include pre-loading selected areas of the WRSA.

Rock Drain

The Eagle Pup and Platinum Gulch drainages each consist of a single main channel that broadens in their uplands. Surface flows occur in the valleys and groundwater springs have been noted along road cuts. The potential magnitude of flow in the drainages, as well as the presence of discharging springs, warrant construction of engineered rock drains to convey expected flows through the WRSAs. The rock drains beneath the WRSAs have been sized based on the estimated runoff from a 200-year return period precipitation event.

To determine the characteristics of potential rock drain materials, the in-situ fracture spacing of waste rock has been estimated and used to predict typical dimensions for the waste rock materials. Based on these estimates, it has been assumed that a dominant particle size of 0.1 m can be attained by exercising control over the size and quality of the materials being placed in the rock drains either through selective use of waste rock, segregation by screening, or end dumping of waste rock. It has also been assumed that the rock drains will have a porosity of 30%. Utilizing these estimates, and applying a factor of safety of 4, the recommended cross-sectional area of the rock drains at the toe of the WRSAs is 210 m^2 for Eagle Pup and 58 m^2 for Platinum Gulch. The safety factor of 4 has been applied to the cross-sectional areas of the rock drain to account for:

- Uncertainty in the block size estimates
- Potential migration of fine grained materials into the voids in the drain
- Potential freezing of the drain
- Decrease in void ratio over time due to compression
- Potential degradation of the rock drain material over time

The rock drains must maintain their flow capacity and therefore cannot degrade over time. Thus, it is recommended that the rock drains be constructed out of non-metal leaching, non-acid generating, clean, durable intrusive waste rock with a D_{50} of at least 0.1 m and a maximum particle size of 1 m. Intrusive rocks are the preferred materials for rock drain construction due to their higher strength and greater block size than the metasedimentary rocks. However, based on the waste rock production schedule provided by Tetra Tech Wardrop on February 6, 2012, sufficient quantities of intrusive waste rock may not be available early in the mine life to construct the rock drain. Therefore, it may be necessary to use metasedimentary rocks to construct portions of the rock drain in Eagle Pup. It is BGC's understanding that these materials may be sourced from a cut near the primary crusher. The limited amount of subsurface information available in this area indicates that potentially suitable metasediments may be present below a depth of about 10 to 15 m; however, further drilling in this area is required to confirm the characteristics of the rock in the primary crusher area and their extent. If mine scheduling dictates that the metasedimentary rocks from the primary crusher area be incorporated into the rock drains it is recommended that the susceptibility of these materials to mechanical degradation be evaluated to determine if they are suitable as rock drain construction materials.

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LIMITATIONS

BGC Engineering Inc. (BGC) prepared this document for the account of Victoria Gold Corporation. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of document preparation. Any use which a third party makes of this document or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

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1.0 INTRODUCTION

1.1. General

BGC Engineering Inc. (BGC) has been retained by Victoria Gold Corporation (Victoria) to complete a Feasibility Study (FS) level geotechnical assessment of the proposed waste rock storage areas (WRSAs) for the Eagle Gold project, located in the Dublin Gulch area of central Yukon. The Eagle Gold project includes two WRSAs; one located in the Eagle Pup drainage and the other in the Platinum Gulch drainage. This report summarizes the geotechnical assessments and design recommendations for both the Eagle Pup and Platinum Gulch WRSAs.

The work described herein has been carried out in conjunction with FS work conducted by Tetra Tech WEI Inc. (Tetra Tech Wardrop). The analyses and interpretations included in this report are based on the following information provided by Tetra Tech Wardrop on the dates indicated:

- Open pit layout provided on November 15, 2011
- Waste rock production schedule provided on February 6, 2012
- Mine facility layouts provided on November 23, 2012 with revisions on February 15, 2012
- Eagle Pup WRSA layout provided on January 20, 2012 with revisions on February 15, 2012
- Platinum Gulch WRSA layout provided on January 20, 2012 with revisions on February 15, 2012.

Minor adjustments to the WRSA geometries and dump sequencing were made by Tetra Tech Wardrop after February 15, 2012 to optimize equipment requirements and production scheduling; however, these have not been incorporated into the waste rock volumes and WRSA heights outlined in our report.

1.2. Previous Work

Mineral exploration activities have been carried out in the Dublin Gulch area since the late 1800s, with drilling of the current pit area beginning in 1978. Geological and engineering studies and reports related to the current locations of the WRSAs have been conducted by Knight Piesold Ltd. (Knight Piesold), Sitka Corp. (Sitka), and Scott Wilson Roscoe Postle Associates Ltd. (Scott Wilson RPA) and include the following:

- Knight Piesold, 1996 – *Report on Feasibility Design of the Mine Waste Rock Storage Area*
- Sitka, 1996 – *Field Investigation Data Report, Dublin Gulch Project*
- Scott Wilson RPA, 2010 – *Pre-feasibility Study on the Eagle Gold Project, Yukon Territory, Canada*

Engineering design work was previously completed on the WRSAs to an extent considered to be feasibility level (Knight Piesold, 1996); however, changes in property ownership, a mineral resource update, new mine plan options, and changes to resource/reserve reporting requirements have resulted in the current feasibility study.

1.3. Current Scope of Work

The FS level geotechnical assessments conducted by BGC for the WRSAs of the Eagle Gold project consisted of the following tasks and deliverables:

- Compilation and review of existing geotechnical data.
- Surface and subsurface investigations to provide additional geotechnical data for the FS.
- Geotechnical assessment and stability assessments of the WRSA based on the data available and the design criteria established by Victoria, Tetra Tech Wardrop, and BGC.
- Recommendations for additional work to be completed at subsequent levels of study for the project to optimize the design of the WRSAs.
- A geotechnical design report outlining the tasks noted above.

This geotechnical design report, and associated drawings and appendices, contains the following information:

1. The project setting and factual data sources that form the basis for this work (Sections 2 and 3).
2. Interpretations of the factual data to characterize the foundation and waste rock materials (Section 4).
3. The FS design of the WRSAs including layouts, stability analyses, and rock drain designs (Section 5).
4. Additional consideration in the design and construction of the WRSAs (Section 6).
5. A summary of the work completed and recommendations for further work (Section 7).

2.0 PROJECT SITE CHARACTERIZATION

2.1. Project Location and Description

The Eagle Gold project is a proposed gold mine located in the Dublin Gulch area of central Yukon approximately 40 km north-northeast of Mayo and 350 km north of Whitehorse (Figure 2-1). The project area is situated within a historically active mining region; exploration targets and mines located near the site include: Mt. Haldane, McQuestern, Keno Hill, and Brewery Creek.

The base case operating scenario for the project includes open pit mining with the ore undergoing three stages of crushing followed by heap leaching and recovery of gold from solution in a carbon adsorption, desorption, and recovery (ADR) plant. The general arrangement of the proposed mine facilities is shown on Drawing 1.

The open pit is expected to produce approximately 92 million tonnes of mineralized resource and 132 million tonnes of waste rock and overburden, based on the production schedule provided to BGC on February 6, 2012. The ore will be placed in a valley heap fill located in the Ann Gulch drainage and will span over and partially fill the middle reaches of the Dublin Gulch drainage.

Waste rock generated from mining activities will be placed in two areas: the Eagle Pup drainage located to the north of the open pit; and the Platinum Gulch drainage located to the south of the open pit (Drawing 1). The Eagle Pup WRSA will contain the majority of the waste rock generated from the open pit and will be developed as a valley fill using haul trucks. At its ultimate configuration the Eagle Pup WRSA will contain approximately 118.7 million tonnes of waste rock, reaching a maximum elevation of 1,298 m above sea level (asl) (Drawing 2). The Platinum Gulch WRSA will also be developed as a valley fill using haul trucks and will be used to store waste rock early in the mine life. At its ultimate configuration the Platinum Gulch WRSA will contain approximately 13.7 million tonnes of waste rock and overburden, reaching a maximum elevation of 1,388 m asl (Drawing 2).

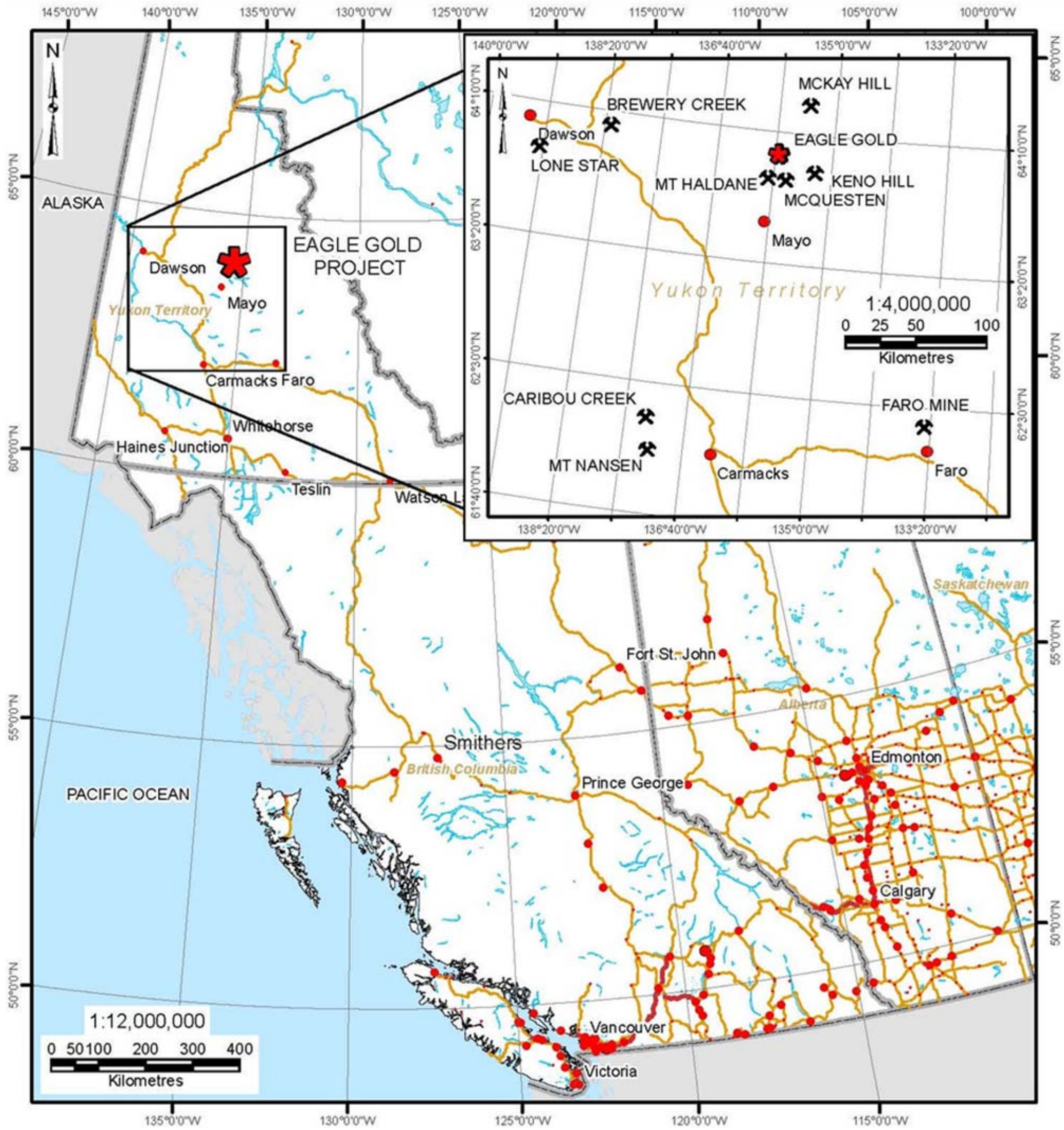

Figure 2-1. Eagle Gold Project Site Location Map

2.2. Physiography

The project area is located in Stewart Plateau which is a physiographic subdivision of the Yukon Plateau. This area is characterized by broad, rolling hills of moderate relief with elevations ranging from approximately 750 m asl in the valley bottoms to over 1,500 m asl in the uplands. The upland areas generally coincide with resistant rock types such as local felsic intrusions. Major drainages in the area include Haggart Creek and Lynx Creek. In its lower reaches Haggart Creek is an extension of Lynx Creek and occupies a very large, broad, U-shaped glacial valley. In its upper reaches Haggart Creek is a much narrower U-shaped glacial valley indicating that it has been less extensively glaciated. Tributaries to

Haggart Creek include Dublin Gulch, Gill Gulch, and Fisher Gulch. These tributaries are much narrower V-shaped valleys with steep valley side slopes. Tributaries to Dublin Gulch include the Eagle Pup and Platinum Gulch drainages, which are proposed for placement of the WRSA's. The Eagle drainage is relatively broad drainage, while the Platinum Gulch drainage is V-shaped and incised.

2.3. Climate

The project area is located within the Mayo Lake-Ross River Eco-region with the St. Elias mountain range to the west being the most dominant physical feature in the region affecting the climate (Stantec, 2010). The St. Elias range tends to block moist maritime air masses resulting in reduced air temperatures and precipitation. As a result the project area is characterized as having a sub-Arctic "continental" type climate with moderate total annual precipitation and extreme temperature variations (Stantec, 2010). Average annual precipitation over the property ranges from 375 to 600 mm, with July being the wettest month (Knight Piesold, 1996). Approximately half of the precipitation falls as snow with daily temperatures below freezing from October through to April (Knight Piesold, 1996). The average monthly temperatures range from a low of approximately -23°C in January to a high of approximately 13°C in July. Temperatures as low as -60°C have been recorded during the winter months, and as high as 35°C during the summer months (Knight Piesold, 1996).

2.4. Permafrost

Based on permafrost distribution maps (Brown, 1978), the project area lies within a zone of discontinuous permafrost. 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 permafrost is typically found on north- and east-facing slopes, highlands, and poorly drained valley bottoms. Coarse-grained, free draining soils are typically ice-free, whereas fine-grained deposits are more likely to contain ice. When encountered the permafrost at the site is generally relatively warm with an average temperature close to 0°C.

2.5. Hydrology

The project area is primarily located within the Dublin Gulch catchment which is a tributary to Haggart Creek. Other drainages which are important to the project site include Ann Gulch, Stewart Gulch, Eagle Pup, Stuttle Gulch, and Platinum Gulch all of which are direct tributaries to either Dublin Gulch or Haggart Creek. Stream flows in the Yukon are typically characterized by peak flows in the spring and low or no flows in the winter. The peak spring flows are generally driven by snow melt or rain-on-snow events with flows decreasing following the disappearance of snow (Knight Piesold, 1996). Intense late summer rainstorms can also generate high flow events particularly within smaller basins such as Dublin Gulch

(Knight Piesold, 1996). The smallest stream flows coincide with the winter months when ice develops on all rivers and many of the smaller streams freeze entirely (Knight Piesold, 1996).

2.6. Geologic Setting

2.6.1. Bedrock Geology

The project area is underlain by Proterozoic to Lower Cambrian metasediments of the Hyland Group which have been intruded by Cretaceous age stocks, dykes, and sills (Knight Piesold, 1996). The metasediments are comprised of intercalated quartzites, phyllites, and minor limestones. The quartzites are variably gritty, micaceous, and massive and the phyllites are comprised of muscovite-sericite and chlorite (Scott Wilson RPA, 2010). The metasediments have been deformed by a regional Cretaceous thrusting event that resulted in the formation of moderate to strong foliation. Subsequent folding has resulted in the foliation generally dipping moderately northwest to southwest throughout the project area. Following the regional deformation the country rocks were intruded by Cretaceous age stocks, dykes, and sills ranging in composition from quartz monzonite to quartz diorite (Knight Piesold, 1996). The Dublin Gulch granodiorite stock is the largest of these intrusions throughout the project site and trends approximately 070° coincident with the axis of the Dublin Gulch anticline (Scott Wilson RPA, 2010).

2.6.2. Surficial Geology

The surficial geology of the project area has been mapped by Bond (1998) and is illustrated in Drawing 3. Pleistocene and Holocene colluvial deposits are abundant in the project area and generally consist of diamicton, gravel, shattered bedrock, and lenses of sand and silt derived from chemical and physical weathering of bedrock and surficial materials. Transport of surface material occurs as creep, sheetwash, and mass wasting and is common on all slopes in the area.

Glacial till is infrequently observed in the project area (Bond, 1998). Where till does occur, it is generally either a silty or sandy clay matrix with clasts up to cobble size. The valley bottom is dominated by alluvium and placer mining tailings. The north facing uplands are covered by an apron or blanket of colluvium over bedrock, as compared with the southern facing uplands, where bedrock is nearer to surface and covered by a veneer of colluvium. The Haggart Creek valley to the west of the project site is filled with a mix of alluvial deposits and placer tailings. A till blanket has been mapped along the east side of Haggart Creek, south of its confluence with Dublin Gulch.

3.0 GEOTECHNICAL DATABASE

3.1. Site Investigations

Geotechnical site investigation programs were undertaken by BGC in 2009, 2010, and 2011 to investigate subsurface conditions at selected mine facilities, including the WRSAs. Details of the site investigation programs are available under separate covers (BGC, 2010, 2011a, 2012a). A summary of the available data is provided below. Foundation conditions within the WRSA footprints have also been documented by Knight Piesold (1996) and Sitka (1996). The results of the site investigations from these studies that pertain to the WRSAs are summarized in Section 4.

3.1.1. Test Pit Investigations

Since 1995 a total of eighty-two test pit excavations have been completed within or adjacent to the current proposed footprint of the Eagle Pup WRSA (Drawing 4). Thirty-one of the test pits were completed by BGC, forty-nine by Sitka, and two by Knight Piesold. During the same time period eighteen test pit excavations were completed within or adjacent to the Platinum Gulch WRSA (Drawing 4). Seven of these were completed by BGC and the other eleven by Sitka. The distribution of the test pits is outlined in Table 3-1. The depths of the test pit excavations ranged from 1 to 9 m. Geotechnical logging was completed for all test pits and representative samples were collected from the pits for laboratory analyses. Detailed logs for the test pits and the results of the laboratory testing are included in BGC's site investigation reports (2010, 2011a, 2012a), Knight Piesold's design report (1996), and Sitka's site investigation report (1996).

3.1.2. Borehole Investigations

Since 1995 a total of eighteen boreholes have been completed within or adjacent to the current proposed footprint of the Eagle Pup WRSA (Drawing 4). Ten of the boreholes were completed by BGC, seven by Sitka, and one by Knight Piesold. During the same time period nine boreholes were completed within or adjacent to the Platinum Gulch WRSA (Drawing 4); four of these were completed by BGC and the other five by Sitka. The distribution of the boreholes is outlined Table 3-1. All but four of the boreholes were completed with diamond drill rigs. As part of the 2011 investigations, BGC completed four boreholes with auger rigs, two of which were drilled with a Cold Regions Research and Engineering Laboratory (CRREL) core barrel to sample ground ice and frozen soils. The boreholes were drilled to an average depth of approximately 30 m, with the deepest hole drilled to nearly 65 m. Geotechnical logging was conducted for all boreholes and representative samples were collected for laboratory analyses. Detailed logs for the boreholes and the results of the laboratory testing are included in BGC's site investigation reports (2010, 2011a, 2012a), Knight Piesold's design report (1996), and Sitka's site investigation report (1996).

Table 3-1. Site Investigations in the WRSAs

Consulting Firm	Number of Test Pits		Number of Boreholes	
	Eagle Pup	Platinum Gulch	Eagle Pup	Platinum Gulch
Knight Piesold	2	0	1	0
Sitka	49	11	7	5
BGC	31	7	10	4
Total	**82**	**18**	**18**	**9**

Notes:

1. Site investigations were completed by Knight Piesold (1996), Sitka (1996), and BGC (2010, 2011a, and 2012a).

3.2. Laboratory Testing

Laboratory index testing was conducted for selected soil samples collected from test pits and boreholes completed within or adjacent to the proposed footprints of the WRSAs. Testing conducted as part of the BGC site investigations included grain size distributions (15 combined sieve analyses and hydrometer tests, and 17 sieve analyses), Atterberg limits testing (7 tests), and moisture content determination (50 tests). Laboratory reports for the testing completed can be found in the BGC site investigation reports (2010, 2011a, 2012a).

Knight Piesold (1996) also conducted laboratory testing as part of the FS work completed in 1996. In addition to soil index testing, Knight Piesold completed multi-stage consolidated-undrained (CU) triaxial tests on five soil samples collected from test pits completed in Bawn Bay Gulch located to the northeast of the WRSAs. The samples were compacted to 95% Modified Proctor maximum dry density at approximately the natural moisture content and then CU testing was completed with confining stresses ranging from 250 to 1,000 kPa. The grain size distribution of some of the samples tested closely approximates those of the colluvium encountered by BGC in the WRSAs. The results of the testing of these samples, which have similar characteristic to the colluvium encountered in the WRSAs, are discussed in Section 5.3.3.

4.0 FOUNDATION AND WASTE ROCK CHARACTERIZATION

4.1. Overburden

4.1.1. Organics

A thin organic cover is widespread across the project site overlying the other overburden units. The cover primarily consists of vegetative root mat, moss, silt and sand, and other organic matter in varying proportions. The typical observed thickness was in the order of 0.2 to 0.3 m.

4.1.2. Colluvium

Colluvium was generally encountered on sloping ground throughout the site, below the organic cover. The relative density of the colluvium was variable and generally ranged from loose to compact. The gradation and thickness of the colluvium was observed to be highly variable, predominantly ranging from boulders and cobbles, with some silt and sand to silty sand with gravel and some cobbles. The colluvium is typically derived from transported weathered metasedimentary and/or intrusive bedrock. Gravel, cobbles, and boulders were generally observed to be angular to subangular.

The colluvium encountered in the test pits and boreholes ranged in thickness from 0 m to 16.4 m throughout the WRSAs with an average thickness of 2.4 m. This average thickness is likely low, however, since some test holes didn't penetrate the full thickness of the colluvium layer.

A distinct colluvial unit was observed within a lobate landform in the Eagle Pup drainage area (Drawing 4). This unit contained completely weathered rock fragments mixed with excess ice, including frequent inclusions of massive ice. The precise extent of this ice-rich colluvium has not been defined; however, it covers an area of approximately 1 ha and was encountered to the bottom of borehole BH-BGC11-42 at 28.2 m below ground surface (bgs), and to approximately 26.1 m bgs in BH-BGC11-63.

4.1.3. Completely Weathered Bedrock

Colluvium was typically observed to be underlain by a horizon of weathered rock. The weathering profile varies substantially across the site, depending on parent rock type and other local factors. The degree of weathering was classified based on the system proposed by Brown (1981). Weathered rock is considered to be part of the overburden where it is completely weathered (i.e. W5) or residual soil (i.e. W6). Less weathered rock, including highly weathered (i.e. W4) rock, is considered for the purposes of this report to be part of the bedrock.

The metasedimentary rock (e.g. quartzite, schist, and phyllite) nearest the ground surface was often observed to be completely weathered to silt with some to trace gravel or sand and gravel with cobbles and trace to some silt and clay. The gravel and cobble clasts tended to be friable, platy and exhibit a 'soapy' film due to the weathering/alteration. The transition from highly or completely weathered rock to a more competent, unweathered rock mass is highly variable; unweathered rock was generally not observed in test pits, and usually not observed at shallow depths in drill holes.

The near-surface granodiorite intrusive rock was often observed to be either completely weathered to a silty sand, or sandy silt, or highly weathered to a poorly graded sand. The thickness of the weathered horizon was highly variable.

4.2. Bedrock

Two major rock types were encountered below the overburden soils within and adjacent to the footprints of the WRSA: metasediments and intrusives. The metasedimentary bedrock encountered ranges from schist to quartzite and is the most common bedrock type encountered in the subsurface investigations. Intrusive rock (granodiorite) was encountered in boreholes and at outcrops in the upper portions of the Platinum Gulch and Eagle Pup valleys. In general the bedrock was encountered at depths ranging from 0 m to 44 m with an average depth of 6.9 m.

4.3. Permafrost and Excess Ice

Frozen ground is widespread throughout the footprint of the Eagle Pup WRSA, with 59 of 93 observations reporting frozen conditions. The frozen ground frequently contained excess ice, with 21 of the 59 frozen ground observations reporting excess ice. Frozen ground and excess ice observations along cross-sections A and B in the Eagle Pup WRSA are shown on Drawings 5 and 6, respectively. Frozen ground is also locally present in the footprint of the Platinum Gulch WRSA and, where present, typically contains excess ice. Of the 23 observations made in Platinum Gulch frozen ground was noted in 11 times with excess ice observed at every one of these locations. Frozen ground and excess ice observations along cross-section C in the Platinum Gulch WRSA are shown on Drawing 7.

The distribution of the observed frozen ground conditions in the Eagle Pup and Platinum Gulch WRSA footprints are shown on Drawing 8. Frozen ground (where present) was observed to an average depth of approximately 3 m in both of the WRSA areas.

During the 2011 site investigation program two thermistors strings were installed to approximately 25 m bgs in the Eagle Pup WRSA in boreholes BH-BGC11-42 and BH-BGC11-63. This is the area identified as the lobate landform containing ice-rich colluvium in Section 4.1.2. Temperature measurements recorded on August 30, 2011 indicated the presence of low-grade permafrost, with a mean temperature of approximately -0.2°C to-0.3°C. Bedrock was not encountered in either borehole, which were completed to depths of up to 26.7 m. The overburden encountered generally consisted of ice-rich, sandy silt colluvium.

4.4. Groundwater and Phreatic Conditions

Groundwater was observed in nine test pits in Eagle Pup and two in Platinum Gulch. The depths to groundwater observed ranged from 0.4 m to 8.2 m. Multiple seeps were also observed along road cuts in both Eagle Pup and Platinum Gulch as shown on Drawing 8. It is assumed that the groundwater table forms a subdued replica of the surface topography, with the water table relatively close to the surface.

4.5. Waste Rock Characterization

In general, waste rock to be placed in the WRSAs will consist of a mixture of metasediments from the Hyland Group and intrusives related to the Dublin Gulch granodiorite stock. Based on WRSA sequencing plans provided by Tetra Tech Wardrop the waste rock will be primarily comprised of metasediments. The intact strengths of these rocks have been estimated from laboratory testing of drill core samples, point load testing, and core logging observations completed for the open pit design studies (BGC, 2012b). The laboratory tests provide relatively precise strengths for a small number of samples which can then be used to calibrate the strength estimates from the larger point load testing database. The resulting strength estimates based on the point load testing are then checked against the more general estimates of strength from the core logging observations to arrive at an average strength for each unit. Based on laboratory testing, point load testing, and core logging observations the design uniaxial compressive strengths (UCS) of the metasediments and the intrusives are estimated to be 80 MPa and 135 MPa, respectively.

In-situ fracture spacing of the rocks have been measured as part of open pit design studies (BGC, 2012b) and have been used to estimate average dimensions of the rock block sizes, prior to blasting. The waste rock block size will be heavily influenced by the length of the various discontinuity sets; however, limited information is available on the discontinuity lengths as the majority of the observations are derived from core, which are small in diameter and have a sampling bias due to their orientation. Preliminary estimates indicate that the metasediments and intrusives will have average in-situ block sizes of about 0.1 and 0.2 m in diameter, respectively. Blasting induced fractures during mining operations will also have an impact on block size. Based on their higher strength and mineralogy, the intrusive rocks would be the most desirable construction materials, and will likely be the most durable from the open pit area; however, siliceous metasedimentary rocks (e.g. quartzites) may also be suitable for construction materials.

5.0 WASTE ROCK STORAGE AREA DESIGN

5.1. General Arrangement

The Eagle Gold project requires two WRSAs to accommodate the volume of waste rock expected to be generated from mining the open pit. The Eagle Pup and Platinum Gulch WRSAs will be located to the north and south of the proposed open pit, respectively (Drawing 1). The layout and sequencing of the WRSAs was developed by Tetra Tech Wardrop in conjunction with preliminary recommendations provided by BGC. As noted in Section 1.1, minor adjustments to the WRSA geometries and dump sequencing were made by Tetra Tech Wardrop after February 15, 2012 to optimize the mine plan. These adjustments have not been incorporated into the waste rock volumes and WRSA heights outlined below.

5.1.1. Eagle Pup Waste Rock Storage Area

The Eagle Pup WRSA will contain most of the waste rock generated from the open pit and will be developed as a valley fill using haul trucks. At its ultimate configuration the Eagle Pup WRSA will cover an area of approximately 94 ha and will contain approximately 118.7 million tonnes of waste rock and overburden. The WRSA will be constructed in 45 m lift heights from an elevation of approximately 935 m asl to 1,298 m asl, resulting in an overall height of approximately 363 m. At the end of its construction the waste rock pile will have an overall angle of approximately 2.5H:1V. Within the footprint of the WRSA the valley bottom of the Eagle Pup drainage ranges in slope from approximately 8° to 25°. As a result, the WRSA will obtain a maximum vertical thickness of approximately 140 m. The ultimate configuration of the WRSA is provided in plan on Drawing 2 and in cross-section on Drawings 5 and 6.

Based on the dump sequencing provided to BGC on January 20, 2012, construction of the Eagle Pup WRSA will be initiated part way up the drainage in Year 0 at elevation 983 m asl. Bottom up construction will then be utilized to advance the WRSA upslope to its ultimate height in Year 3 while the lowest lift is progressively pushed out. Following this, nearly all of the lifts will be progressively pushed out until the final toe is established in Year 5. The upper lifts will then continue to be pushed out until the overall angle is increased to a final surface slope of approximately 2.5H:1V in Year 9. A series of plans showing the progression of the WRSA is provided in Appendix A.

5.1.2. Platinum Gulch Waste Rock Storage Area

The Platinum Gulch WRSA will also be developed early in the mine life from Year 0 to Year 3 as a valley fill using haul trucks. At its ultimate configuration the Platinum Gulch WRSA will cover an area of approximately 38 ha and will contain approximately 13.7 million tonnes of waste rock and overburden. The Platinum Gulch WRSA will be constructed in 45 m lift heights from an elevation of approximately 1,020 m asl to 1,388 m asl, resulting in an overall height of approximately 368 m. At the end of its construction the waste rock pile surface will have an overall slope of approximately 2.4H:1V. The Platinum Gulch drainage is moderately steep with the valley bottom sloping at approximately 21° in the WRSA footprint. As a result, the WRSA will only attain a maximum vertical thickness of approximately 40 m. The ultimate configuration of the WRSA is provided in plan on Drawing 2 and in cross-section on Drawing 7.

Based on the dump sequencing provided to BGC on January 20, 2012, construction of the Platinum Gulch WRSA will be initiated in the upper reaches of the drainage in Year 0 at elevation 1,213 m asl. Independent lifts will then be constructed both above and below this in Year 1. In Year 2 the final toe will be established and the lower lifts expanded outwards. Finally, in Year 3 the upper lifts will be expanded outwards to the final overall surface slope of 2.4H:1V. A series of plans showing the progression of the WRSA is provided in Appendix A.

5.2. Underdrainage Requirements

The Eagle Pup and Platinum Gulch drainages each consist of a single main channel that broadens in the uplands. Seasonal flows are present in the valleys, and springs have been noted along road cuts (Drawing 8). The construction of engineered rock drains in the valley bottoms is required to convey the expected groundwater and runoff flows through the WRSAs. Based on discussions between Victoria, Knight Piesold, and BGC, a 200-year precipitation event was selected for design of the rock drains. The peak instantaneous flows discharging from the Eagle Pup and Platinum Gulch drainages due to the 200-year precipitation event are estimated to be 2.1 m^3/s and be 2.3 m^3/s, respectively (C. Aurala, 2011, pers. comm.).

In the upper reaches of each rock drain the contributing drainage area decreases and thus the required cross-sectional area of the rock drains also decreases. Utilizing the estimated peak flows for the drainages, the flow at specific locations along the drainages was estimated by pro-rating the total flow based on the total catchment area that reports to that location. This was particularly important in Platinum Gulch as the WRSA is located higher up in the drainage and thus only about 40% of the total drainage catchment reports to the toe of the WRSA resulting in substantially smaller cross-sectional area requirements for the rock drain.

Cross-sectional areas of the rock drains required to convey the flows have been determined at key locations using the Wilkin's equation (1956), as follows:

$$Q = nAWm^{0.5}i^{0.54} \quad [1]$$

where:

Q = flow rate (m^3/s)

n = porosity

A = cross-sectional area through which the water flows (m^2)

W = Wilkin's empirical constant (5.243)

m = hydraulic mean radius (m)

i = hydraulic gradient

The required cross-sectional area is inversely proportional to the hydraulic gradient. Therefore, for Eagle Pup the approximate hydraulic gradient along the lower portion of the drainage where the slope is less steep (8°) was used in the design. For Platinum Gulch the slope of the valley bottom is relatively consistent at 21° within the footprint of the WRSA and, therefore, this value was used for design.

The hydraulic mean radius of the rock drain materials can be calculated from the following equation:

$$m = \frac{ed}{6r_e} \qquad [2]$$

where:

e = void ratio

d = "dominant" particle diameter (m)

r_e = particle surface-area-efficiency

The particle surface area efficiency is typically about 1.3 for coarse angular rock and the porosity of the rock drains is estimated to range from between 30% and 50%. A relatively low porosity of 30% has been assumed for the rock drain design to compensate for degradation of the waste rock, the potential buildup of fine grained materials, and to consider the effects of high confining stress on the rock drains due to the weight of overlying waste rock.

For design purposes it has been assumed that the "dominant" particle diameter is represented by the mean particle size (D_{50}) of the waste rock. Geotechnical drilling conducted within the open pit area (BGC, 2012b) indicates that the average in-situ block size could range from 0.1 m to 0.2 m for the metasedimentary and igneous rocks, respectively. Based on these estimates, it has been assumed that a D_{50} of 0.1 m can be reasonably attained by exercising control over the size and quality of the materials being placed in the rock drains either through selective use of waste rock, segregation by screening, or end dumping of the waste rock.

Using the above equations, the cross-sectional area of the rock drains required to convey the pro-rated design flows has been estimated. In order to provide adequate protection against:

- Potential migration of fine grained materials
- Freezing of the drains
- Possible reduction in the flow capacity due to consolidation
- Potential degradation of the rock drain materials over time.

A cross sectional area of the drains which is four times the value calculated is recommended (i.e. a safety factor of 4) giving maximum rock drain cross-sectional areas of 210 m^2 and 58 m^2 for Eagle Pup and Platinum Gulch, respectively.

Recommended cross-sectional areas of the rock drains at various drainage divides are summarized in Table 5-1. Material estimates for construction of the rock drains are provided in Table 5-2. The geometry of the rock drains has been determined assuming a minimum height of 4 m and angle-of-repose side slopes. It is noteworthy that the cross-sectional area of the rock drains is highly dependent on both the D_{50} and the void ratio of the material used for construction. For this level of study both these parameters have been approximated based on the in-situ block size estimates from geotechnical drilling within the open pit area and engineering judgment. If a D_{50} of at least 0.1 m and/or a porosity of at least 30% cannot be obtained for this material, the size of the drains will need to be increased. Further steps to quantify the size distribution of the waste rock should be undertaken during detailed design.

The rock drains must maintain their flow capacity and cannot degrade over time. Therefore, it is recommended that the rock drains be constructed of non-metal leaching, non-acid generating, clean, durable intrusive waste rock with a D_{50} of at least 0.1 m and a maximum particle size of 1 m. The preferred rock type based on strength and block size estimates is the intrusive rocks. However, based on the waste rock production schedule provided by Tetra Tech Wardrop, the volume of intrusive waste rock may be limited early in the mine life and the quantities required for construction of the entire rock drain may not be available. Therefore, it may be necessary to use metasedimentary rocks to construct portions of the rock drains. It is our understanding that these rocks may be sourced from a cut near the primary crusher. A review of the limited subsurface information available in this area indicates that potentially suitable metasediments may be present below a depth of between 10 m and 15 m. The volume of competent metasedimentary rocks available and the durability of these materials in this area have not been confirmed yet and therefore the suitability of this rock drain material source is strongly qualified and should only be considered preliminary at this time. If mine scheduling dictates that the metasediments from the primary crusher area be incorporated into the rock drains, it is recommended that the susceptibility of these materials to mechanical degradation be evaluated to determine if they are suitable for construction material.

It will be necessary to clear and grub organic soils from the footprint of the rock drains to an average depth of 0.3 m in preparation for placement of the drain rock. To minimize the amount of fines migrating into the rock drains, overburden materials and fine-grained waste rock should not be placed directly over top of the drain. If this cannot be avoided a filter material, consisting of either synthetic or natural materials may be required to prevent fines from infiltrating into the rock drains.

As shown in Drawing 1, sediment control ponds are located in the Eagle Pup and Platinum Gulch drainages downstream of the WRSAs. In the case of the Eagle Pup drainage the sediment control pond is located at the toe of the WRSA. The rock drain should be graded into the sediment control pond by extending it from the toe of the WRSA. The details of this interaction should be considered at the next stage of design. For preliminary guidance it can be assumed that the rock drain will grade into the sediment control pond at an angle ranging between 3H:1V and 5H:1V. It can also be assumed that the material used to construct this segment of the drain will need to consist of clean, durable waste rock with a D_{50} of at least 0.3 m in order to provide a non-erodible outlet.

Table 5-1. Recommended Rock Drain Cross-Sectional Areas at Key Locations

Facility	Location[1]	Calculated Rock Drain Area (m^2)	Recommended Rock Drain Area[2] (m^2)	Recommended Rock Drain Width (m)
Eagle Pup	925 m elev.	53	210	58
Eagle Pup	950 m elev.	48	193	54
Eagle Pup	1000 m elev.	34	137	40
Eagle Pup	1100 m elev.	15	62	21
Platinum Gulch	1025 m elev.	14	58	20
Platinum Gulch	1150 m elev.	14	58	20

Notes:

1. Locations refer to the elevation in the valley bottom. See Drawing 8 for the recommended rock drain widths, assuming a rock drain height of 4 m and side slope angles of 37º.
2. A factor of safety of 4.0 has been assumed.

Table 5-2. Material Estimates for Rock Drain Construction

Facility	Description	Average Depth[1] (m)	Volume (m^3)
Eagle Pup	Clearing and Stripping	0.3	27,000
	Rockfill	-	145,000
Platinum Gulch	Clearing and Stripping	0.3	2,600
	Rockfill	-	25,000

Notes:

1. Average depth of stripping to remove organic soils from the footprint of the rock drains.

5.3. Stability Assessment

5.3.1. Design Criteria

Geotechnical design criteria selected for the Eagle Pup and Platinum Gulch WRSAs (Table 5-3) are generally based on those recommended by the Yukon Water Board (2009) and the British Columbia Mine Waste Rock Pile Research Committee (1991). BGC recommends that under static loading conditions a minimum factor of safety of 1.3 be applied to short term developments (e.g. during mine operations) and that a minimum factor of safety of 1.5 be applied to the long term (e.g. post-closure) of the WRSAs. Under pseudo-static seismic loading conditions BGC recommends that a minimum factor of safety of 1.1 be applied. Based on an evaluation of appropriate seismic design criteria for the project site conducted by BGC (2011b) the recommended seismic design event for the WRSAs is an earthquake with a 1-in-475-year return period that generates a peak horizontal ground acceleration (PGA) of 0.14 g.

Table 5-3. Recommended Geotechnical Design Criteria

Criteria	Description
Static Factor of Safety – short term (mine operations)	1.3
Static Factor of Safety – long term (post-closure)	1.5
Pseudo-static Factor of Safety – short and long term	1.1
Design Earthquake Return Period	1-in-475-year event

5.3.2. Methodology

The stability of the Eagle Pup and Platinum Gulch WRSAs were assessed under static and pseudo-static loading conditions using the two-dimensional, limit equilibrium software package Slope/W (Geostudio, 2007, version 7.17). The minimum factor of safety was estimated 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 horizontal seismic coefficient (k_h) applied is equal to half the peak horizontal ground acceleration (PGA) for the design event considered. Hynes-Griffin and Franklin concluded that earth dams and embankments should not develop deformations greater than 1 m if this criterion is satisfied. This method assumes liquefaction does not occur in either the foundation or the waste rock. Separate checks are required to determine the liquefaction potential of these materials.

5.3.3. Material Properties

Material properties used in the stability assessments were based on the site investigation results, laboratory testing, and experience with materials showing similar characteristics. A summary of the relevant material properties is provided in Table 5-4.

Table 5-4. Summary of Material Properties used in Stability Analyses

Material Type	Unit Weight (kN/m^3)	Effective Stress Parameters		Total Stress Parameters	
		Friction Angle (°)	Cohesion (kPa)	Friction Angle (°)	Cohesion (kPa)
Waste Rock	19	Non-linear strength function[1]		Non-linear strength function[1]	
Colluvium – ice-poor	18	34	0	30	0
Colluvium – ice-rich	18	30	0	30	0
Bedrock – completely weathered	20	35	50	35	50
Bedrock – Type 3	27	Hoek-Brown strength function[2]		Hoek-Brown strength function[2]	
Bedrock – Type 2	27	Hoek-Brown strength function[2]		Hoek-Brown strength function[2]	
Bedrock – Type 1	27	Hoek-Brown strength function[2]		Hoek-Brown strength function[2]	

Notes:

1. See Section 5.3.3.1.
2. See Section 5.3.3.4

Effective stress parameters have been used for analyses considering static loading conditions and total stress parameters for pseudo-static loading conditions. It is noteworthy that for the analyses it has been assumed that the waste rock is free draining and will not develop excess pore pressures under seismic loading. Graphic logs of the different material types encountered during the site investigation for selected areas of the Eagle Pup WRSA are shown in cross-section on Drawing 5 and 6 and for the Platinum Gulch WRSA on Drawing 7. These cross-sections have been used for subsequent stability analyses.

5.3.3.1. Waste Rock

The shear strength of the waste rock in both WRSAs was modeled using an empirical approach suggested by Barton and Kjaernsli (1981) for rockfills. In this approach the internal angle of friction is stress-dependent and can be estimated using the following equation:

$$\phi' = R \cdot \log\left(\frac{S}{\sigma_n'}\right) + \phi_r \quad [3]$$

where:

ϕ' = internal angle of friction

ϕ_r = the residual friction angle

σ_n' = effective normal stress

R = equivalent roughness

S = equivalent strength

The equivalent strength, S, is a size dependent parameter that accounts for scale effects. The equivalent roughness, R, is a parameter that is dependent on the shape and density of the rockfill. Barton and Kjaernsli (1981) provide plots from which the equivalent roughness and equivalent strength parameters can be estimated for a given material based on the following:

- Uniaxial compressive strength (UCS)
- Average (D_{50}) particle size
- Degree of particle roundness
- Porosity following compaction

Table 5-5 provides a summary of the parameters assumed for the waste rock. Note that in Equation 3 the residual friction angle has been used in place of the basic friction angle (ϕ_b) originally suggested by Barton and Kjaernsli (1981). In subsequent applications of this method it was noted that the residual friction angle (ϕ_r) is more appropriate for conservative, long-term design strengths (Barton, 2008). Therefore, given that the waste rock storage areas will remain in perpetuity, the lower, more conservative residual friction angle was considered more appropriate.

As outlined in Section 4.5, the average UCS of the intact rock for the metasedimentary and intrusive rocks in the pit area is estimated to range from 80 to 135 MPa. Based on the waste rock production schedule provided by Tetra Tech Wardrop the waste rock will primarily consist of metasediments. Therefore, 80 MPa has been used to estimate the equivalent rockfill strength values for stability assessments and design.

Also as outlined in Section 4.5, based on fracture spacing measured from geotechnical drillholes completed in the open pit area, the D_{50} of the waste rock is estimated to range from approximately 100 mm for the metasediments to 200 mm for the intrusives. For design purposes the waste rock was assumed to have a D_{50} of approximately 100 mm to reflect the anticipated composition of the waste rock. The shape / texture of the waste rock has been classified as “angular and rough”. This classification is based on site reconnaissance and is consistent with the shape / texture of blasted rock.

Information provided by Tetra Tech Wardrop indicates the waste rock is estimated to have a density of 1.94 tonnes / m^3 (loose) and the average intact waste is estimated to have a specific gravity of 2.62 (T. Hantelmann, 2011, pers. comm.). Based on these values, the waste rock is estimated to have a void ratio of 0.35 which is equivalent to a porosity of approximately 26%. It is recognized that the porosity of the waste rock will vary spatially throughout the WRSAs and will be dependent on multiple factors such as: the dump construction method; the overlying thickness of waste rock; the grain size distribution of the waste rock, the resistance of the materials to particle crushing; and the moisture content. Therefore, a porosity of 30% was used in estimating the strength of the rock fill for stability analyses and design, adding conservatism to account for potentially looser packing of the waste rock than indicated by the density estimate.

Small scale direct shear testing has been completed on drill core samples as part of open pit design studies (BGC, 2012b). Based on testing results from foliation surfaces a residual friction angle of 31° has been selected for design.

The strength curves for the waste rock derived using the Barton and Kjaernsli (1981) method are shown in Figure 5-1, along with strength curves suggested by Leps (1970) for “weak” and "average" compacted rockfill. Leps defined weak rockfill as having a UCS ranging from 3 to 17 MPa and average rockfill as having a UCS ranging from 17 to 69 MPa. In general, the rockfill strength estimated with the Barton and Kjaernsli method is between the weak and average rockfill strengths suggested by Leps. The rockfill strengths are considered reasonable even though a much higher UCS of 80 MPa is being applied to the waste rock, as the curves suggested by Leps are for compacted rockfill. Given that the waste rock in the WRSAs will be placed in a relatively loose state its shear strength would be expected to be less than that of a compacted rockfill with an equivalent UCS.

Table 5-5. Waste Rock Strength Parameters

Parameter	Value	Source
D_{50}	100 mm	Estimated from fracture spacing measured geotechnical drillhole in the open pit
UCS	80 MPa	Estimated from UCS and point load testing conducted by BGC (2012b)
R	4	Angular, rough rockfill with a porosity of 30%
S	20 MPa	Based on a UCS of 80 MPa and a D_{50} of 100 mm
ϕ_r	31°	Estimated from direct shear testing conducted by BGC (2012b)

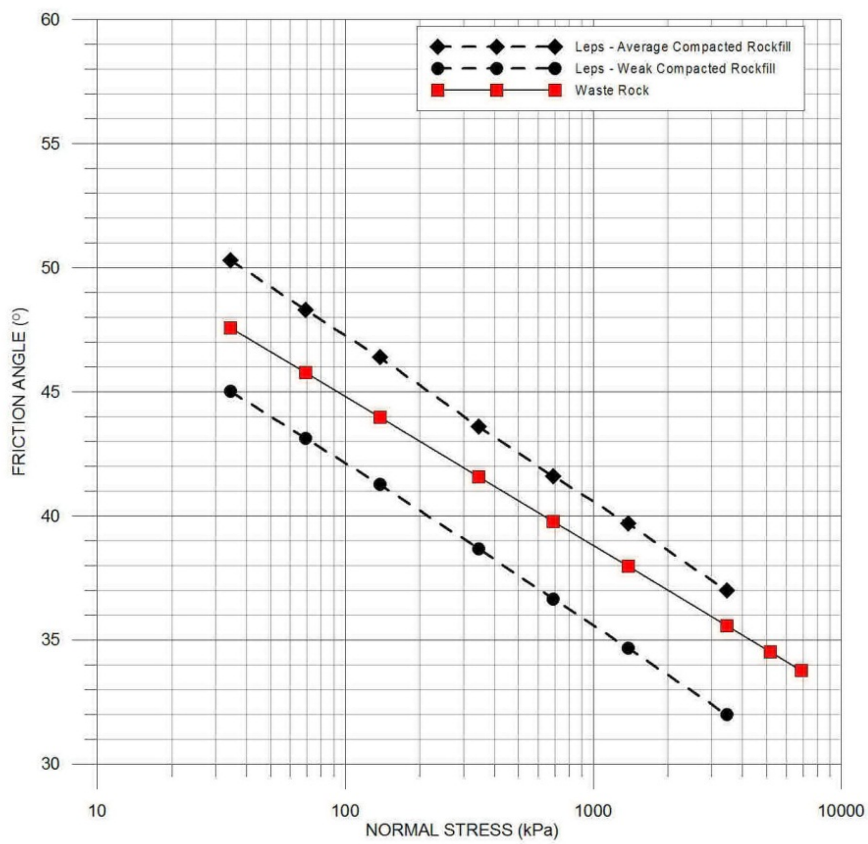

Figure 5-1. Waste Rock Non-linear Strength

5.3.3.2. Colluvium

As part of the FS work that Knight Piesold completed in 1996 a multi-stage consolidated-undrained (CU) triaxial test was conducted on a sample consisting of 45% gravel, 23% sand, 26% silt, and 6% clay. The sample was compacted to 95% Modified Proctor maximum dry density at approximately the natural moisture content and then CU testing was completed with confining stresses ranging from 250 to 1000 kPa. The results of the triaxial testing indicated the following strength parameters:

- Effective stress parameters - $\phi' = 38°$ and $c' = 68$ kPa.
- Total stress parameters - $\phi = 34°$ and $c = 38$ kPa.

The grain size distribution of the sample tested closely approximates those of the colluvium tested by BGC in the Eagle Pup WRSA. For design effective strength parameters of $\phi' = 34°$ and $c' = 0$ kPa and a total strength of $\phi = 30°$ and $c = 0$ kPa were selected and are considered to be conservative strength parameters for the ice-poor colluvium, based on the limited testing results outlined above and BGC's engineering judgment.

As the ice-rich colluvium thaws it will generate water and will likely be less compact than the ice-poor colluvium. Therefore, for short term loading scenarios a friction angle of 30° has been applied to the this material for both effective and total strength analyses. The thin layer of organic materials on the ground surface have not been incorporated into the stability analysis models as it is assumed that they are not thick enough to control deep seated failures. In addition, it is anticipated that these materials will be removed and stockpiled for reclamation purposes.

5.3.3.3. Completely Weathered Bedrock

Based on visual classifications, field observations, and limited in-situ penetration testing the completely weathered bedrock was assigned effective strength parameters of $\phi' = 35°$ and $c' = 50$ kPa and a total strength of $\phi = 35°$ and $c = 50$ kPa.

5.3.3.4. Bedrock

Data collected from geomechanical logging of drill core and field observations of the bedrock has been used to classify the bedrock into three categories: Type 1, 2, and 3 (BGC, 2012c). Type 3 bedrock is usually the first "rock-like" material underlying the overburden soil materials, however, sharp contacts between overburden and Type 2 or Type 1 rock have occasionally been observed. Type 3 rock is defined as being rock that is highly weathered or less (i.e. W4 or better), and has intact strength greater than R0 (i.e. minimum UCS strength 1 MPa). Type 2 rock is defined as rock with a Geological Strength Index (GSI, after Hoek and Marinos, 2000) of 30 or greater, and core recovery during drilling of 50% or greater. Type 1 rock is defined as having a GSI exceeding 40.

A rock mass strength envelope was developed for each bedrock category using the Hoek-Brown criteria (Hoek et al., 2002). The parameters required for the Hoek-Brown criteria are outlined below and provided in Table 5-6.

- Geological strength index (GSI) of the rock mass
- Unconfined Compressive Strength (UCS) of the intact rock
- Material constant (m_i) of the intact rock
- An assumed rock mass disturbance factor ("D") which downgrades the rock mass strength based on the type of excavation method and stress relief.

The GSI is approximately equivalent to the Rock Mass Rating (Bieniawski, 1976) for values of RMR_{76} greater than 18. The GSI was estimated for each bedrock category based on median RMR_{76} parameters from geotechnical core logging conducted by BGC throughout the project site.

Initial estimates of the intact rock strength were made by BGC during geotechnical core logging of drillholes based on simple field tests and observations, following the International Society of Rock Mechanics standard (ISRM, 1978). The strength grades were used to estimate the UCS of the rock based on correlations available in literature (Brown, 1981). Point load testing was also conducted on drill core samples to estimate the UCS of the intact rock.

The Hoek-Brown material constant (m_i) reflects the induration, grain or crystal interlocking, and mineralogy of the intact rock sample. The material constant for the bedrock was estimated to be 11 for the Type 1 rock, and 6 for the Type 2 and Type 3 rock.

The rock mass disturbance factor ("D") is a subjective value representing the effects of mining on the rock mass properties. Blast damage, stress relief, and mining induced relaxation will dilate or "loosen" the fabric of the rock mass and may generate new fractures. For design, BGC has assumed that the bedrock within the footprints of the WRSAs will not be affected by blasting or other mine processes and thus a value of D = 0 has been applied to the rock mass.

Table 5-6. Hoek-Brown Parameters for Bedrock

Unit	Hoek-Brown Input Parameters[1]			Hoek-Brown Strength Properties		
	GSI[2]	UCS[3]	m_i	m_b	s	a
Type 1 Rock	51	54	11	1.912	0.0043	0.505
Type 2 Rock	36	33	6	0.610	0.0008	0.515
Type 3 Rock	28	25	6	0.459	0.0003	0.526

Notes:

1. The Hoek-Brown failure criteria have been estimated using a disturbance factor ('D') of 0 for all units.
2. Median RMR_{76} parameters are used for each geotechnical unit.
3. UCS for Type 1 and Type 2 rocks are estimated from point load testing. UCS for Type 3 rock is estimated from median strength grades.

5.3.4. Pore Pressures and the Effects of Ground Thawing

As outlined in Section 4.4, it is assumed that the groundwater table forms a subdued replica of the surface topography. For the stability analyses conducted the groundwater table was generally modeled coincident with the original ground surface for each section to simulate the potential effects of ponding where vertical seepage through the waste rock pile intersects the natural ground. It has been assumed that the waste rock will be free draining and perched water tables will not develop within the WRSAs.

Construction of the WRSAs will involve the placement of lifts of waste rock on potentially frozen ground. Depending on the thickness, initial temperature, and timing of the lift placement, the thermal regime of the initially frozen foundation may be altered, particularly if the lift is placed during the summer. Thawing at a slow rate allows for generated water to flow from the soil at the same rate as melting occurs and therefore it is unlikely that excess pore pressures generated will be sustained. For faster thawing rates, excess pore pressures may be generated which can reduce the effective shear strength of the foundation soils.

The magnitude of excess pore pressures generated due to thaw consolidation was estimated by predicting the rate of thaw and comparing this rate to the estimated coefficient of consolidation for the foundation soil. Assuming that the permafrost is at a temperature close to melting (0°C) the transient thaw penetration can be estimated from the modified Stefan equation (Nixon and McRoberts, 1973) as follows:

$$X = \left(\frac{2k_u T_S}{L}\right)^{1/2} \cdot t^{1/2} \qquad [4]$$

where:

X = thaw penetration depth (m)

k_u = unfrozen thermal conductivity (W/(m-°C)

T_s = applied constant surface temperature (°C)

L = volumetric latent heat of the soil (J/m^3)

m = hydraulic mean radius (m)

t = time (s)

As Equation 1 shows, the rate of thaw penetration will decrease with increasing latent heat (i.e. ice content). Assuming that the frozen soil has an average dry density of 1350 kg/m^3 and an average water content of 40% the unfrozen thermal conductivity and the volumetric latent heat can be estimated using methods described in Andersland and Ladanyi (2004) to be 1.1 W(m-°C)) and 180.2 MJ/m^3, respectively. Assuming that placing a lift of waste rock is thermally equivalent to applying a constant surface temperature of +5°C (a conservative assumption over the long-term considering that the project site is in a discontinuous permafrost environment and, as such, the waste rock is expected to cool with time), the estimated rate of thaw penetration is presented in Figure 5-2.

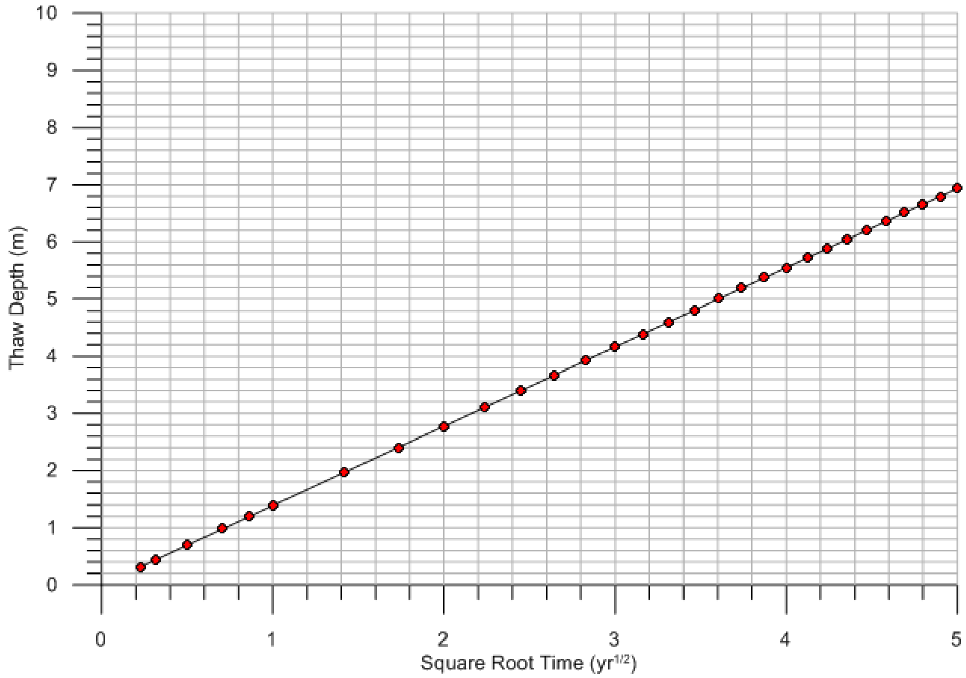

Figure 5-2. Estimated Rate of Thaw Penetration

The thaw coefficient, α, can be determined from best-fit slope of the curve and indicates that thaw will penetrate at an average rate of 1.4 m/year$^{1/2}$ or 0.25 mm/s$^{1/2}$.

The thaw consolidation ratio, R, is a dimensionless parameter that provides a measure of the relative rates of generation and expulsion of excess pore water and is expressed by the following equation (Nixon and McRoberts, 1971):

$$R = \frac{\alpha}{2 \cdot \sqrt{c_v}} \qquad [5]$$

where:

R = thaw consolidation coefficient

α = thaw coefficient (mm/s$^{1/2}$)

c_v = coefficient of consolidation (mm^2/s)

Thaw consolidation tests have not been carried out on soil samples from the Eagle Gold project site, but coefficients of consolidation have been reported to range from 10 (sandy silts) to 0.01 mm^2/s (clays) (Nixon and McRoberts, 1973). Conservatively assuming a coefficient of consolidation of 1 mm^2/s for the silt colluvium and substituting 0.25 mm/s$^{1/2}$ for α, gives a thaw consolidation coefficient R = 0.13.

For slope stability calculations, the thaw consolidation value R is equivalent to the more commonly-used “pore pressure ratio” (R_u). Therefore, slope stability analyses have been carried out by applying a R_u of 0.15 to the thawed soil.

It is noted from Figure 5-2 that even after 25 years, the permafrost in the area of the ice-rich lobate landform is not expected to fully melt, with only the upper 7 m or so of the permafrost expected to thaw. This is based on the assumption that the waste rock will continue to be thermally equivalent to applying a constant surface temperature of +5°C.

5.3.5. Cases Considered

As discussed in Section 4.3, frozen ground frequently containing excess ice was observed in both the Eagle Pup and Platinum Gulch drainages. However, there were many areas observed as either unfrozen or frozen but free of excess ice. Based on the thaw consolidation analysis completed, excess pore pressures are expected to be generated in areas of waste rock placement where the foundation contains excess ice. The distribution of excess ice cannot be confidently determined with the data currently available. Therefore, for the purposes of the stability analyses, two cases were considered:

1. No excess pore pressures are generated in the overburden.
2. Excess pore pressures are generated in the upper 3 m of the overburden throughout the entire footprints of the WRSAs as a result of excess ice thawing from waste rock placement.

Case 1 is considered appropriate for both short term (e.g. during mine operations) and long term (e.g. post-closure) timeframes. Case 2 is only considered appropriate for short term timeframes given that, in general, it is estimated that excess pore pressures generated as a result of excess ice thawing from waste rock placement will have dispersed for the majority of the areas covered with waste rock well before the end of the mine life. As noted earlier, however, it may take longer for this to occur in areas such as the ice-rich lobate landform where excess ice extends to a significant depth.

For each of these cases, scenarios were considered for slip surfaces initiating from the upper, mid, and lower portion of the waste rock pile and exiting near the toe of the overall WRSA. A scenario was also considered for a slip surface initiating along the crest or bench of the lowest lift of both the Eagle Pup and Platinum Gulch WRSA. Applying Case 2 to evaluations of the overall stability of the WRSAs is considered to be a conservative approach given that excess ice is not observed throughout the WRSA footprints. However, the results of these conservative assessments give an indication of the impact of excess ice and highlight the need for additional subsurface investigations.

5.3.6. Results

Stability analyses were initially completed assuming that no excess pore pressures were generated in the overburden. The results of these analyses are provided in Table 5-7. In general, the factors of safety for the Eagle Pup WRSA range from 1.3 to 2.0 under static loading conditions and from 1.2 to 1.6 under pseudo-static loading conditions. For analyses completed for the Eagle Pup that included excess pore pressures in the foundation the factors of safety range from 1.2 to 1.8 under static loading conditions and from 1.1 to 1.5 under pseudo-static loading conditions.

For the Platinum Gulch WRSA factors of safety ranged from 1.1 to 1.5 under static loading conditions and from 1.0 to 1.2 under pseudo-static loading conditions for analyses with no excess pore pressures generated in the overburden. For analyses that included excess pore pressures in the foundation the factors of safety range from 0.9 to 1.1 under static loading conditions and is approximately 0.9 for pseudo-static loading conditions.

Images from the stability models showing the slip surfaces are included in Appendix B.

Table 5-7. Stability Analysis Results

Facility	Failure Type	Foundation Condition	Factor of Safety	
			Static	Pseudo-static
Eagle Pup	Overall	No excess pore pressure	2.0	1.6
Eagle Pup	Mid slope		1.8	1.5
Eagle Pup	Lower slope		1.5	1.4
Eagle Pup	Lowest lift		1.3	1.2
Eagle Pup	Overall	Excess pore pressure	1.8	1.5
Eagle Pup	Mid slope		1.7	1.4
Eagle Pup	Lower slope		1.5	1.3
Eagle Pup	Lowest lift		*1.2*	1.1
Platinum Gulch	Overall	No excess pore pressure	1.5	1.2
Platinum Gulch	Lowest lift		*1.1*	*1.0*
Platinum Gulch	Overall	Excess pore pressure	*1.1*	*0.9*
Platinum Gulch	Lower lift		*0.9*	*0.9*

Notes:

1. Factors of safety that do not meet those recommended in Table 5-3 are shown in italicized text.

5.3.7. Discussion

The stability analyses indicate that, in general, the proposed configuration for the Eagle Pup WRSA meets the recommended factors of safety (Table 5-3) for both short term and long term stability. One exception, however, was noted for a scenario where a slip surface initiates along the crest or bench of the lowest lift. For this specific scenario the lowest lift could become unstable if excess pore pressures are generated in the foundation. From Drawing 8 it can be seen that frozen ground with excess ice was observed near the toe of the WRSA. The excess ice in this area was estimated to make up 10-15% of the soil by volume. Prior to placing waste rock in this area it will be necessary to remove this material and replace it with coarse, durable waste rock or pre-load the material to allow the ice to thaw and the water generated to dissipate prior to constructing the full height of the lift. It will also be necessary to prevent interim toes of the WRSA from being constructed out onto soil that contains excess ice that could generate excess pore pressures as it thaws. Additional investigations should be undertaken to delineate and characterize soils containing excess ice, particularly in areas where final and interim toes of the WRSA may be located.

The stability analyses conducted indicate that the overall stability of the Platinum Gulch WRSA meets the recommended factors of safety for the case where excess pore pressures are not generated in the overburden. However, slip surfaces initiating along the crest of the lowest lift and extending into the soils at the toe of that lift do not meet the recommended factors of safety for this case. Therefore, it will be necessary to re-grade (flatten) or reduce the height of the lowest lift to achieve an acceptable level of stability. In addition, any interim toes or individual lifts which remain in place over the summer season may need to be re-graded or stabilized with lower wrap-around lifts to achieve an acceptable level of stability. This could possibly be included in the reclamation plan for the slopes, if the mine production and dump construction sequencing will accommodate this.

The recommended factors of safety are not met for any of the scenarios considered in Platinum Gulch when excess pore pressures are generated in the foundation. Based on the information collected to date it appears to be unlikely that excess ice is pervasive throughout Platinum Gulch. Applying excess pore pressures to evaluations of the overall stability of the WRSAs is considered to be a conservative approach; however, as can be seen from Drawing 8, additional data over the footprint of the WRSA is needed to confirm this assumption. The results highlight the need for additional subsurface investigations to delineate and characterize soils potentially containing excess ice throughout the footprint of the WRSA. If excess ice is found to be pervasive in the Platinum Gulch WRSA then foundation preparations and/or bottom up construction along with a re-design of the layout may be required. If excess ice is only locally present and not pervasive then, depending on where it is located (e.g. near the toes of individual lifts), procedures may need to be implemented to allow the ice to thaw and the water generated to dissipate prior constructing each lift of the WRSA. These procedures could include pre-loading select areas of the WRSA, as discussed above, or flattening the face of the lowermost lifts.

6.0 ADDITIONAL CONSIDERATIONS

6.1. Water Diversion and Management

Controlling surface runoff and groundwater is an important element in preventing pore pressures from developing within waste rock storage areas and reducing the potential for erosion of the waste rock, thus enhancing overall stability. In general, surface water runoff can be controlled and infiltration can be minimized by expending relatively little effort during mining operations. A water management plan is being developed by Knight Piesold for the WRSAs as part of the FS and therefore will not be discussed in detail in this report. However, the primary means of controlling runoff and infiltration to waste rock piles generally include the following:

- Divert surface water flows away from the WRSAs, wherever possible and practical.
- Grading, crowning, or in-sloping the running surfaces of the operating lifts to divert water away from areas of WRSAs which are important to their overall stability, such as along the outer perimeters.
- Construct swales and/or ditches within the surface of the piles that tie into natural drainage channels which will convey surface water away from the WRSA catchments.
- Preferentially grade all surfaces to avoid ponding.

Control of surface water runoff by these means is recommended and has been assumed in determining the factors of safety presented above.

6.2. Material Placement and Sequencing

6.2.1. General Material Placement

Overburden and fill materials that are not required for reclamation and that are placed in the WRSAs should be mixed with coarse, durable waste rock at a ratio such that the overall strength of the mixture is dictated by the waste rock. A general rule-of-thumb to achieve this is that mixtures should not exceed 20% overburden by volume. In addition, overburden spoil materials should not be concentrated along the foundation or within the final side slopes of the WRSAs. Caution should be taken to prevent large quantities of overburden from being placed in any one area, as these materials will be less likely to drain when subsequent lifts are placed and could generate localized excess pore pressures, which could contribute to slope instability. In addition, if overburden is temporarily stockpiled on the WSRAs for later use as reclamation cover then it should be placed away from the edge of the WRSAs so as not to influence the stability of the waste rock piles.

In general, the waste rock from the open pit area is not anticipated to consist of materials that are prone to weathering and/or degradation. However, if waste rock prone to weathering and/or mechanical degradation is encountered it should be treated as overburden and handled as outlined above.

6.2.2. Seasonal Placement

Seasonal challenges should be anticipated during construction of the WRSAs due to the presence of overburden containing excess ice. During the summer months, as the ground thaws, instabilities may occur near the toes of the WRSAs if they are advanced over thawed or thawing ground that contains excess ice. Seasonal dumping campaigns focusing on advancing the WRSAs out onto native ground during the winter months and building on existing waste rock lifts during the summer months could be considered to limit the advancement of the WRSAs onto thawed or thawing ground.

6.2.3. Ice-rich Lobate Landform

As discussed in Section 4.1.2 a distinct lobate landform comprised of ice-rich colluvium with frequent inclusions of massive ice was encountered in the Eagle Pup drainage (Drawing 4). This ice-rich colluvium is approximately 1 ha in plan area and was encountered to the bottom of borehole BH-BGC11-42 at 28.2 m bgs and to approximately 26.1 m bgs in BH-BGC11-63. Due to the nature and extent of this landform BGC provided recommendations to Tetra Tech Wardrop in an email dated December 13, 2011 summarizing a sequence of waste rock placement that should be implemented so that the ice-rich lobe is buttressed with waste rock prior to advancing the WRSA upslope above it. In the email provided to Tetra Tech Wardrop it was recommended that this be achieved by first constructing a lift of waste rock immediately below the ice-rich lobate landform. The purpose of this lift is to act as a platform for subsequent lifts. Once this platform lift is established, the next lift of waste rock (i.e. the buttressing lift) should be constructed in front of the ice-rich lobate landform such that it extends out a sufficient distance (at least 135 m) from the native ground surface that the ice-rich lobe is supported. The overall angle of the combined lifts at this stage of the WRSA development should not exceed 3H:1V.

Following this initial waste placement sequencing, the WRSA can continue to be developed upwards at an overall angle of 3H:1V. The buttress could also be out from the native ground surface, in which case the buttress would need be widened by approximately 65 m for a total width of at least 200 m. Once the buttress has been extended out to a width of at least 200 m from the native ground surface, the WRSA could be developed upwards at an overall angle of about 2.5H:1V. The WRSA sequencing for the FS was provided by Tetra Tech Wardrop to BGC on January 20, 2012. Our review of the sequencing indicates that the above recommendations have been followed.

6.3. Foundation Preparation

Clearing and stripping of the organic soils will be required throughout the footprint of the rock drains in both the Eagle Pup and Platinum Gulch WRSAs (Drawing 8). An average stripping depth of 0.3 m has been assumed to remove the organic soils. In general, clearing and stripping should be performed in as short a time as possible in advance of waste rock placement to minimize the exposure period of the de-vegetated ground. This will limit the amount of erosion that occurs in these areas. The organic soils should be stockpiled for re-use in reclamation work.

There are a number of ground-related challenges that may arise with any clearing and stripping of the WRSAs and other earthworks completed in these areas. These include:

- Presence of discontinuous permafrost, including some areas with excess ground ice.
- Relatively short "traditional" (i.e. spring/summer/fall) construction season, with specific challenges and limitations during other parts of the year (e.g. poor trafficability and material workability on hillsides before mid-summer; and long, harsh winter).
- Presence of steep slopes and geological hazards.

Excavation of frozen ground, particularly ice rich permafrost, requires additional effort and care. Well-bonded, ice-rich frozen ground will be difficult to excavate and may require ripping. Further consideration needs to be given to the thaw behaviour of this material, and allowances made for adequate drainage and associated erosion control, as well as additional time and effort for the work. Exposure of ice-rich permafrost and the associated thaw can result in wet, muddy, soft ground, and poor trafficability, along with local slumping and other nuisance effects. Consideration should be given to completing the foundation preparation and rock drain construction in the winter months to reduce the challenges outlined above.

Excavated frozen ground will generally be unsuitable for reuse without substantial effort to thaw and drain, and may be suitable for reuse only for limited applications, depending on the moisture and fines contents. It will be necessary to plan for temporary or permanent stockpiling of the wasted ice-rich frozen soil. These materials will be unstable when thawed and will not stand at steep angles or significant height, so a large footprint or containment berm may be required to store relatively small volumes. The design of these stockpiles was not included in BGC's scope of work.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Key aspects of the geotechnical assessments of the Eagle Pup and Platinum Gulch WRSAs and recommendations for subsequent levels of study are summarized below:

1. Construction of the WRSAs will involve the placement of lifts of waste rock on potentially frozen ground containing excess ice. Depending on the thickness, initial temperature, and timing of the waste rock placement, the thermal regime of the initially frozen foundation may be altered, particularly when a lift is placed during the summer months. Depending on the rate of thaw and the ability of the soils to dissipate the water generated, excess pore pressures could be generated reducing the effective shear strength of the foundation soils. This can result in instabilities of the WRSAs.
2. The stability analyses completed indicate that, in general, the Eagle Pup WRSA meets the recommended factors of safety for the cases considered. The exception to this is for the scenario where a slip surface initiates along the crest or bench of the lowest lift. For this specific scenario the lowest lift is considered unstable if excess pore pressures are generated in the foundation as a result of excess ice thawing from waste rock placement. It is recommended that additional investigations need to be undertaken to delineate and characterize soils containing excess ice in areas where final and interim toes will be located. If it is determined that excess ice is pervasive throughout these areas then mitigation will be required such as: excavating the ice-rich material and replacing it with coarse, durable waste rock. Alternatively, the area could be pre-loaded with waste rock to allow the ice time to thaw and the water generated to dissipate prior to constructing the full height of the lift.
3. The stability analyses completed indicate that the overall stability of the Platinum Gulch WRSA meets the recommended factors of safety as long as excess pore pressures are not generated in the overburden. However, slip surfaces initiating along the crest or bench of the lowest lift do not meet the recommended factors of safety for this case. Therefore, it may be necessary to re-grade the lowest lift to achieve an acceptable level of stability. In addition, any individual lifts (e.g. those detached from other lifts) will also need to be re-graded in order to achieve an acceptable level of stability. This could be implemented as part of the reclamation plan for this area, which will require flatter slopes than the angle of repose slopes which will be in place at the end of the waste placement.
4. The recommended factors of safety are not met for any of the scenarios considered in Platinum Gulch when excess pore pressures are generated in the foundation. Applying excess pore pressures to evaluations of the overall stability of the WRSA is considered to be a conservative approach given that it is unlikely that excess ice is pervasive throughout the footprint. However, the results of these evaluations highlight the need for additional subsurface investigations. Therefore, it is recommended that additional investigations be undertaken to delineate and

characterize soils containing excess ice throughout the footprint of the WRSA. If excess ice is found to be pervasive then mitigation measures will be required such as: excavating the ice-rich material from areas critical for stability and replacing it with coarse, durable waste rock; and/or utilizing bottom-up construction. If excess ice is only locally present and not pervasive then, depending on where it is located (e.g. near the toes of individual lifts), procedures may need to be implemented to allow the ice time to thaw and the water generated to dissipate prior constructing each lift of the WRSA. These procedures could include pre-loading select areas of the WRSA.

5. The pseudo-static seismic stability analyses completed assume that liquefaction does not occur in either the foundation or the waste rock. The resistance of these materials to liquefaction should be assessed at detailed design. This may require additional site investigations including geophysics.
6. A distinct lobate landform comprised of ice-rich colluvium with frequent inclusions of massive ice was encountered in the Eagle Pup. Due to the nature and extent of this landform it is recommended that waste rock placement be sequenced in a manner such that the ice-rich lobe is buttressed with waste rock prior to advancing the WRSA upslope.
7. Construction of engineered rock drains in the valley bottoms of the Eagle Pup and Platinum Gulch drainages is recommended to convey water flows through the WRSAs and prevent a phreatic surface from developing within the waste rock piles. The rock drains must maintain their flow capacity and cannot degrade over time. Therefore, it is recommended that the rock drains be constructed out of non-metal leaching, non-acid generating, clean, durable intrusive waste rock with a D_{50} of at least 0.1 m and a maximum particle size of 1 m. Based on the waste rock production schedule, intrusive waste rock may not be available early in the mine life in the quantities required for the rock drain construction. Therefore, it may be necessary to use metasedimentary rocks to construct the rock drains. It is BGC's understanding these may be sourced from a cut near the primary crusher. A review of subsurface information available in this area indicates that suitable metasediments may be present below a depth of about 10 to 15 m. However, these materials require further evaluations to confirm their suitability for the rock drain. If the mine schedule requires that these metasediments be incorporated into the rock drain it is recommended that the susceptibility of these materials to mechanical degradation be evaluated to determine if they are suitable construction materials.
8. It is also recommended that the particle size distribution of the various waste rock sources be better defined to confirm assumptions regarding the proposed materials for the rock drains. Maximizing block sizes by modifying blasting and excavation techniques could significantly reduce the required size of the rock drains and thus reduce construction costs.
9. Sediment control ponds are located in the Eagle Pup and Platinum Gulch drainages downstream of the WRSAs. In the case of the Eagle Pup drainage the sediment

control pond is located at the toe of the WRSA. It is recommended that the rock drain be graded into the sediment control pond by extending it from the toe of the WRSA. It is recommended that the details of this interaction be considered at the next stage of design.

8.0 CLOSURE

We trust the above satisfies your requirements at this time. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

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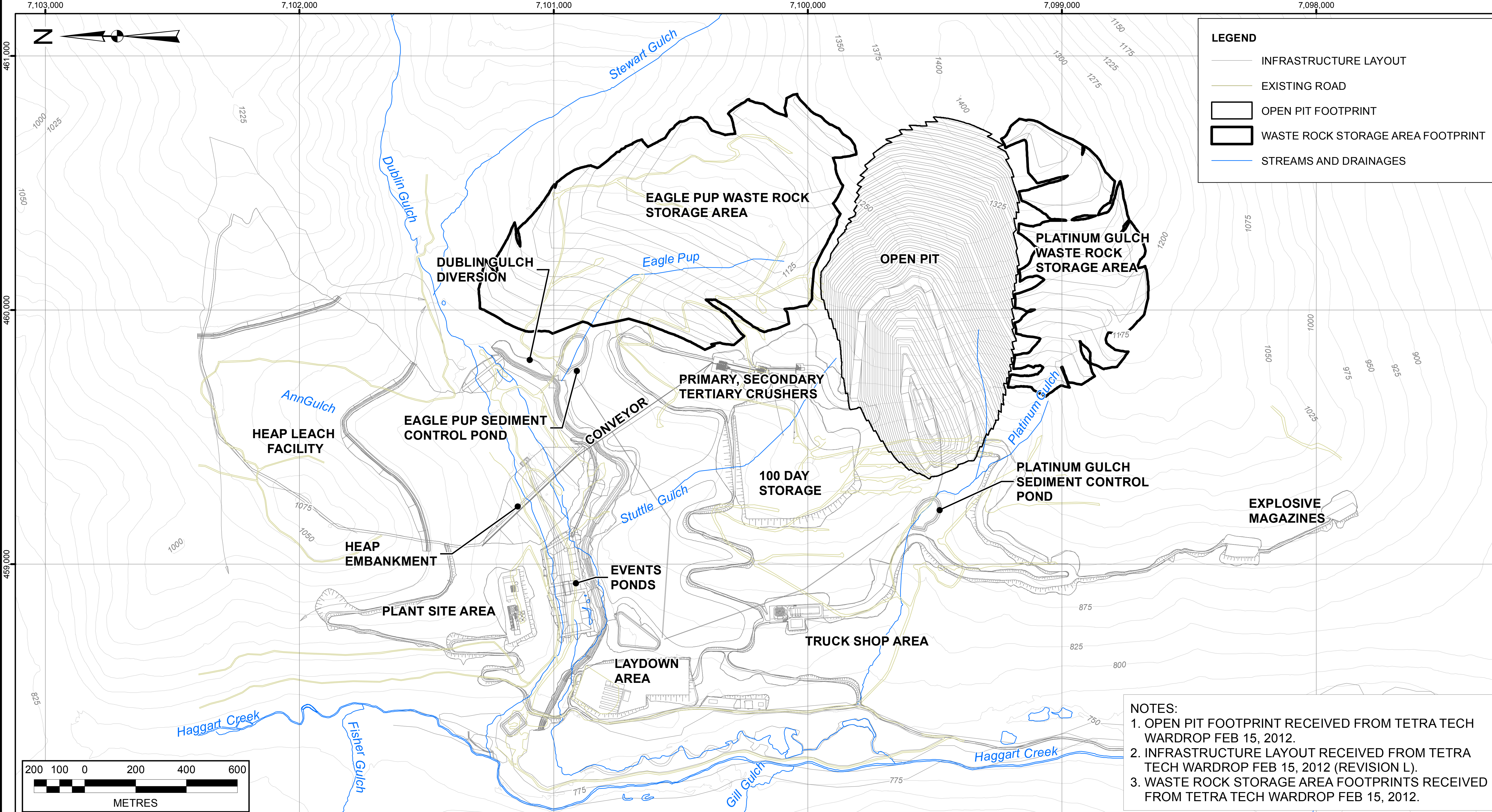
DRAWINGS



NOTES:
1. OPEN PIT FOOTPRINT RECEIVED FROM TETRA TECH WARDROP FEB 15, 2012.
2. INFRASTRUCTURE LAYOUT RECEIVED FROM TETRA TECH WARDROP FEB 15, 2012 (REVISION L).
3. WASTE ROCK STORAGE AREA FOOTPRINTS RECEIVED FROM TETRA TECH WARDROP FEB 15, 2012.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:15,000
DATE:	FEB 2012
DRAWN:	LL, MIB
DESIGNED:	BMM
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

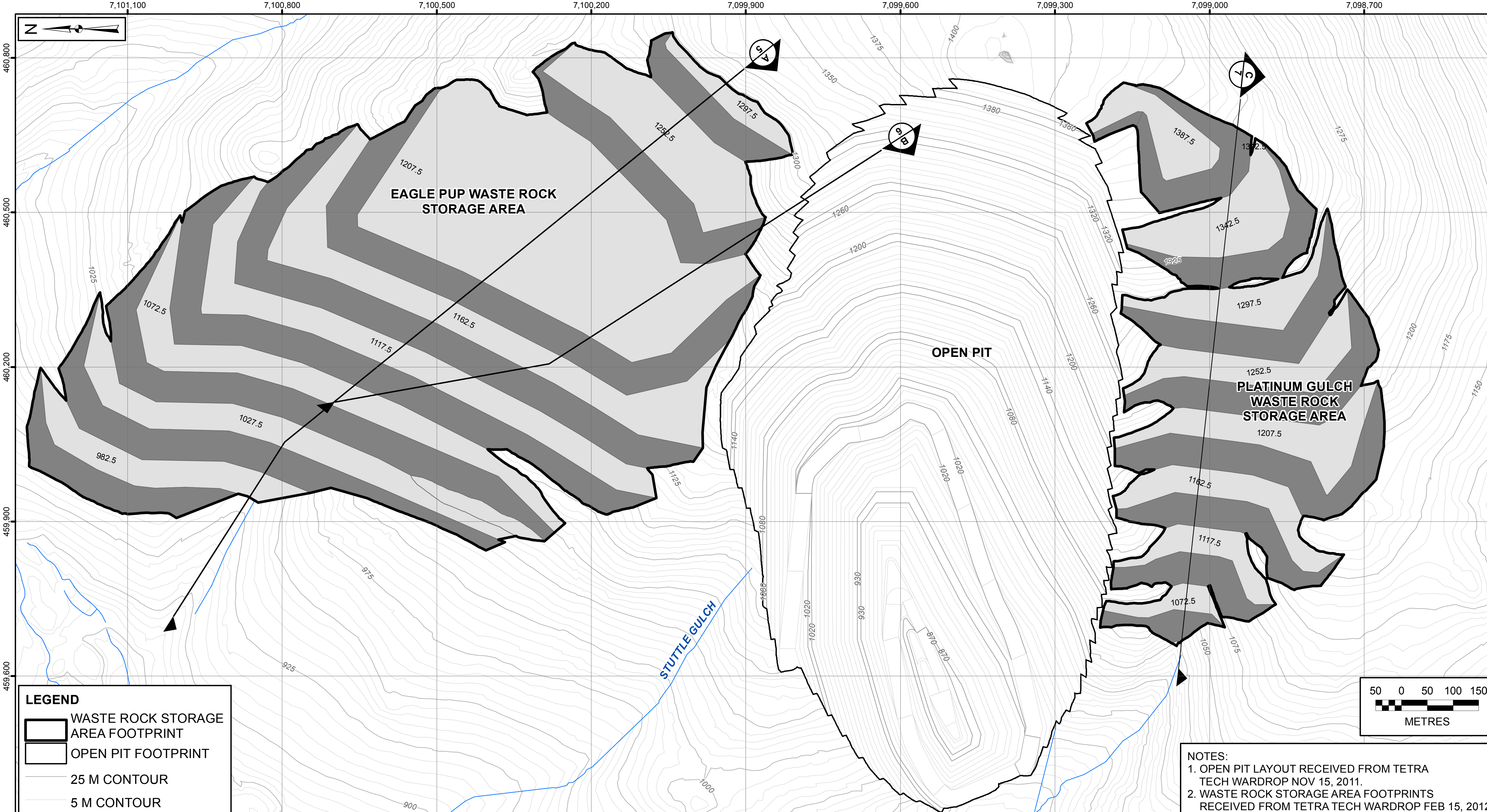
PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS

TITLE: PROPOSED GENERAL ARRANGEMENT

PROJECT No.:	DWG No.:	REV.:
0792-006	01	

X:\Projects\0792 Victoria Gold\004_EG_FS_Infrastructure\Workspace\20110817_Report_Eagle_Gold_Project_Feasibility_Study_Geotechnical_Assessment_And_Design_Of_Waste_Rock_Storage_Areas\01_Proposed General Arrangement.mxd Date: February 21, 2012 Time: 4:43 PM

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012



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SCALE:	1:7,500
DATE:	FEB 2012
DRAWN:	MIB
DESIGNED:	BMM
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS

TITLE: ULTIMATE CONFIGURATION OF THE WASTE ROCK STORAGE AREAS

PROJECT No.:	DWG No.:	REV.:
0792-006	02	

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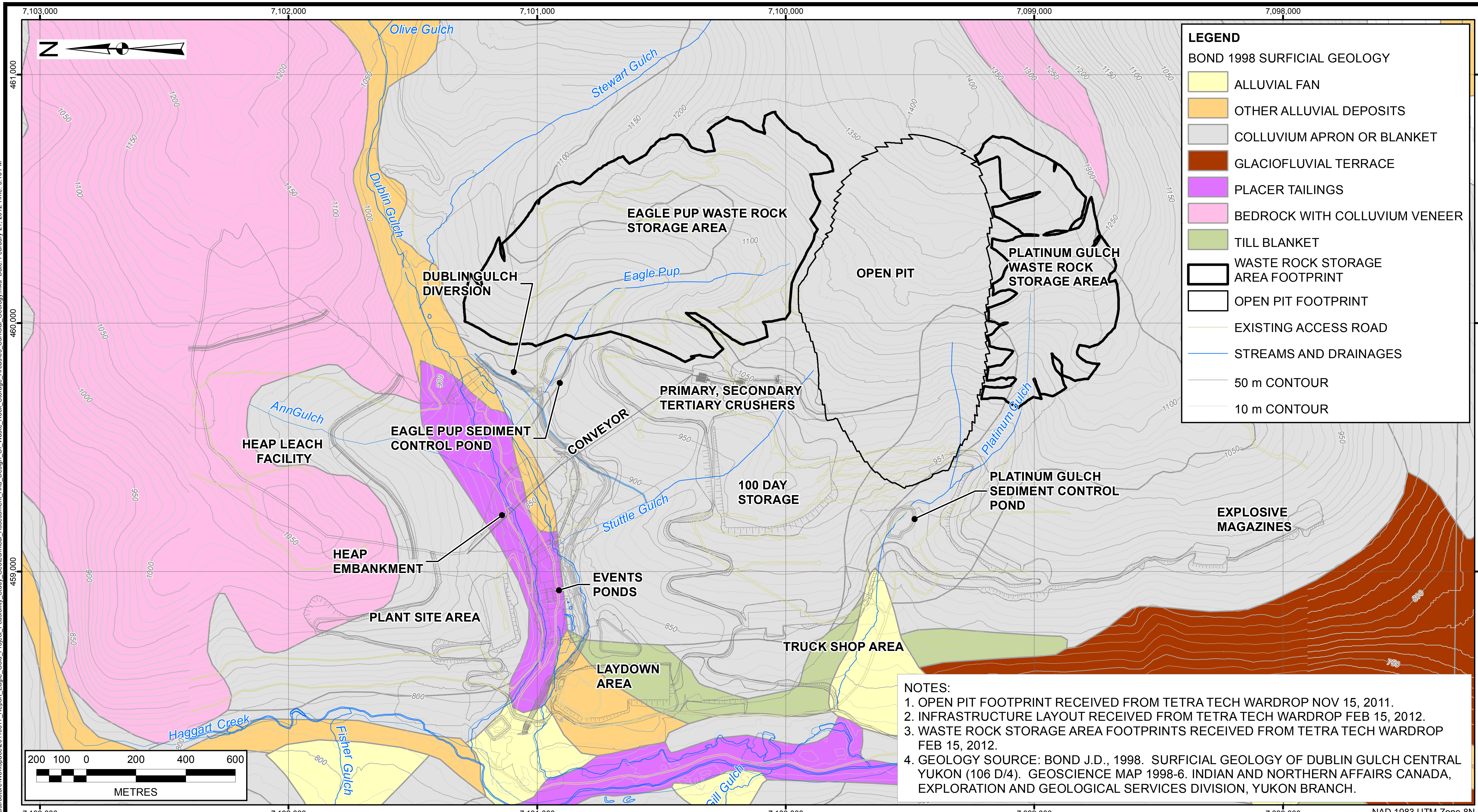

NOTES:
1. OPEN PIT FOOTPRINT RECEIVED FROM TETRA TECH WARDROP NOV 15, 2011.
2. INFRASTRUCTURE LAYOUT RECEIVED FROM TETRA TECH WARDROP FEB 15, 2012.
3. WASTE ROCK STORAGE AREA FOOTPRINTS RECEIVED FROM TETRA TECH WARDROP FEB 15, 2012.
4. GEOLOGY SOURCE: BOND J.D., 1998. SURFICIAL GEOLOGY OF DUBLIN GULCH CENTRAL YUKON (106 D/4). GEOSCIENCE MAP 1998-6. INDIAN AND NORTHERN AFFAIRS CANADA, EXPLORATION AND GEOLOGICAL SERVICES DIVISION, YUKON BRANCH.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:15,000
DATE:	FEB 2012
DRAWN:	LL, MIB
DESIGNED:	DW
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS

TITLE: SURFICIAL GEOLOGY

PROJECT No.:	DWG No.:	REV.:
0792-006	03	

X:\Projects\0792 Victoria Gold\004_EG_FS_Infrastructure\Workspace\20110817_Report_Eagle_Gold_Project_Feasibility_Study_Geotechnical_Assessment_And_Design_Of_Waste_Rock_Storage_Areas\03_Surficial_Geology.mxd Date: February 21, 2012 Time: 5:16 PM

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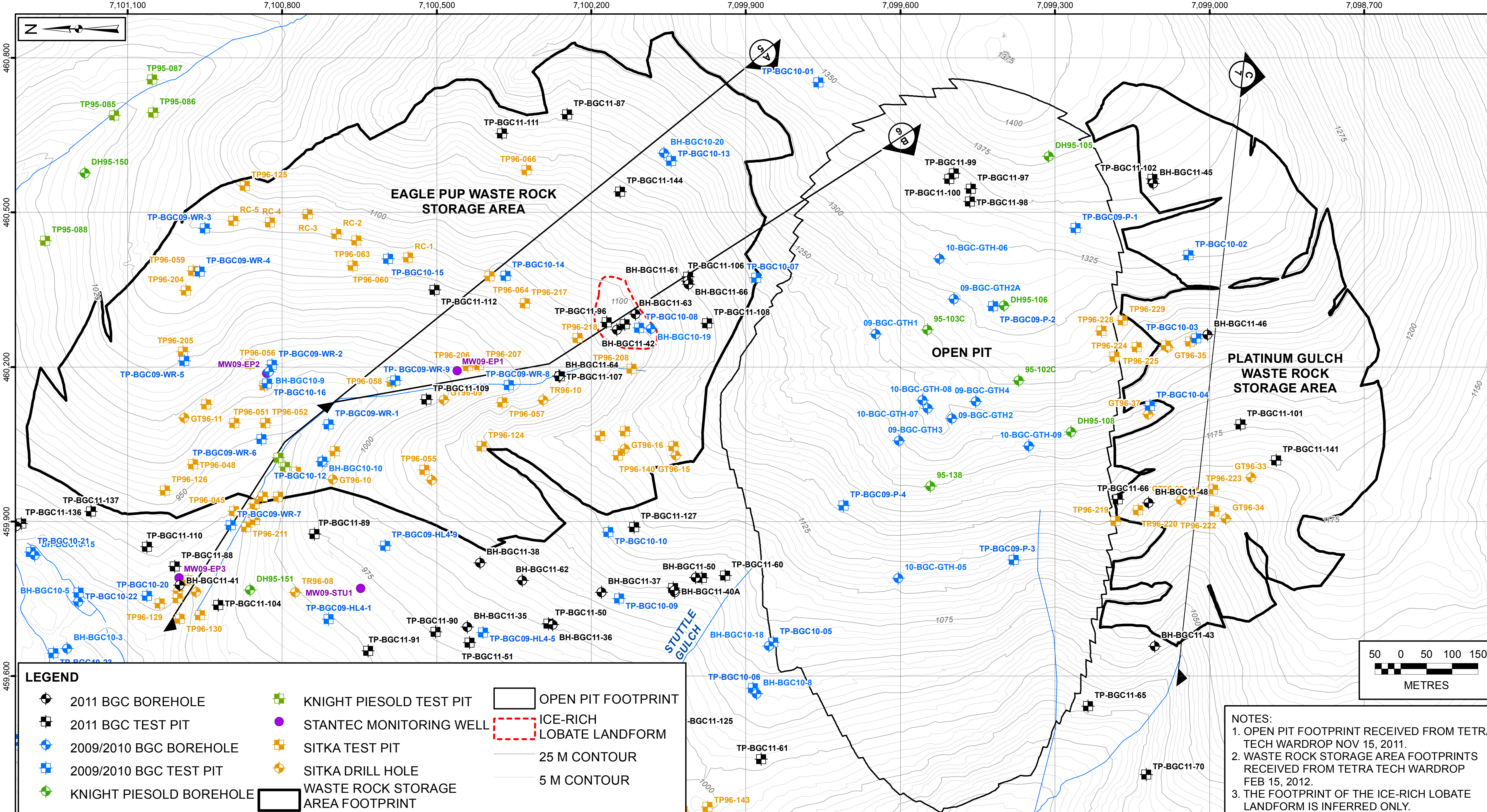


REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE: 1:7,500
DATE: FEB 2012
DRAWN: SMR, MIB
DESIGNED: BMM
CHECKED: BMM
APPROVED: HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

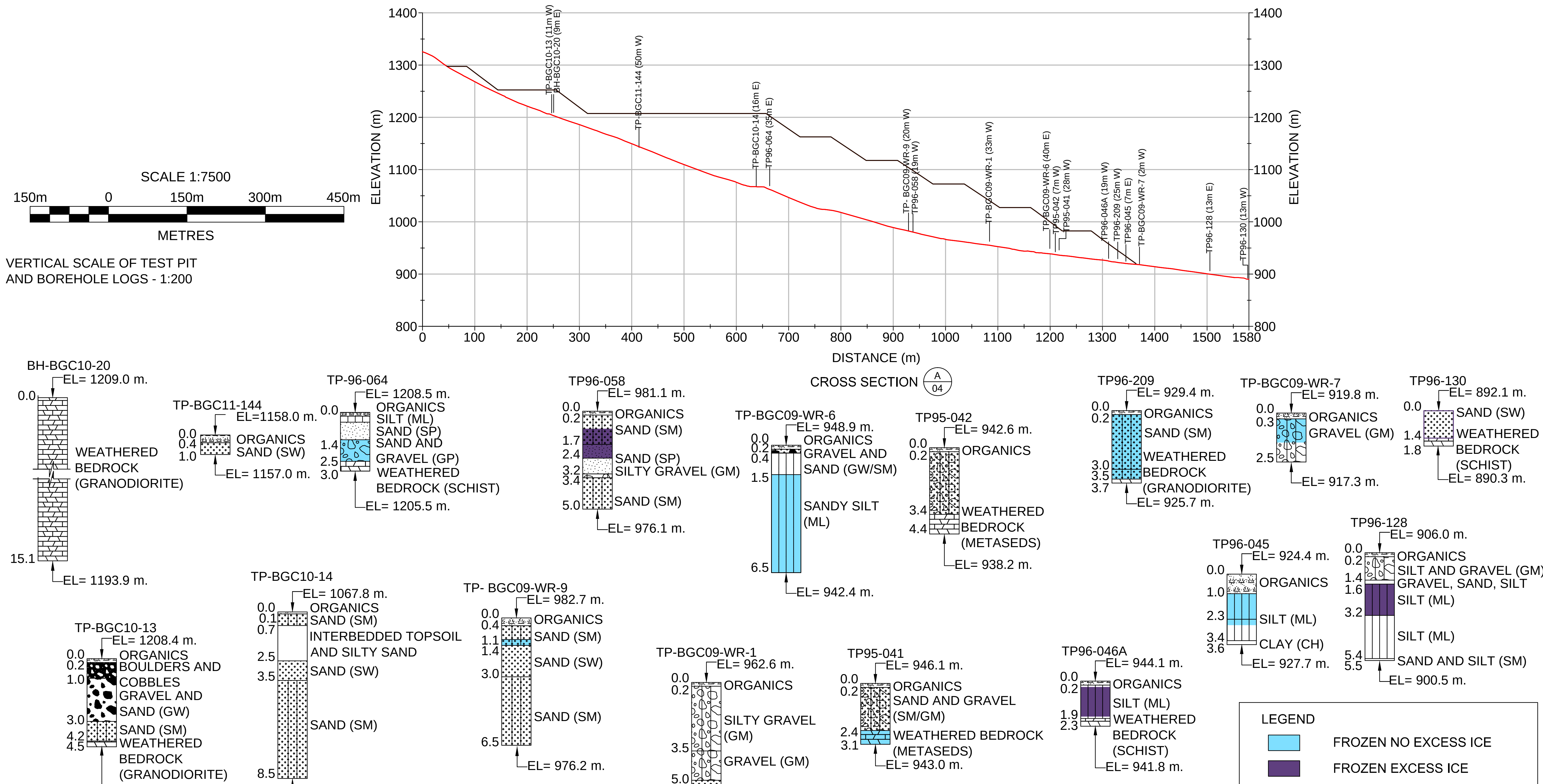
PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS

TITLE: SITE INVESTIGATION PLAN

PROJECT No.: 0792-006
DWG No.: 04
REV.:

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

X:\Projects\0792 Victoria Gold\004_EG_FS_Infrastructure\Workspace\20110817_Report_Eagle_Gold_Project_Feasibility_Study_Geotechnical_Assessment_And_Design_Of_Waste_Rock_Storage_Areas\04_SiteInvestigationPlan.mxd Date: February 21, 2012 Time: 5:23 PM



NOTES:

1. FOR DETAILED TEST PIT AND BOREHOLE LOGS REFER TO SITE INVESTIGATION DATA REPORTS COMPLETED BY SITKA (1996) AND BGC (2010, 2011a, 2012a).
2. WASTE ROCK STORAGE AREA LAYOUT RECEIVED FROM TETRA TECH WARDROP JAN 20, 2012.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:7500
DATE:	FEB 2012
DRAWN:	COC
DESIGNED:	EC
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS

TITLE: SECTION A EAGLE PUP WASTE ROCK STORAGE AREA

PROJECT No.:	DWG No.:	REV.:
0792-006	05	

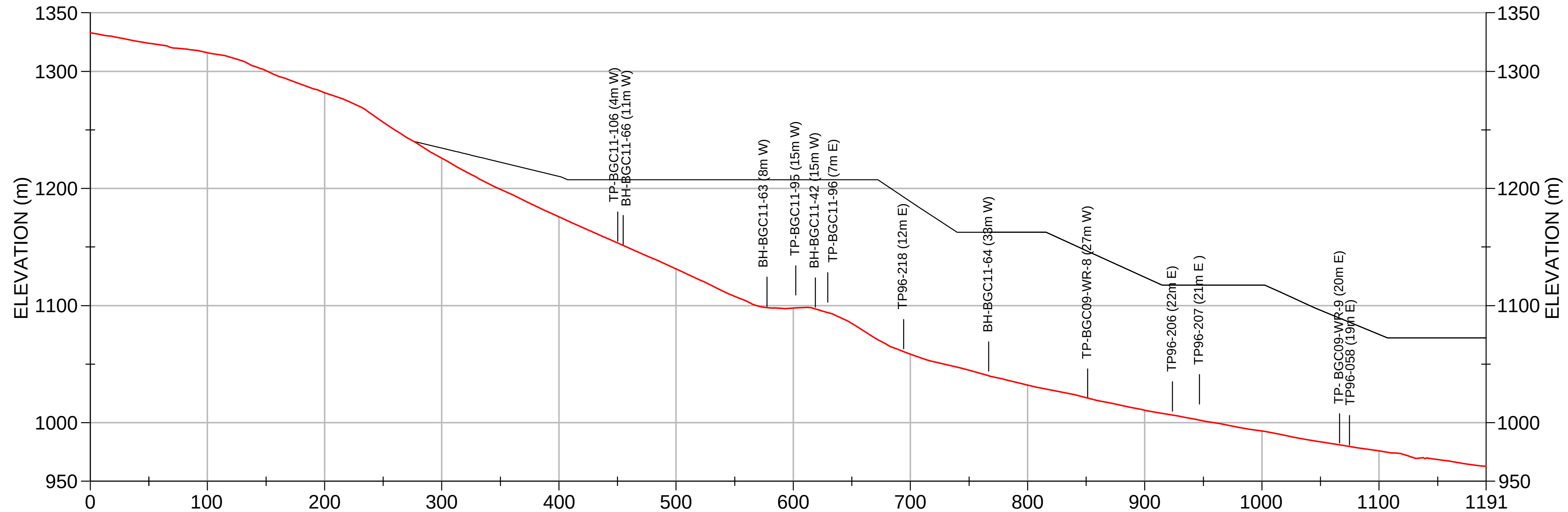
DWG TO BE READ WITH BGC REPORT TITLED " EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS " DATED FEBRAURY 2012.

SCALE 1:5000

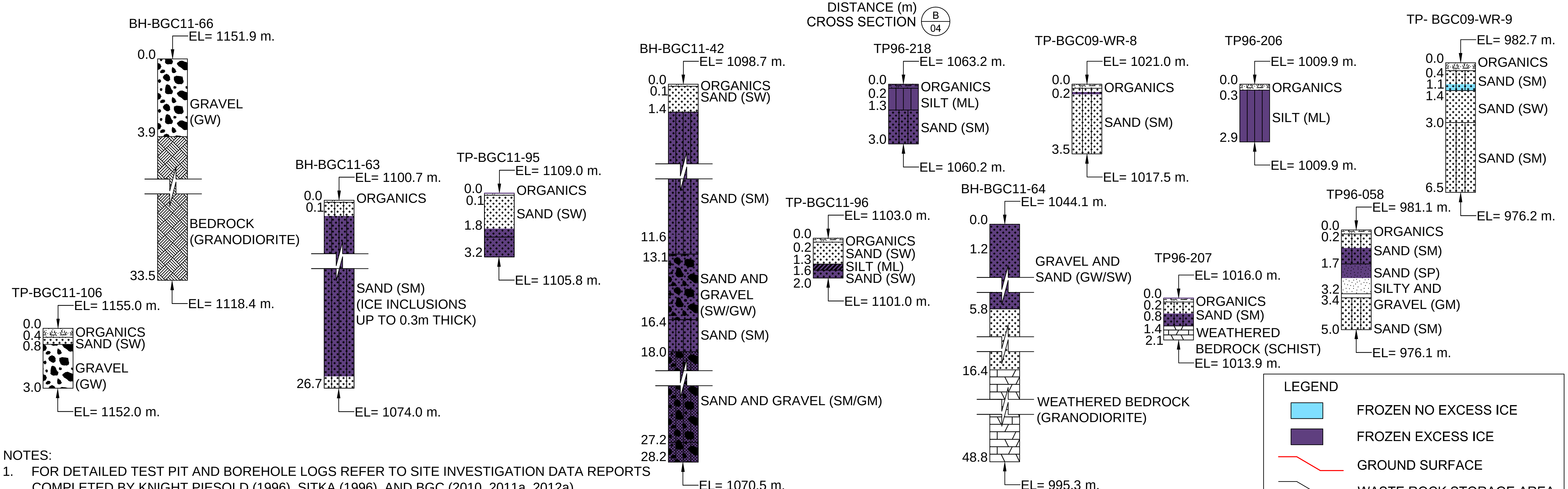
100m 0 100m 200m 300m

METRES

VERTICAL SCALE OF TEST PIT AND BOREHOLE LOGS - 1:200



CROSS SECTION B / 04



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1. FOR DETAILED TEST PIT AND BOREHOLE LOGS REFER TO SITE INVESTIGATION DATA REPORTS COMPLETED BY KNIGHT PIESOLD (1996), SITKA (1996), AND BGC (2010, 2011a, 2012a).
2. WASTE ROCK STORAGE AREA LAYOUT RECEIVED FROM TETRA TECH WARDROP JAN 20, 2012.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:5000
DATE:	FEB 2012
DRAWN:	COC
DESIGNED:	EC
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS

TITLE: SECTION B EAGLE PUP WASTE ROCK STORAGE AREA

PROJECT No.:	DWG No.:	REV.:
0792-006	06	

DWG TO BE READ WITH BGC REPORT TITLED " EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS " DATED FEBRUARY 2012

SCALE 1:5000

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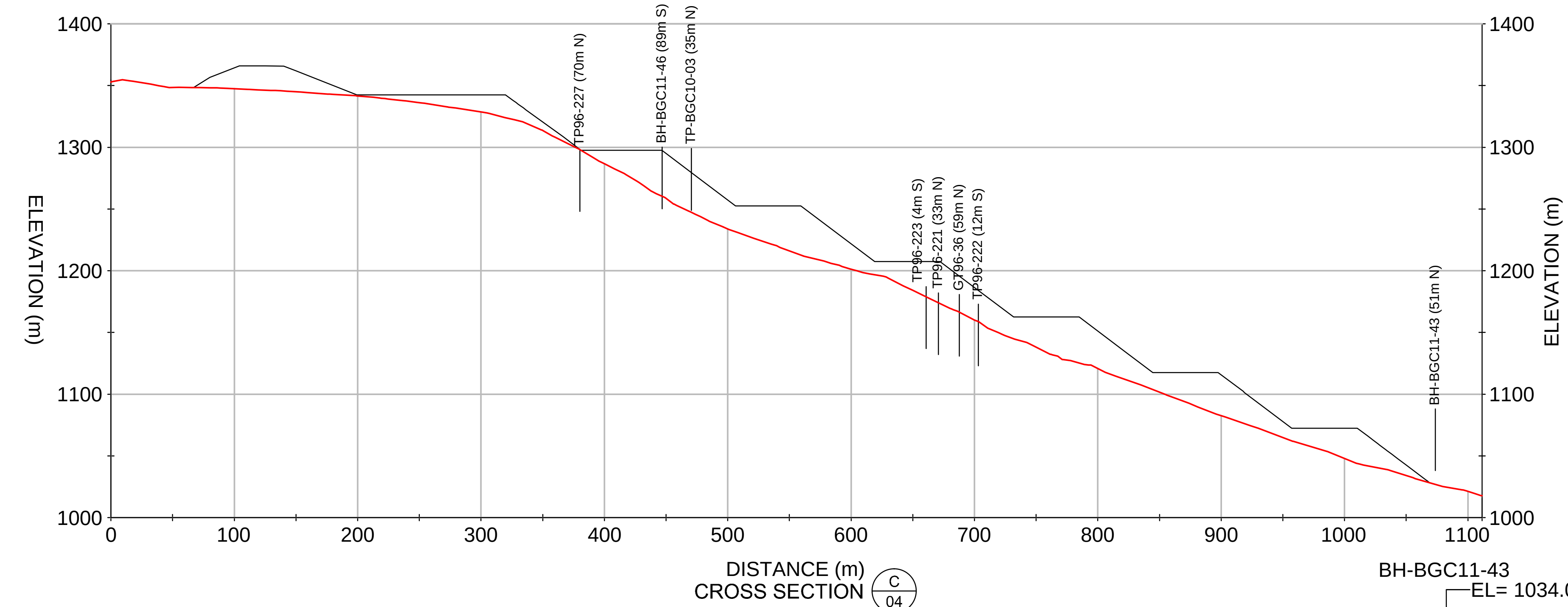
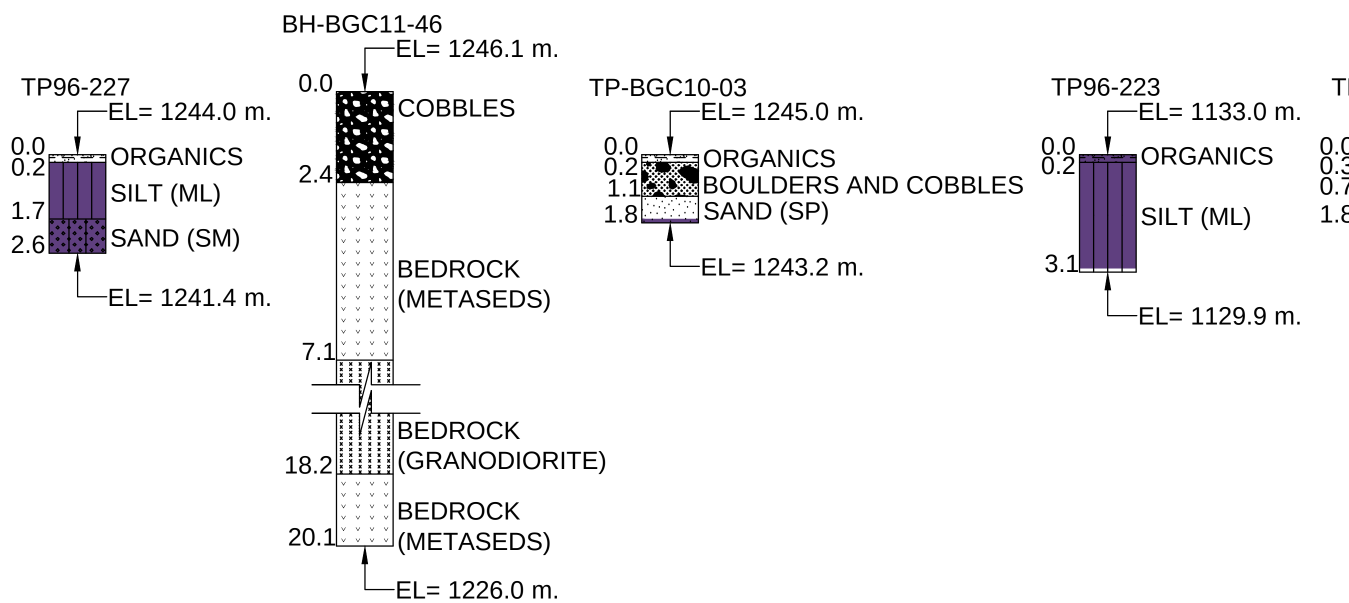
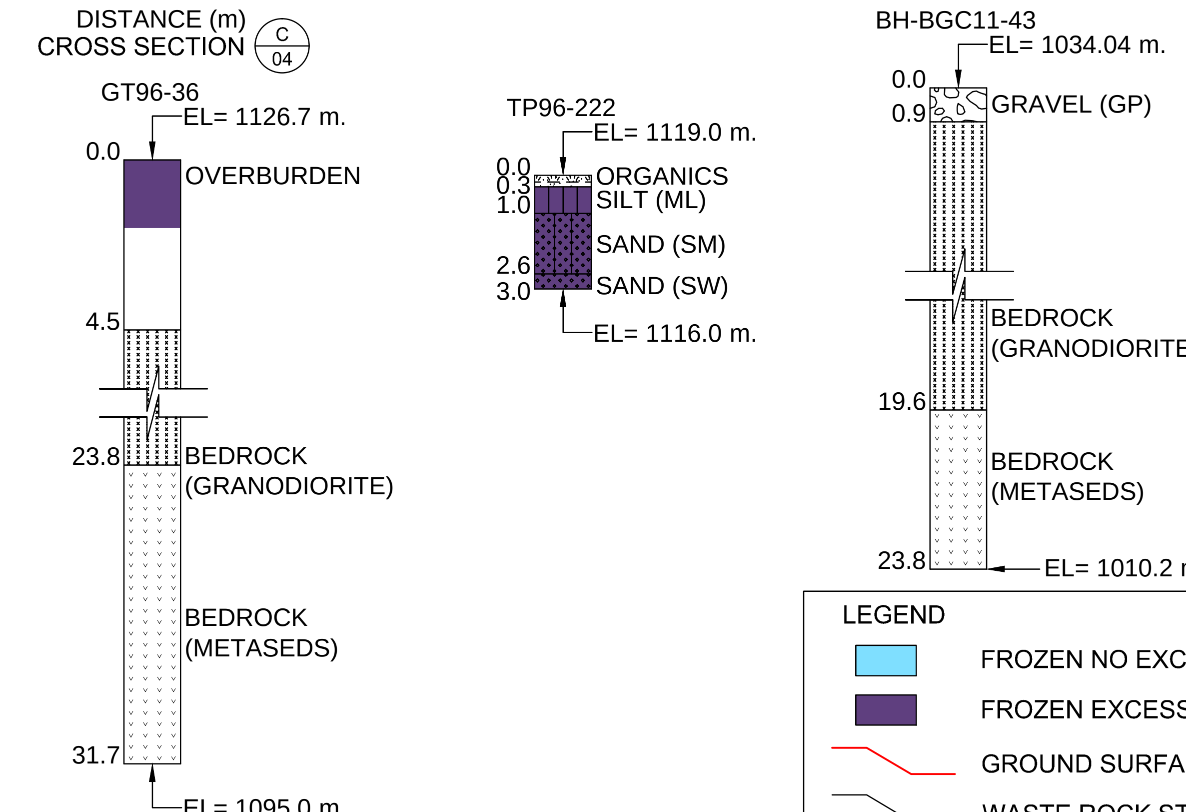
METRES

VERTICAL SCALE OF TEST PIT AND BOREHOLE LOGS - 1:200







LEGEND

- FROZEN NO EXCESS ICE
- FROZEN EXCESS ICE
- GROUND SURFACE
- WASTE ROCK STORAGE AREA

NOTES:

1. FOR DETAILED TEST PIT AND BOREHOLE LOGS REFER TO SITE INVESTIGATION DATA REPORTS COMPLETED BY KNIGHT PIESOLD (1996), SITKA (1996), AND BGC (2010, 2011a, 2012a).
2. WASTE ROCK STORAGE AREA LAYOUT RECEIVED FROM TETRA TECH WARDROP JAN 20, 2012.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:5000
DATE:	FEB 2012
DRAWN:	COC
DESIGNED:	EC
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS

TITLE: SECTION C PLATINUM GULCH WASTE ROCK STORAGE AREA

PROJECT No.:	DWG No.:	REV.:
0792-006	07	

DWG TO BE READ WITH BGC REPORT TITLED " EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS " DATED FEBRUARY 2012

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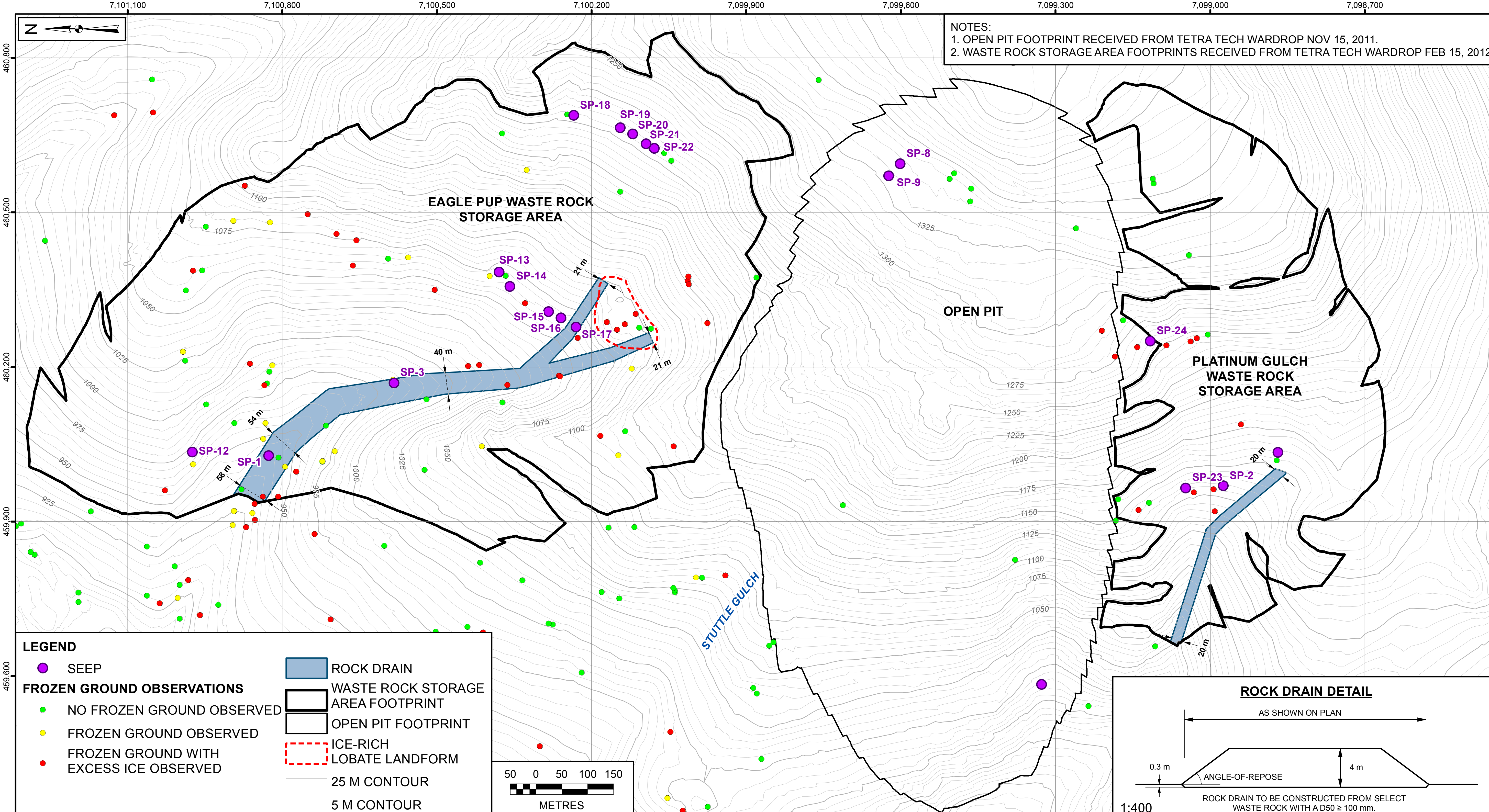


REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:7,500
DATE:	FEB 2012
DRAWN:	SMR, MIB
DESIGNED:	BMM
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

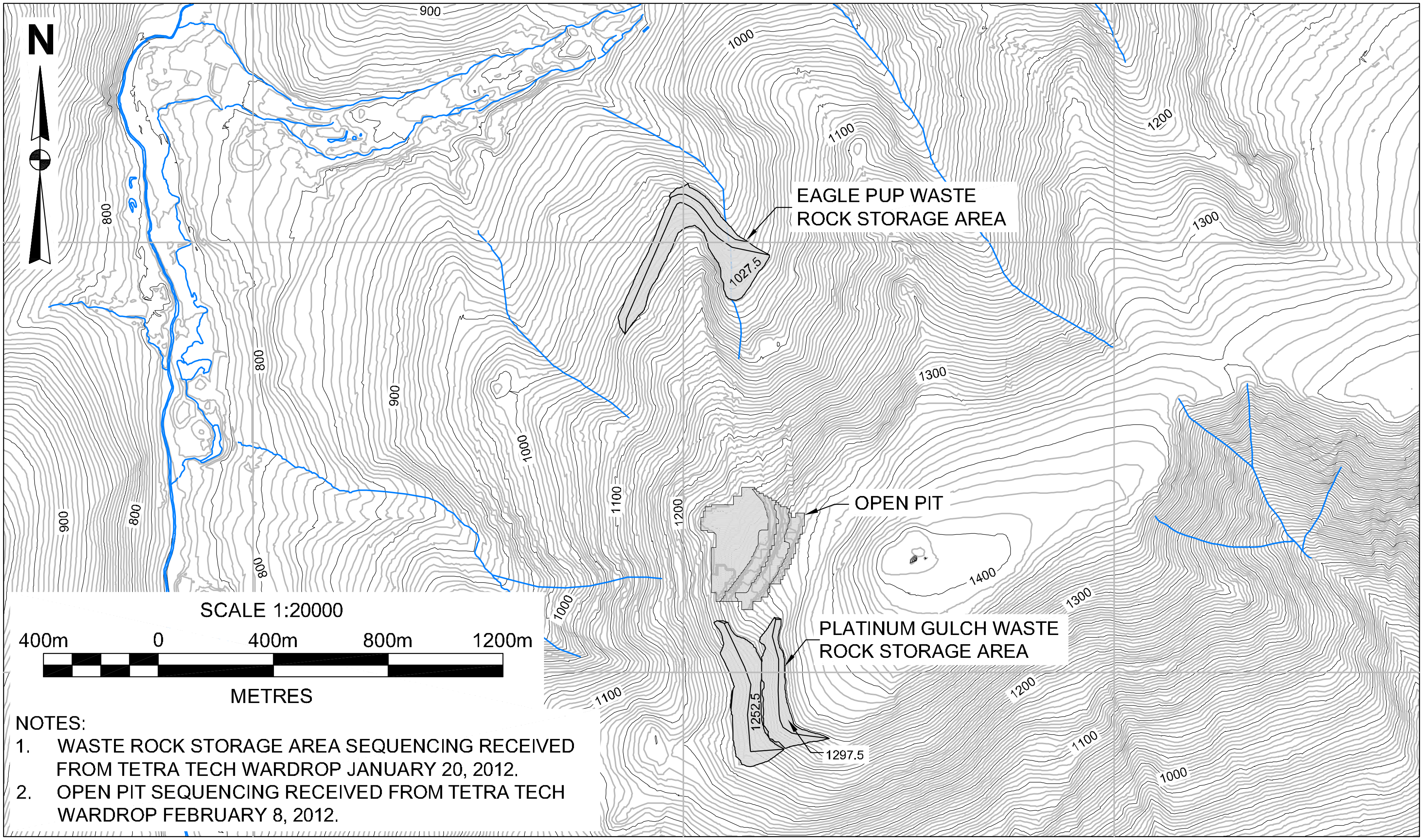
PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS

TITLE: SEEPAGE AREAS AND FROZEN GROUND OBSERVATIONS

PROJECT No.:	DWG No.:	REV.:
0792-006	08	

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

APPENDIX A
END OF PERIOD PLANS AND WRSA SEQUENCING



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 0
DRAWN: DK	APPROVED: HWN		
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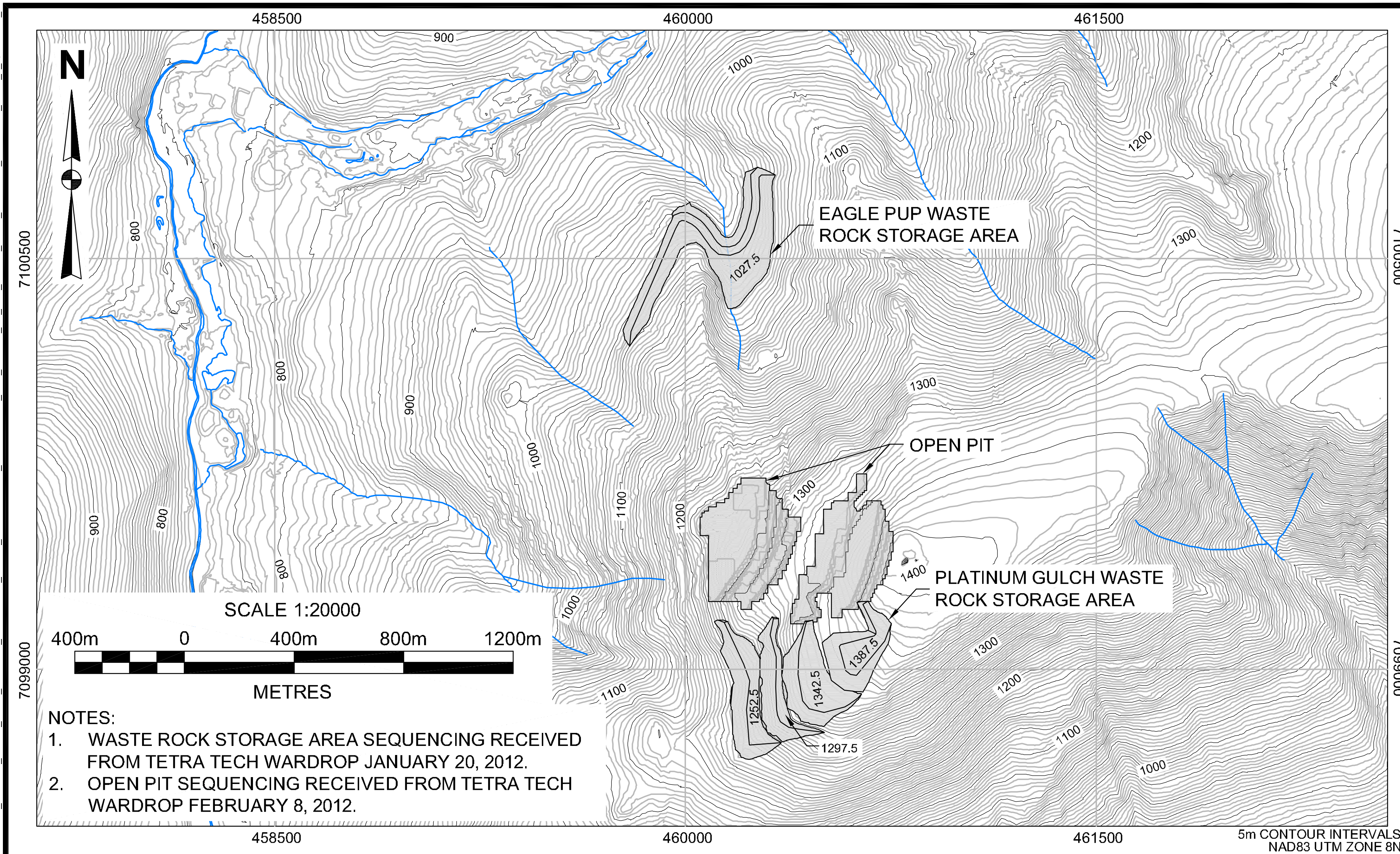

NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 1 QUARTER 2
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 / DWG No.: A-2 / REV.:

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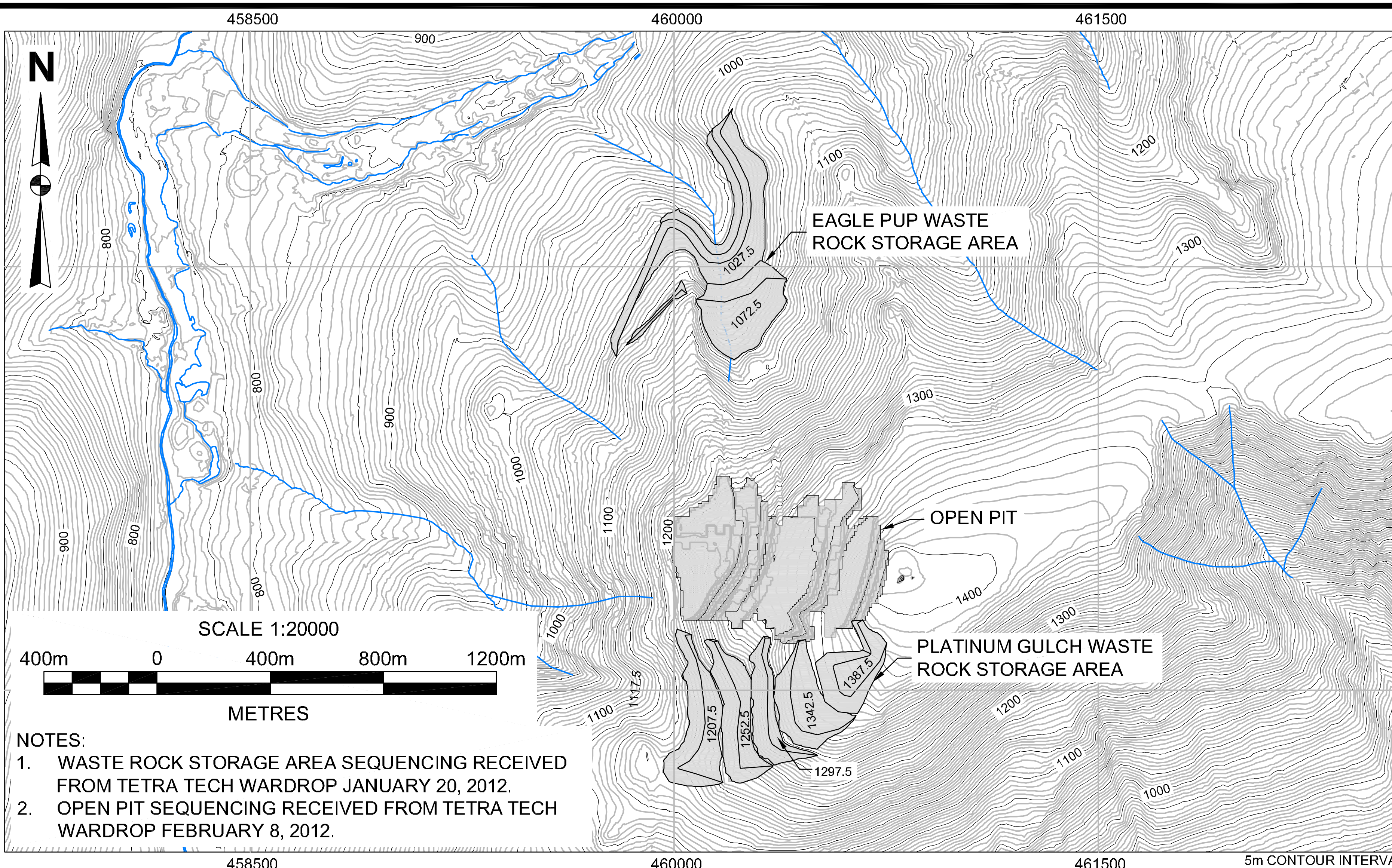

NOTES:
1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

5m CONTOUR INTERVALS
NAD83 UTM ZONE 8N

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 1 QUARTER 3
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 / DWG No.: A-3 / REV.:

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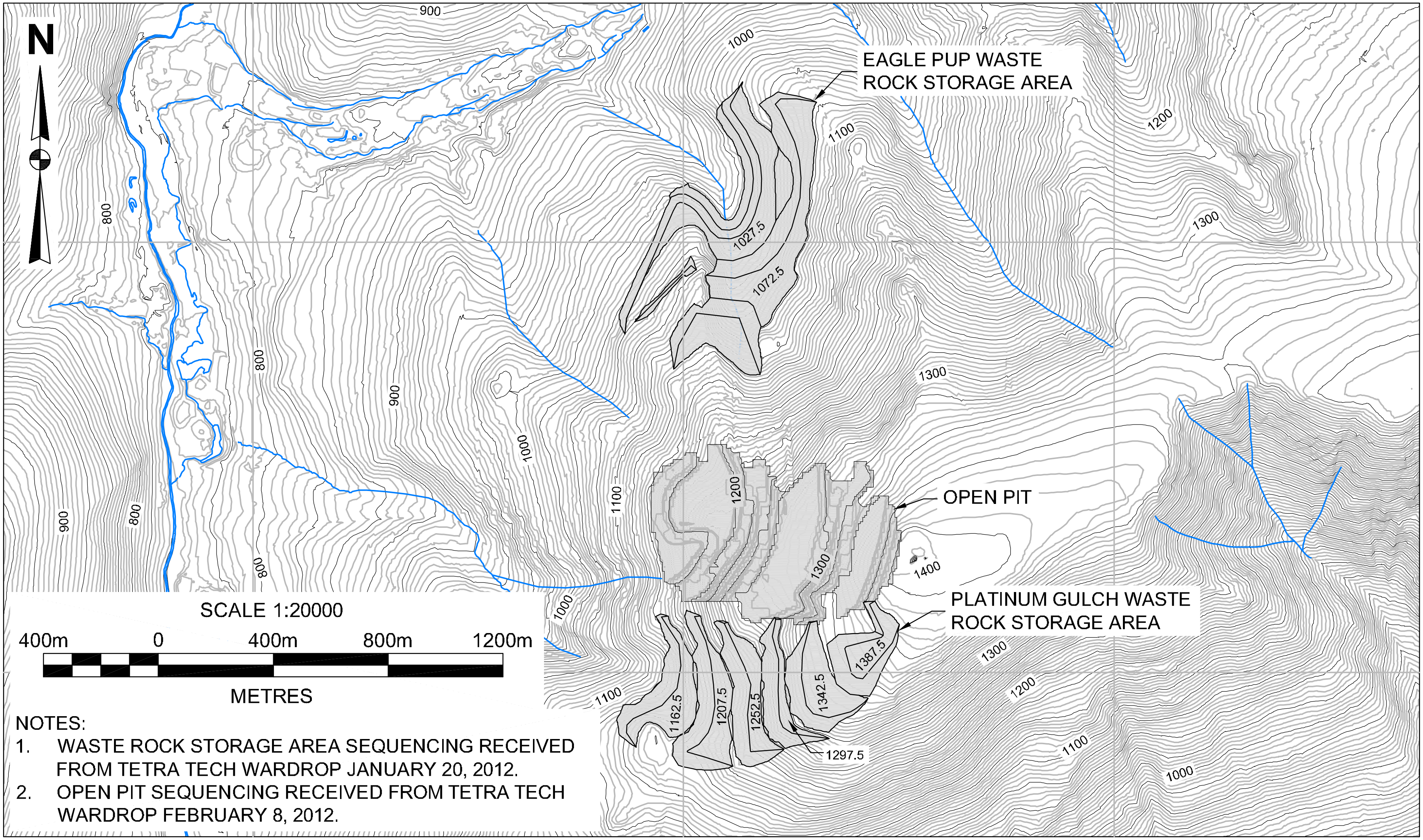
DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 1 QUARTER 4
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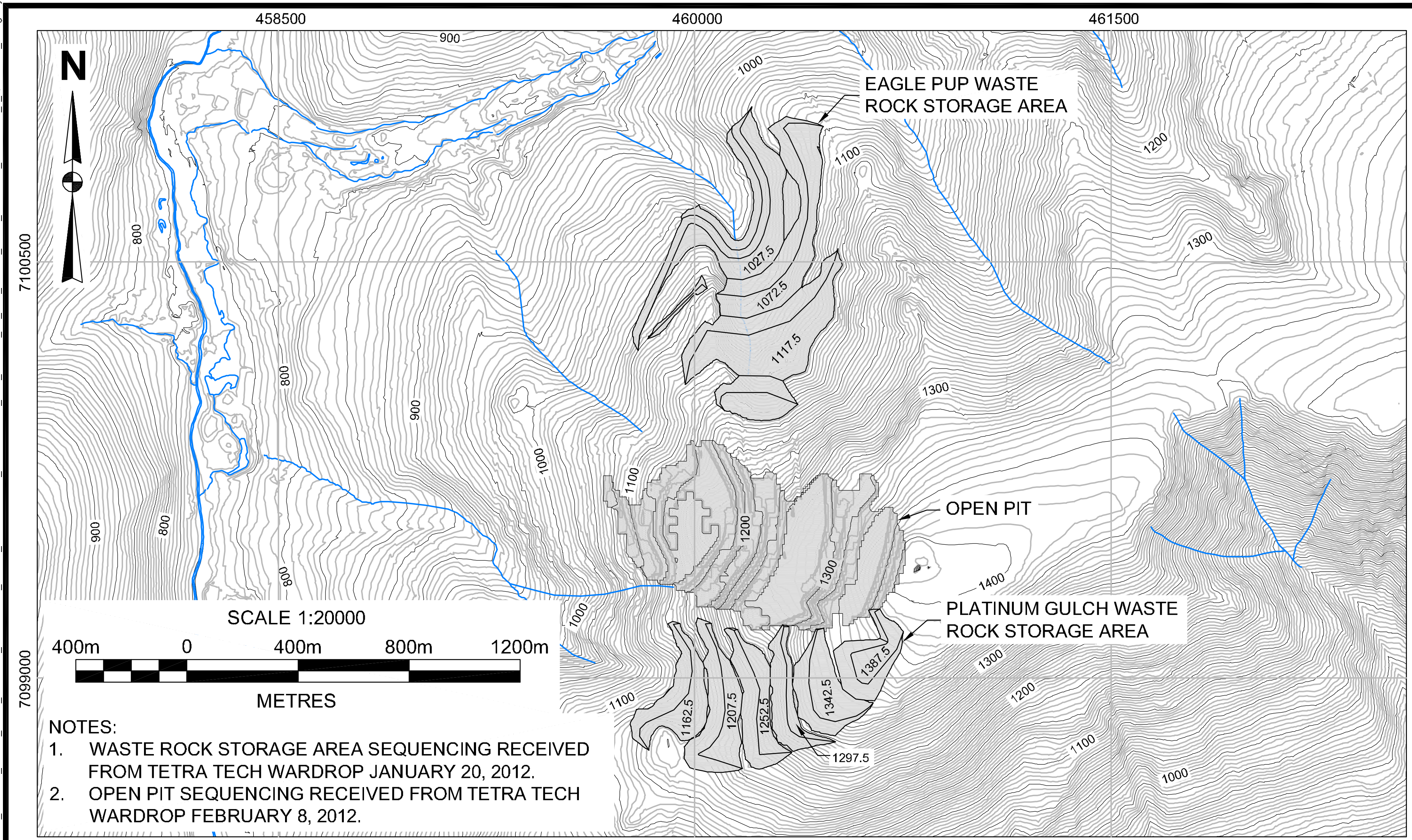
DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012



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2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

5m CONTOUR INTERVALS
NAD83 UTM ZONE 8N

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 2 QUARTER 1
DRAWN: DK	APPROVED: HWM	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 / DWG No.: A-5 / REV.:

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

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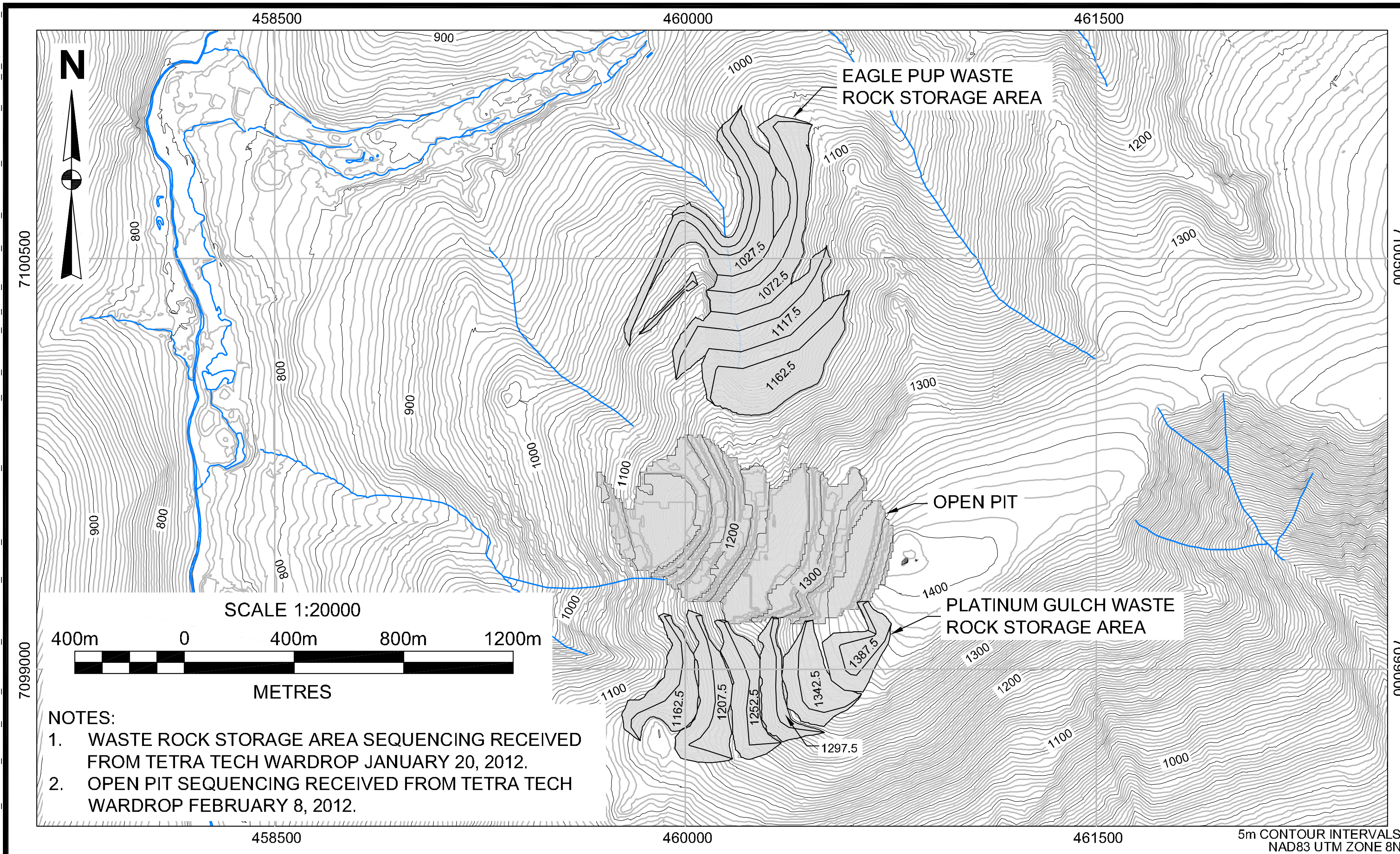

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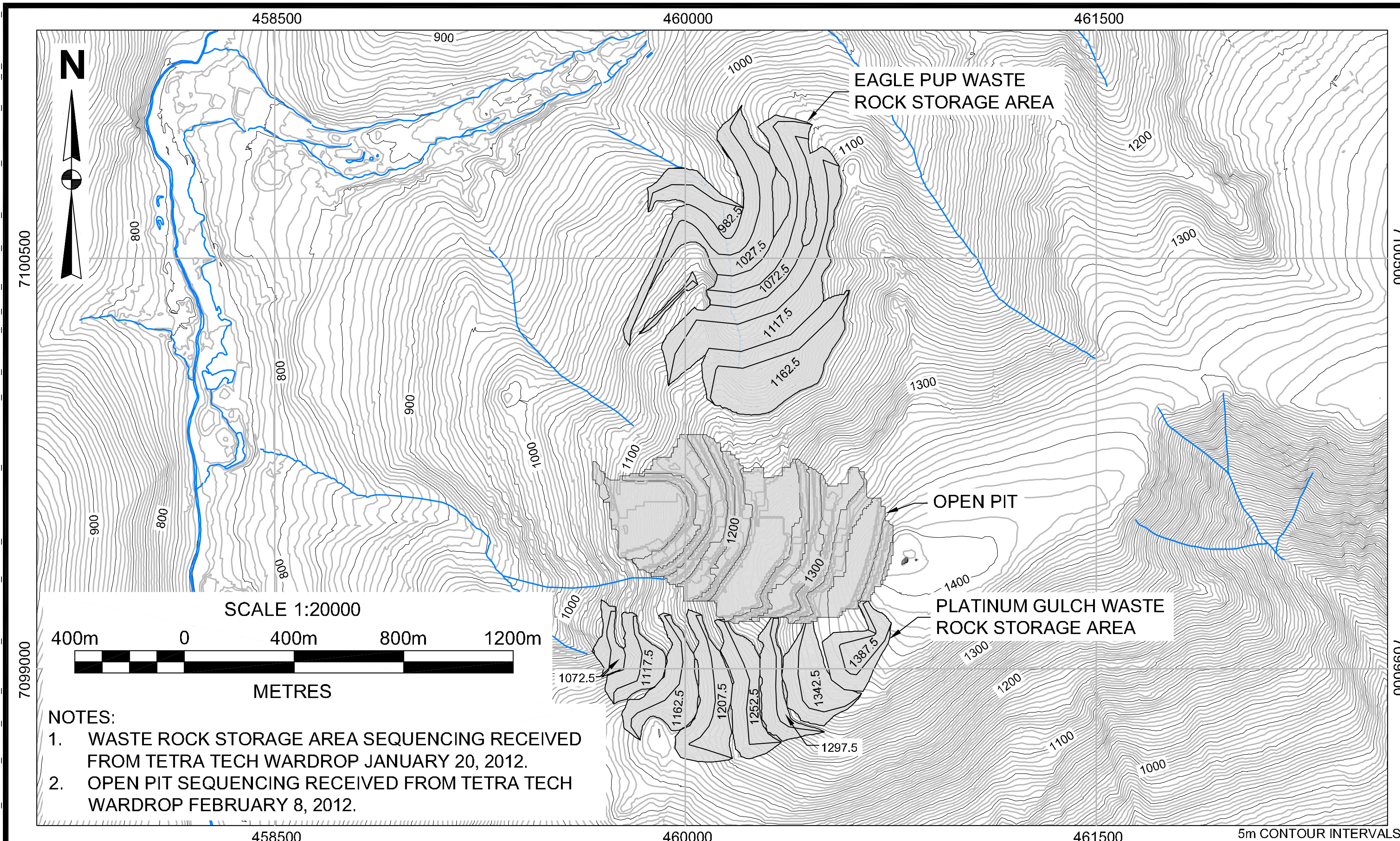
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

5m CONTOUR INTERVALS
NAD83 UTM ZONE 8N

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 2 QUARTER 2
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 / DWG No.: A-6 / REV.:

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 2 QUARTER 3
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 · DWG No.: A-7 · REV.:

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

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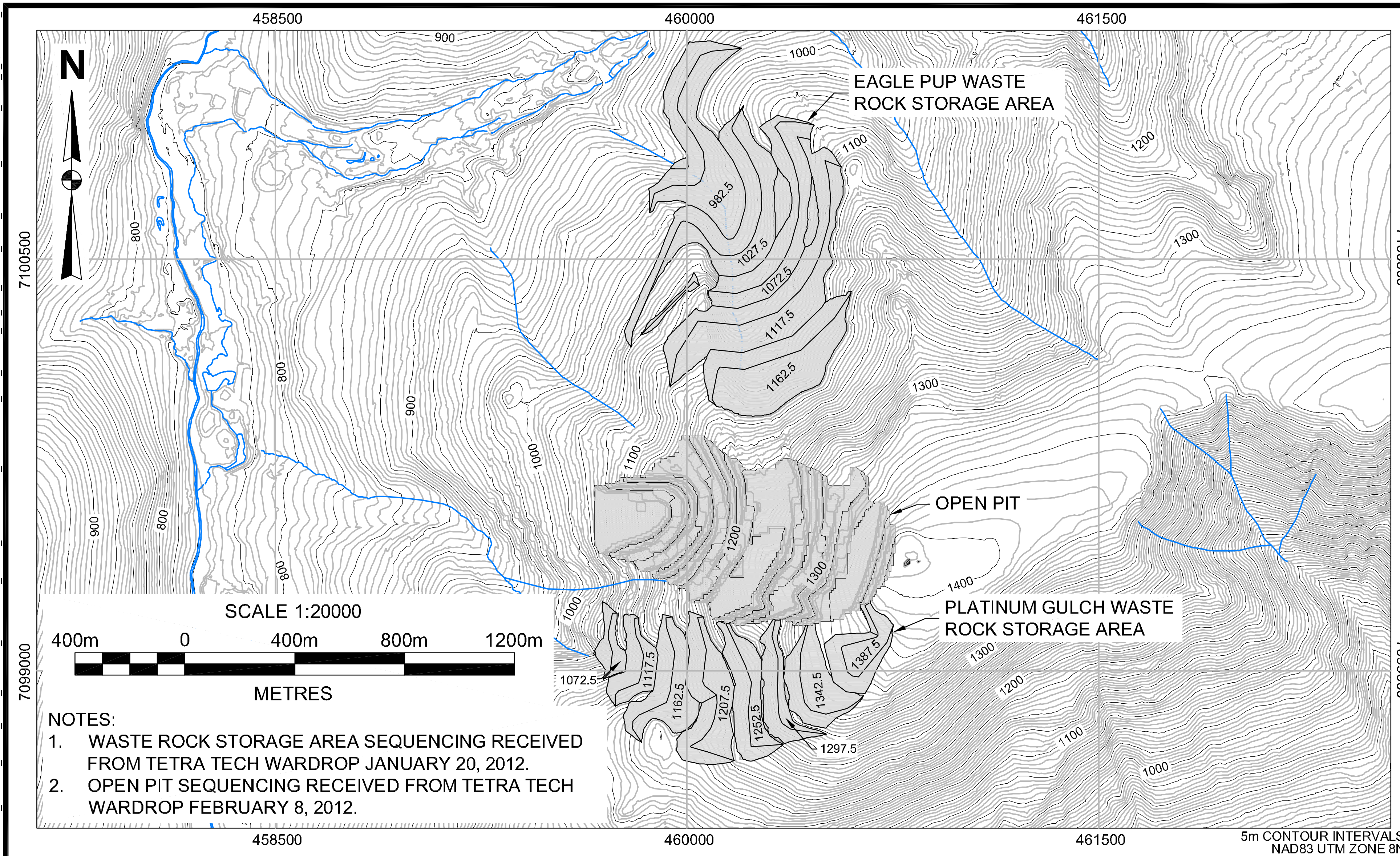


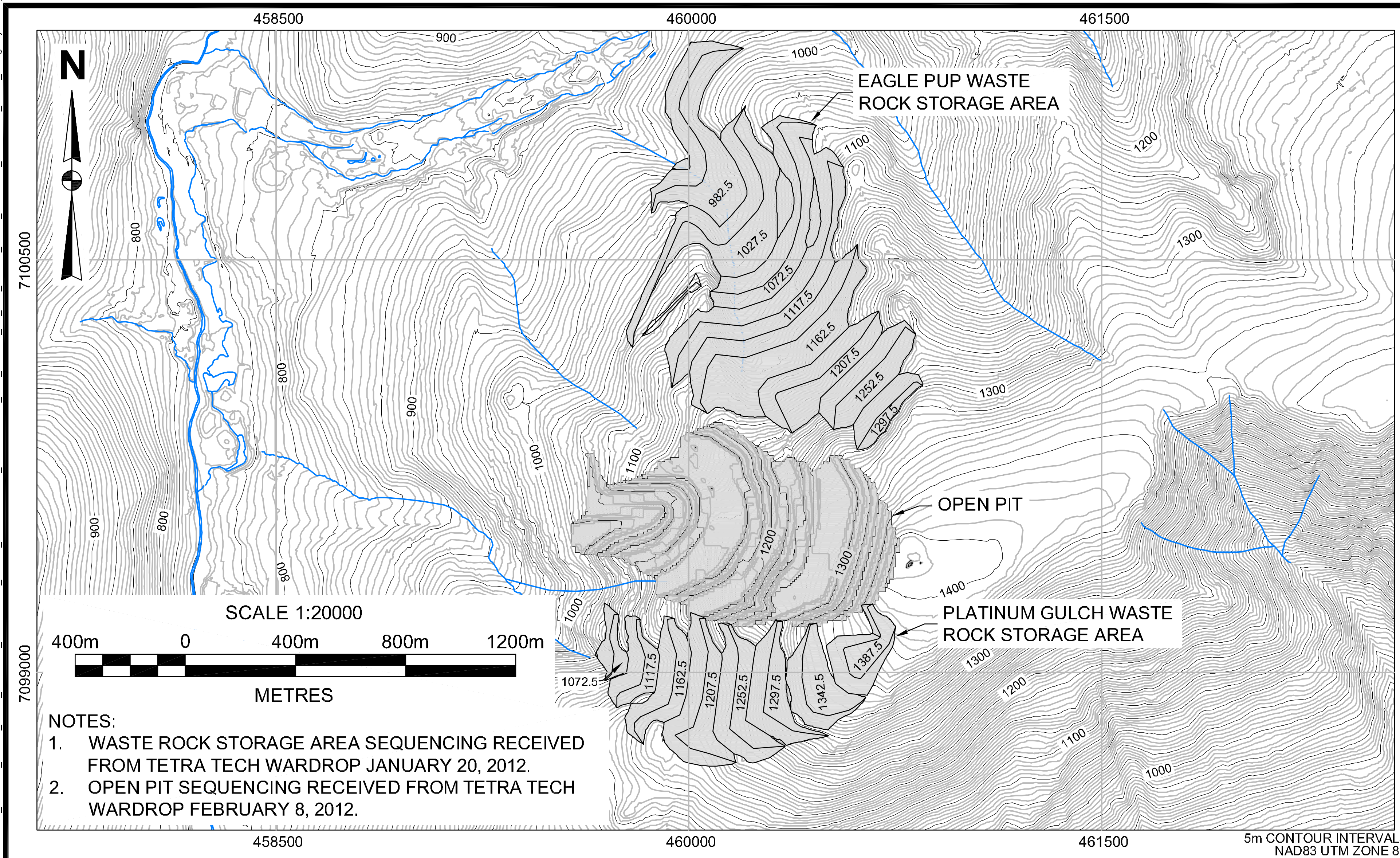
NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 2 QUARTER 4
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 · DWG No.: A-8 · REV.:

X:\Projects\0792 Victoria Gold\006\Workspace\20120131_REPORT_EAGLE_GOLD_PROJECT_FEASIBILITY_STUDY_GEOTECHICAL_ASSESSMENT_AND_DESIGN_OF_THE_WASTE_ROCK_STORAGE_AREAS\A-8_YEAR_2_QUARTER_4.dwg

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

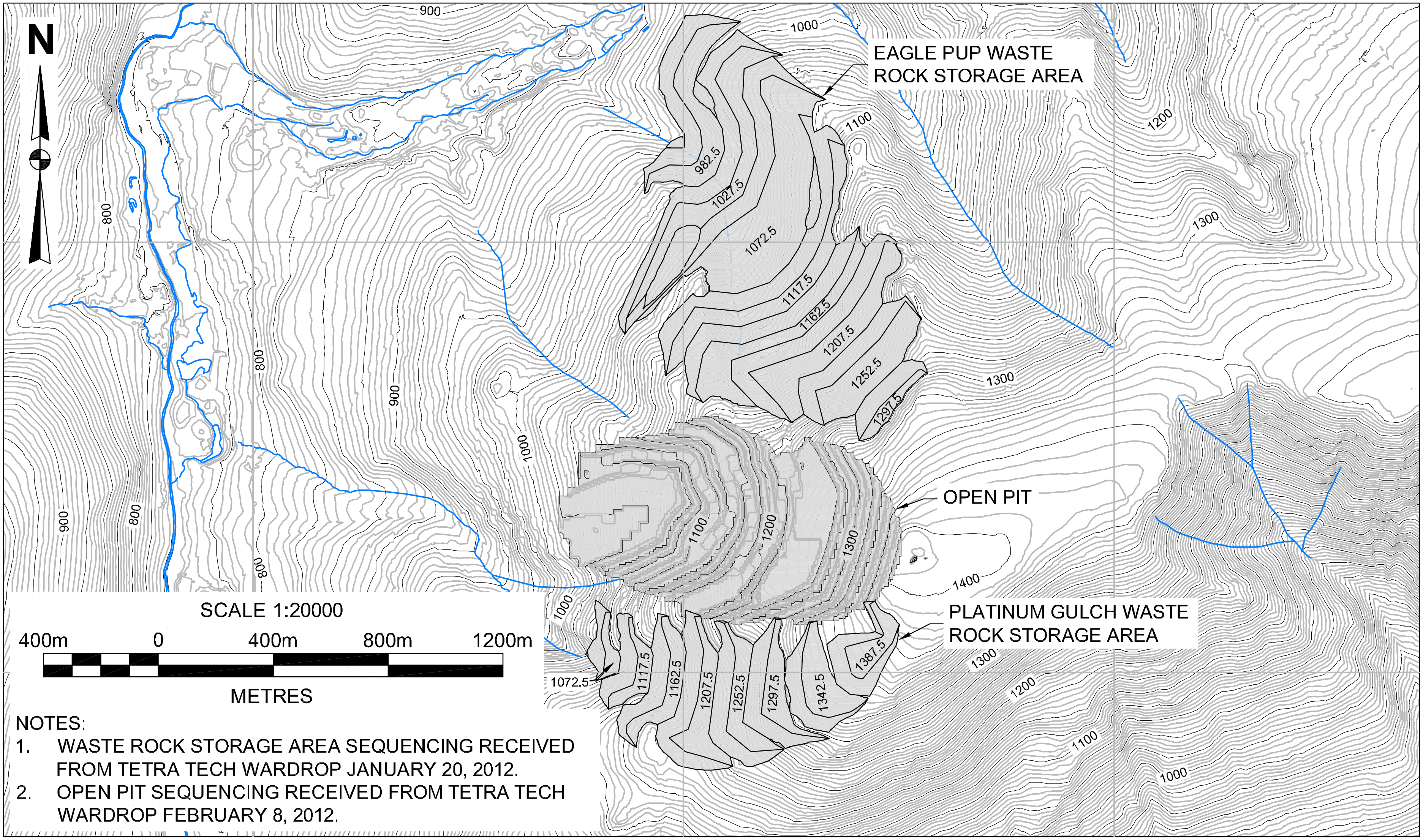


NOTES:
1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 3
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 · DWG No.: A-9 · REV.:

X:\Projects\0792 Victoria Gold\006\Workspace\20120131_REPORT_EAGLE_GOLD_PROJECT_FEASIBILITY_STUDY_GEOTECHICAL_ASSESSMENT_AND_DESIGN_OF_THE_WASTE_ROCK_STORAGE_AREAS\A-9_YEAR_3.dwg Layout: Layout

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

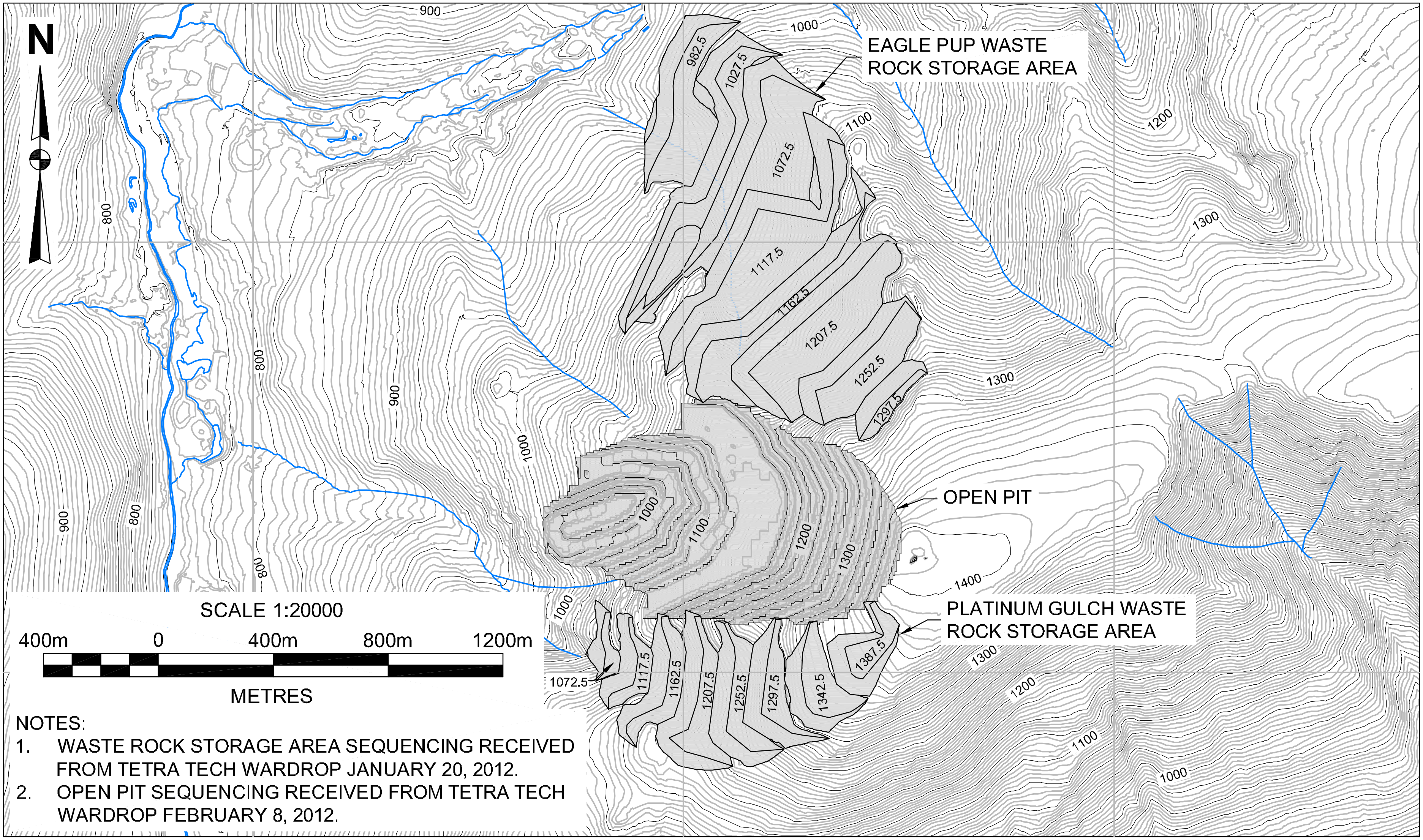


5m CONTOUR INTERVALS
NAD83 UTM ZONE 8N

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 4
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 / DWG No.: A-10 / REV.:

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

X:\Projects\0792 Victoria Gold\006\Workspace\20120131_REPORT_EAGLE_GOLD_PROJECT_FEASIBILITY_STUDY_GEOTECHICAL_ASSESSMENT_AND_DESIGN_OF_THE_WASTE_ROCK_STORAGE_AREAS\A-10_YEAR_4.dwg Layout: Layo



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

5m CONTOUR INTERVALS
NAD83 UTM ZONE 8N

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 5
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 / DWG No.: A-11 / REV.:

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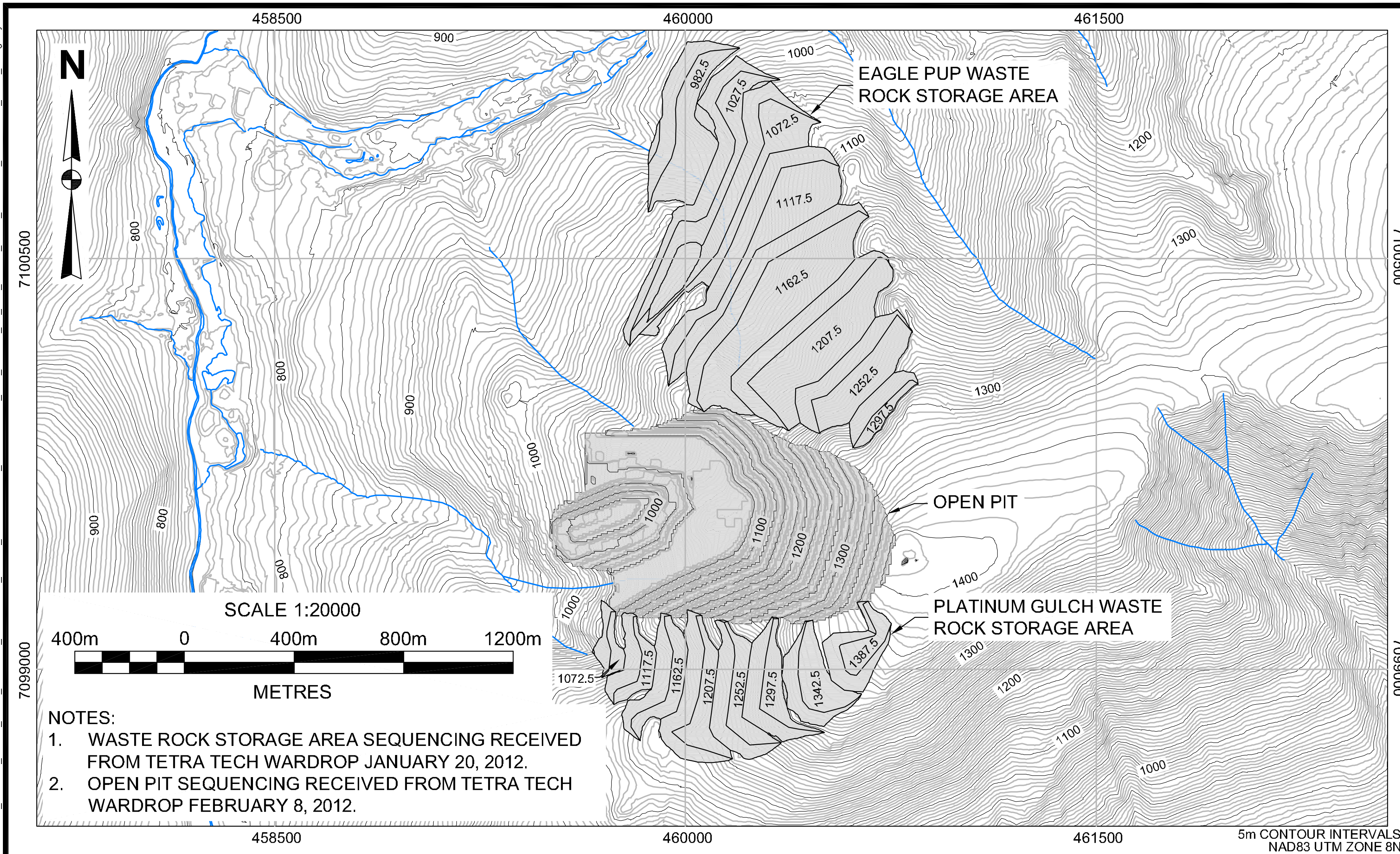
DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 6
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 · DWG No.: A-12 · REV.:

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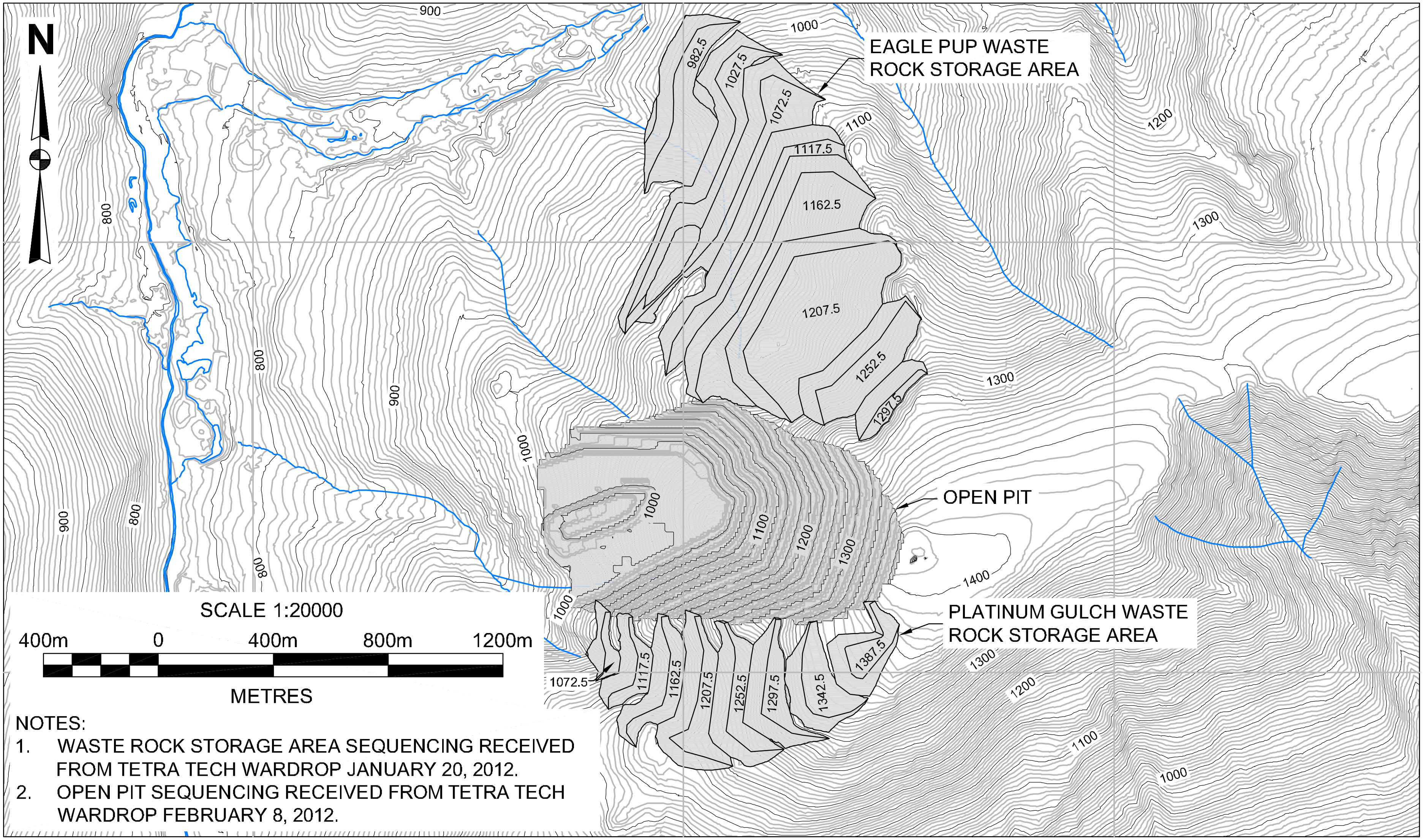
DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM		
DATE: FEB 2012	CHECKED: BMM		
DRAWN: DK	APPROVED: HWN		

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

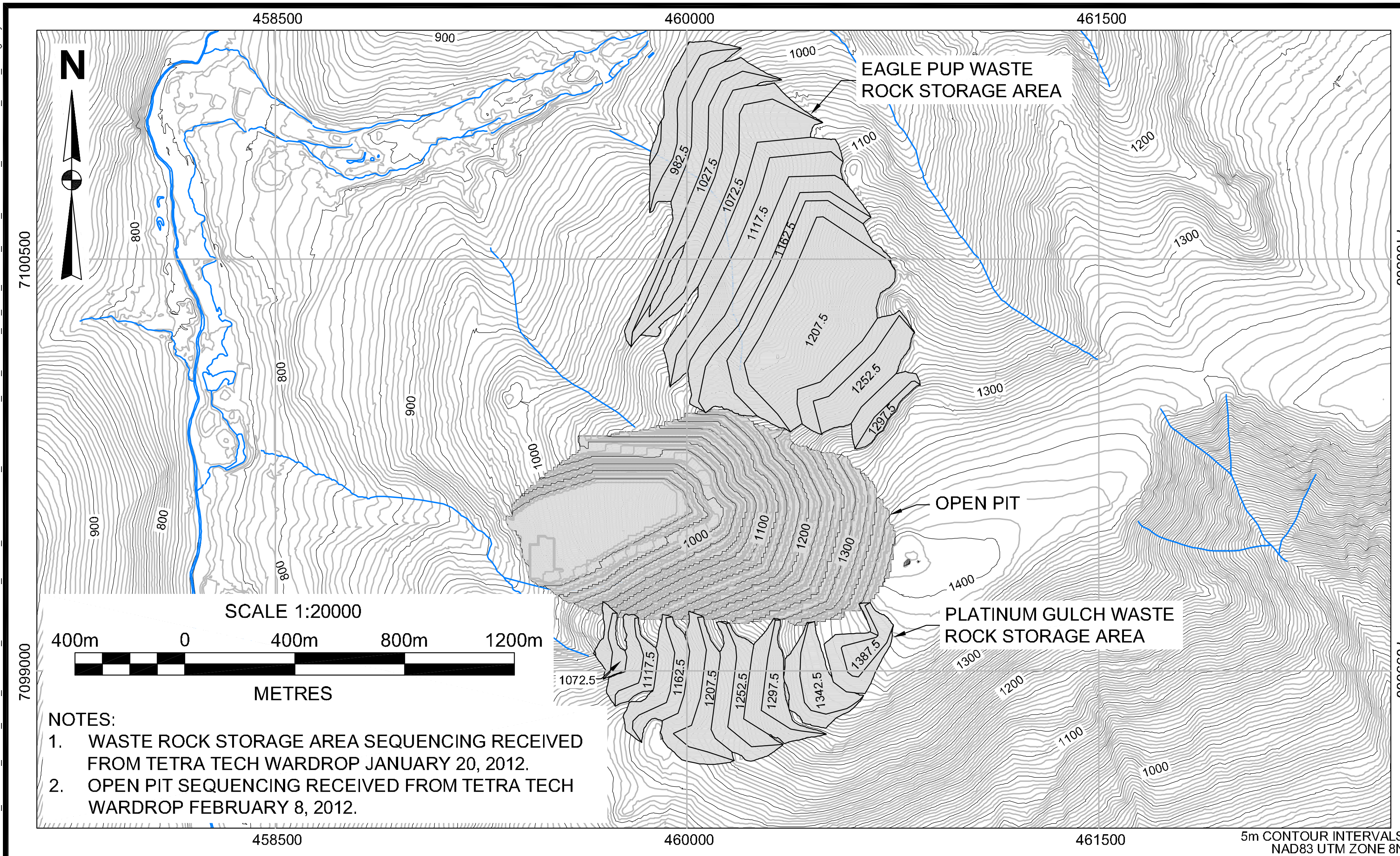
PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS

TITLE: YEAR 7

CLIENT: VICTORIA GOLD CORPORATION

PROJECT No.:	DWG No.:	REV.:
0792-006	A-13	

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 8
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 / DWG No.: A-14 / REV.:

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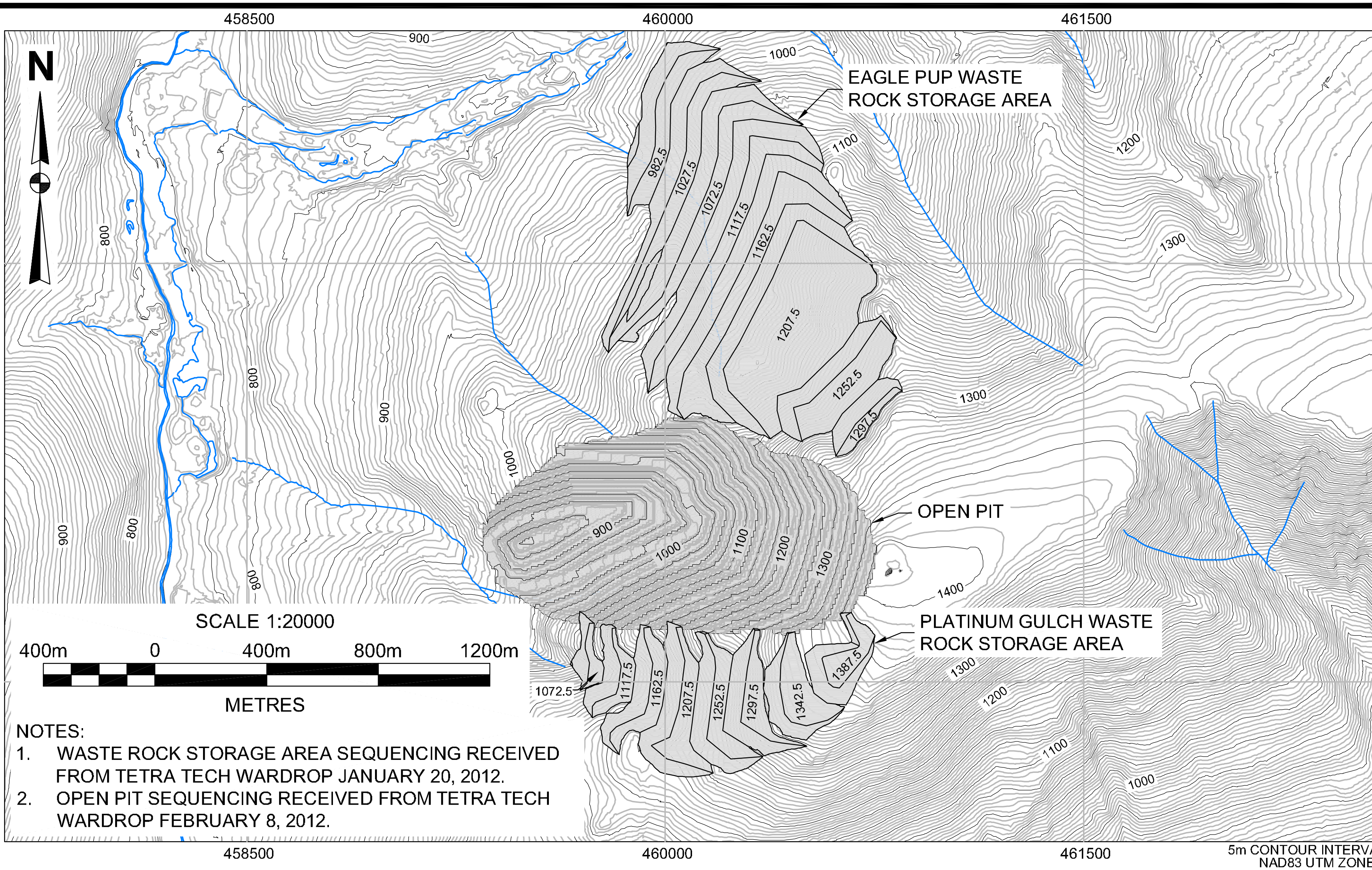
DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000	DESIGNED: BMM	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
DATE: FEB 2012	CHECKED: BMM		TITLE: YEAR 9
DRAWN: DK	APPROVED: HWN	CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006 / DWG No.: A-15 / REV.:

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

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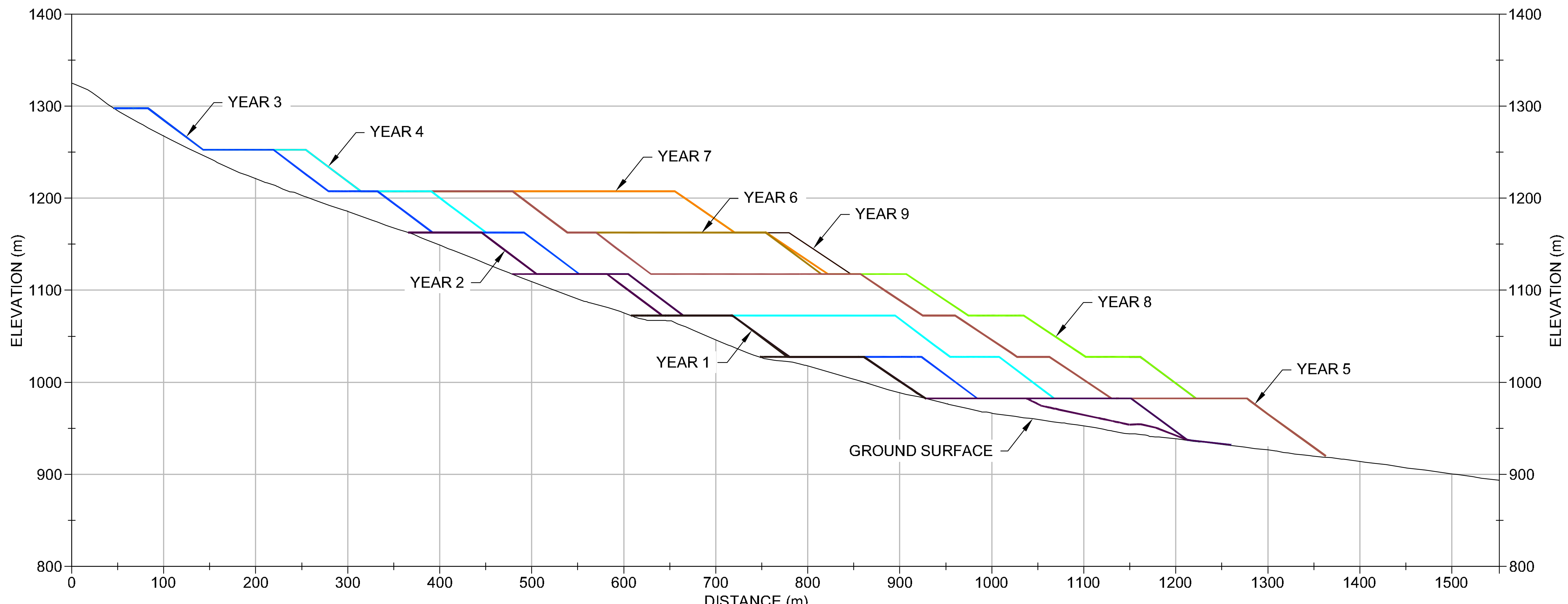


CROSS SECTION A / -

LEGEND

YEAR 1	YEAR 6
YEAR 2	YEAR 7
YEAR 3	YEAR 8
YEAR 4	YEAR 9
YEAR 5	

SCALE 1:5000

100m 0 100m 200m 300m

METRES

NOTE:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:5000
DATE:	FEB 2012
DRAWN:	DK
DESIGNED:	BMM
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

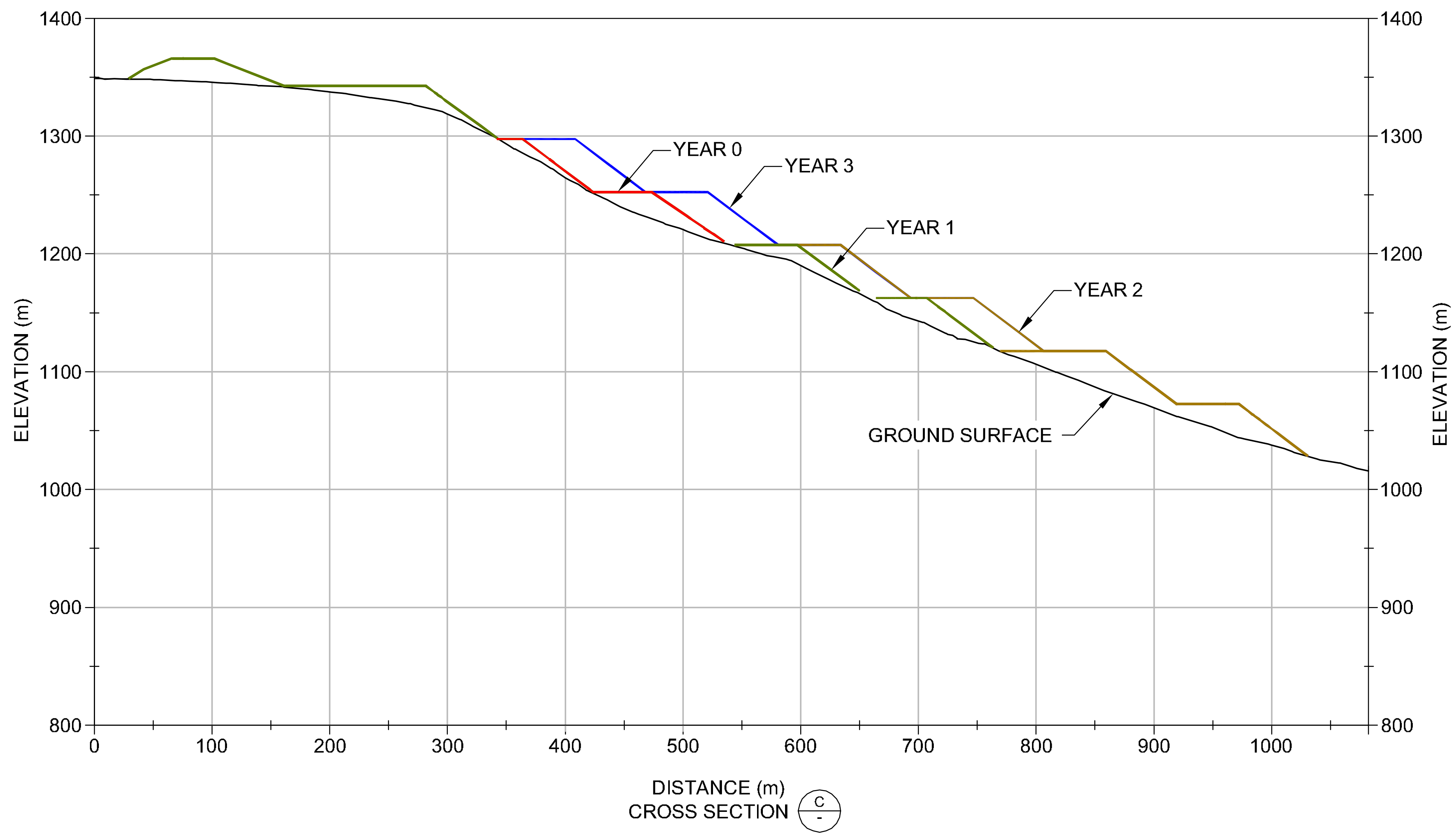
CLIENT: VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS

TITLE: SECTION A - EAGLE PUP SEQUENCING

PROJECT No.:	DWG No.:	REV.:
0792-006	A-16	

DWG TO BE READ WITH BGC REPORT TITLED " EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS " DATED FEBRUARY 2012



SCALE 1:5000

100m 0 100m 200m 300m

METRES

NOTE:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012

LEGEND

- YEAR 0
- YEAR 1
- YEAR 2
- YEAR 3

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:5000
DATE:	FEB 2012
DRAWN:	DK
DESIGNED:	BMM
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS

TITLE: SECTION C - PLATINUM GULCH SEQUENCING

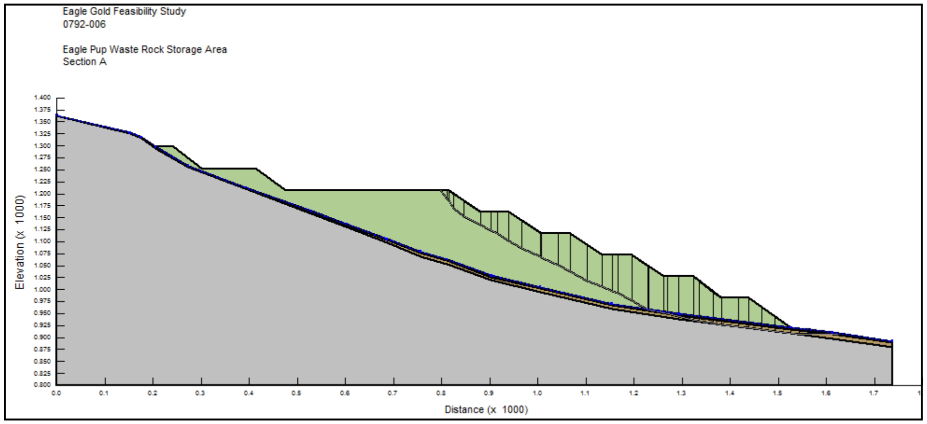
PROJECT No.:	DWG No.:	REV.:
0792-006	A-17	

DWG TO BE READ WITH BGC REPORT TITLED " EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS " DATED FEBRUARY 2012.

APPENDIX B
STABILITY ANALYSIS RESULTS

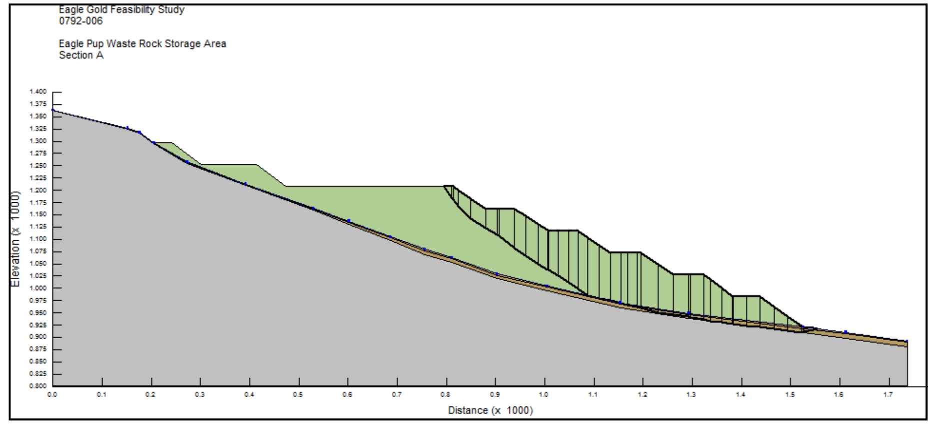
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



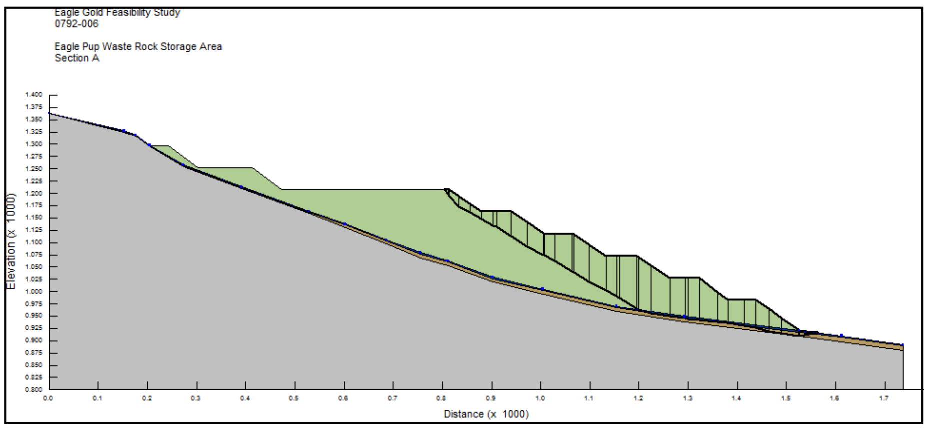
Eagle Pup WRSA - Section A - Overall
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 2.0



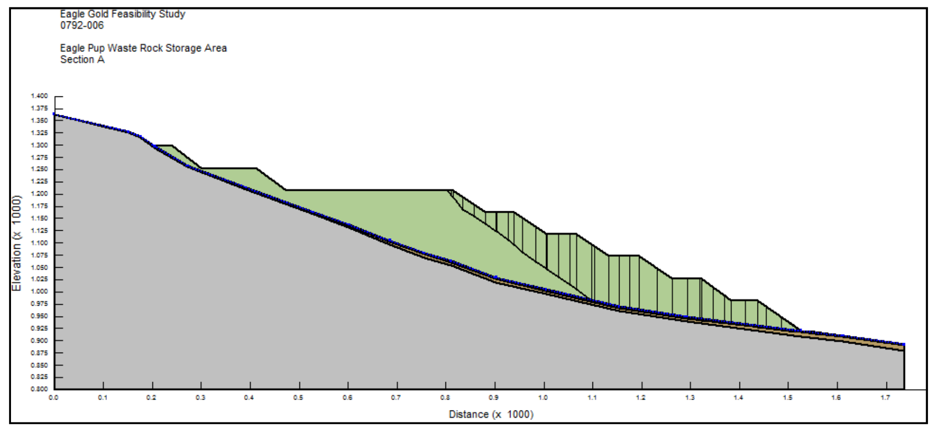
Eagle Pup WRSA - Section A - Overall
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.6



Eagle Pup WRSA - Section A - Overall
Loading Condition: Static
Foundation Condition: Excess PWP

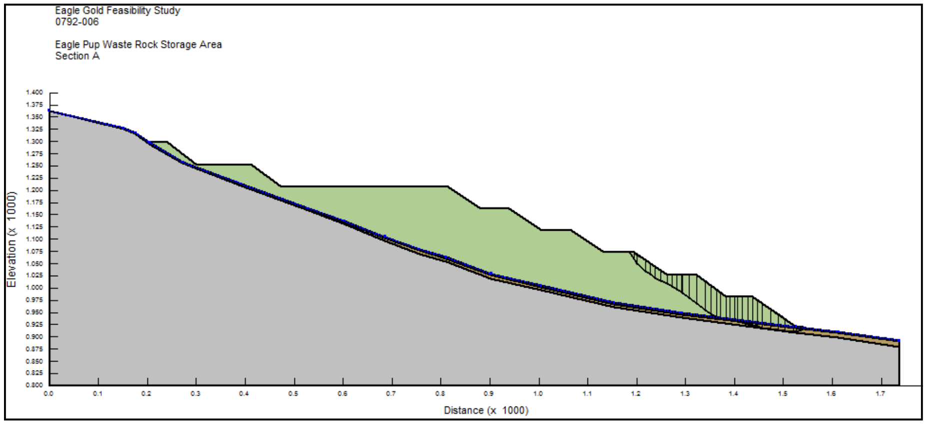
Factor of Safety: 1.8



Eagle Pup WRSA - Section A - Overall
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

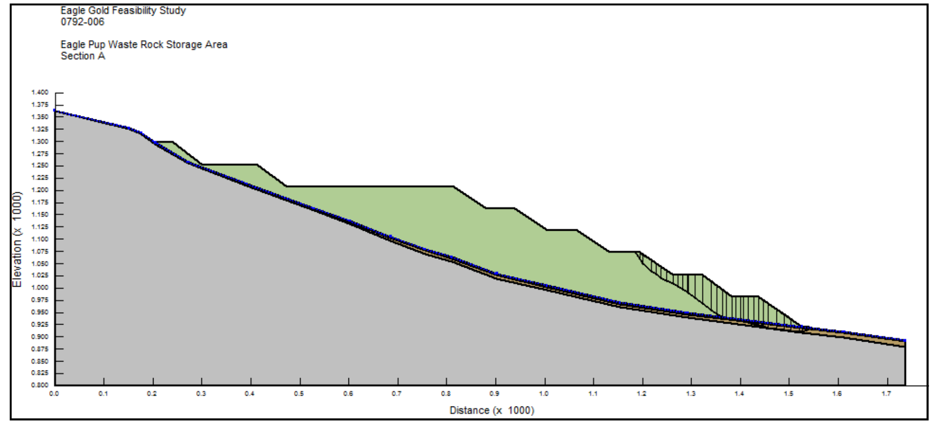
Factor of Safety: 1.5

Notes:
1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.



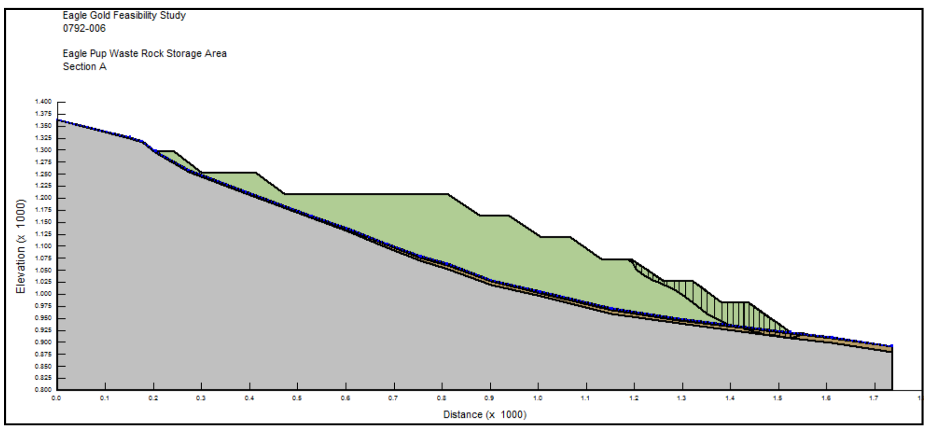
Eagle Pup WRSA - Section A - Mid Slope
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 1.8



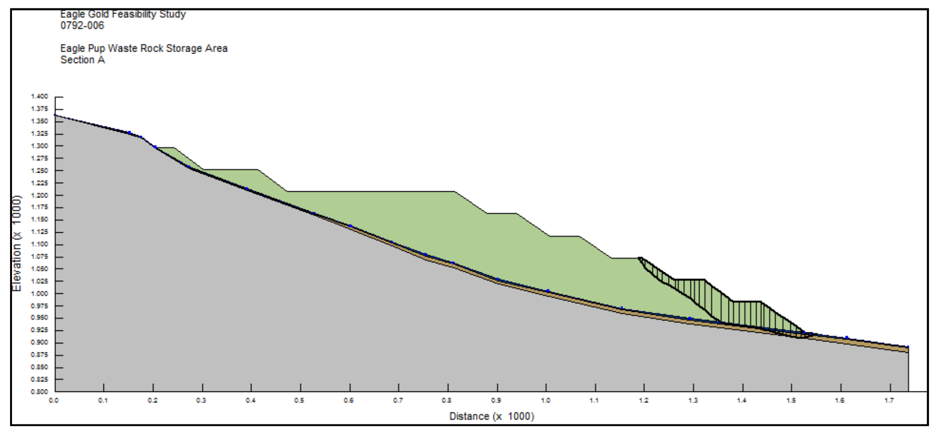
Eagle Pup WRSA - Section A - Mid Slope
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.5



Eagle Pup WRSA - Section A - Mid Slope
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 1.7



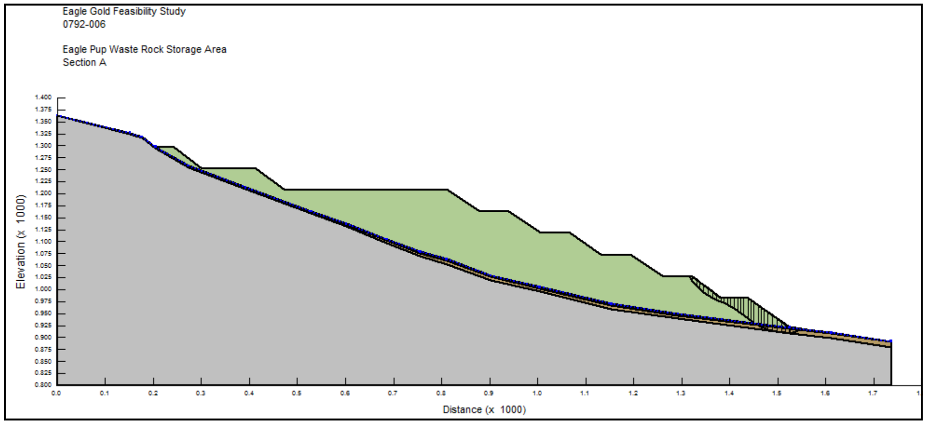
Eagle Pup WRSA - Section A - Mid Slope
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

Factor of Safety: 1.4

Notes:
1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

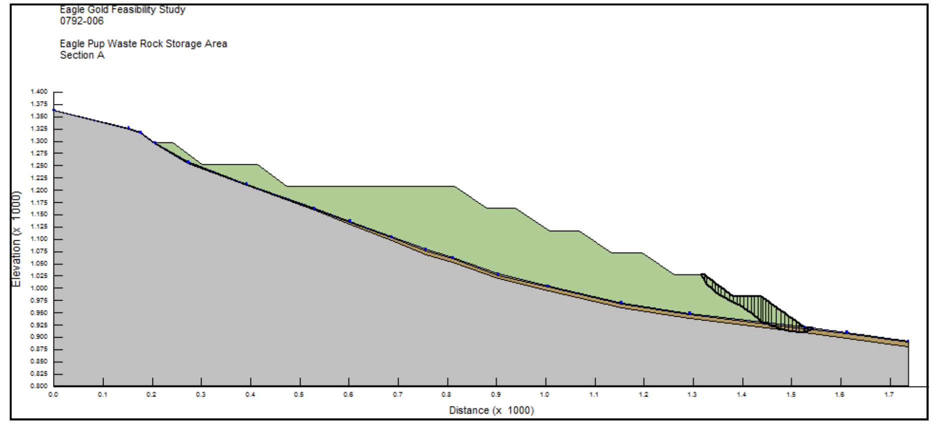
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



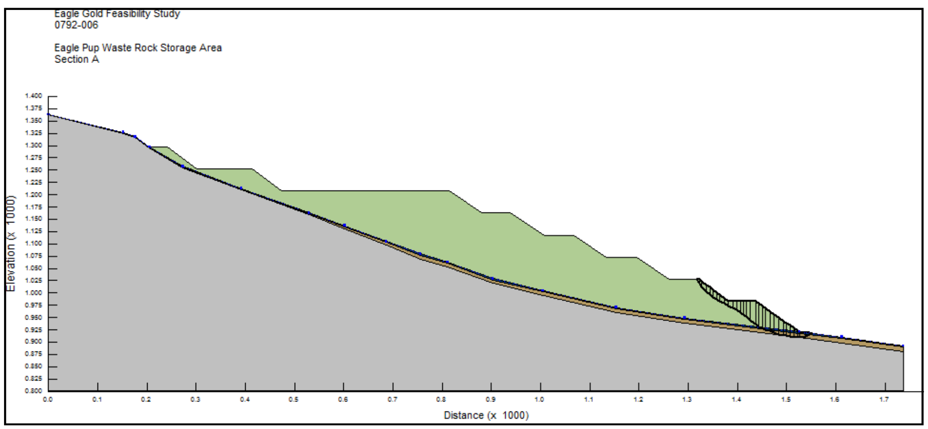
Eagle Pup WRSA - Section A - Lower Slope
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 1.5



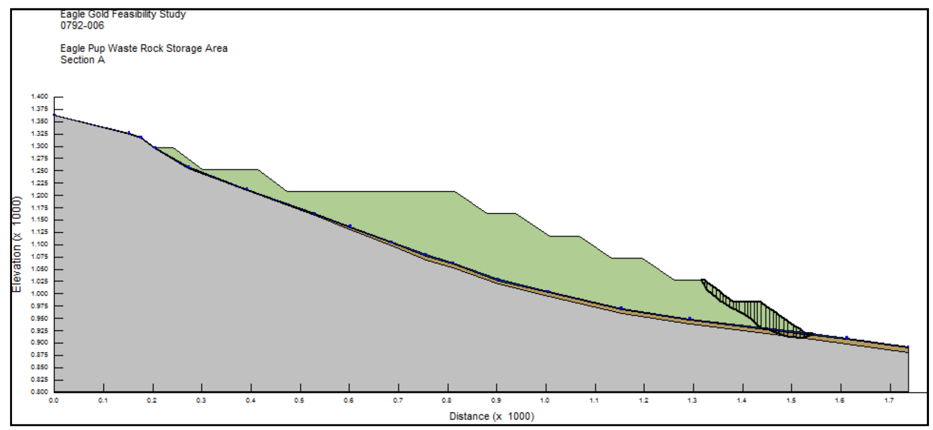
Eagle Pup WRSA - Section A - Lower Slope
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.4



Eagle Pup WRSA - Section A - Lower Slope
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 1.5



Eagle Pup WRSA - Section A - Lower Slope
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

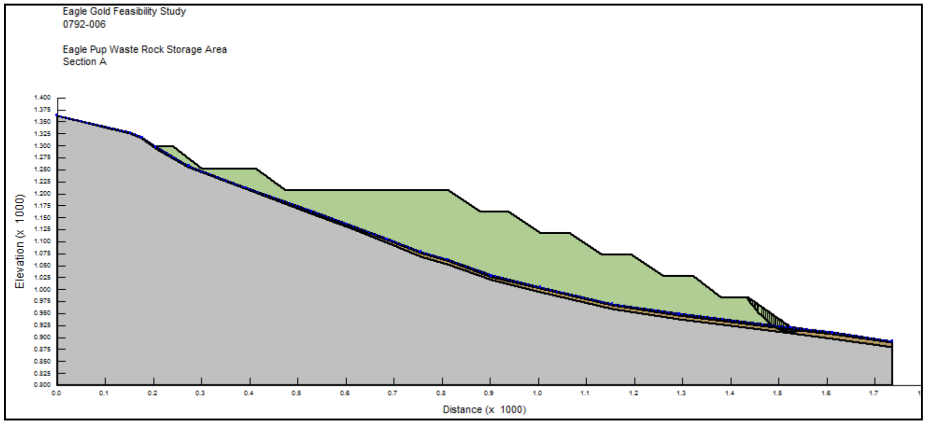
Factor of Safety: 1.3

Notes:

1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

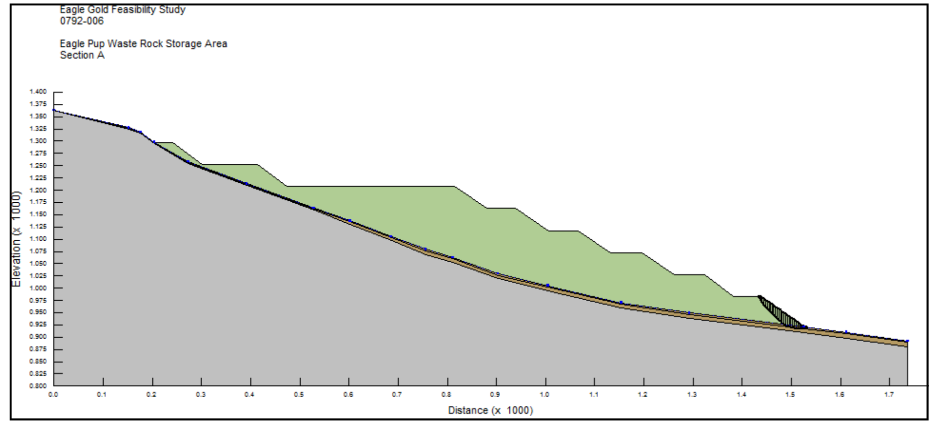
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



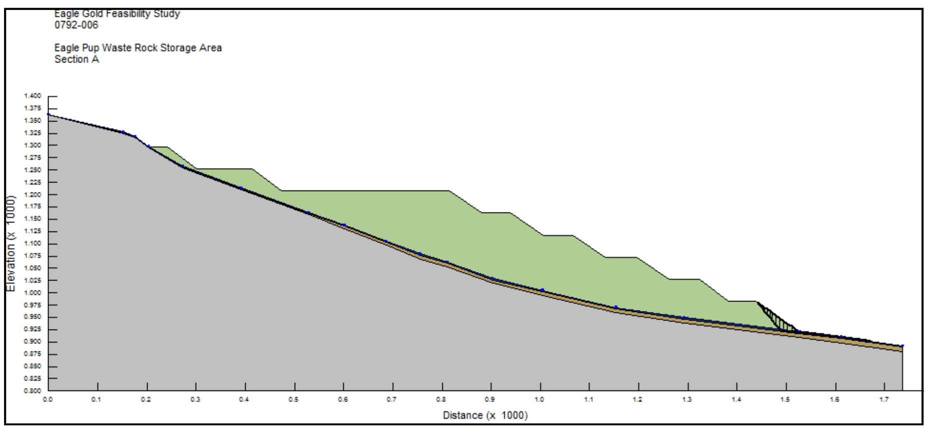
Eagle Pup WRSA - Section A - Lowest Lift
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 1.3



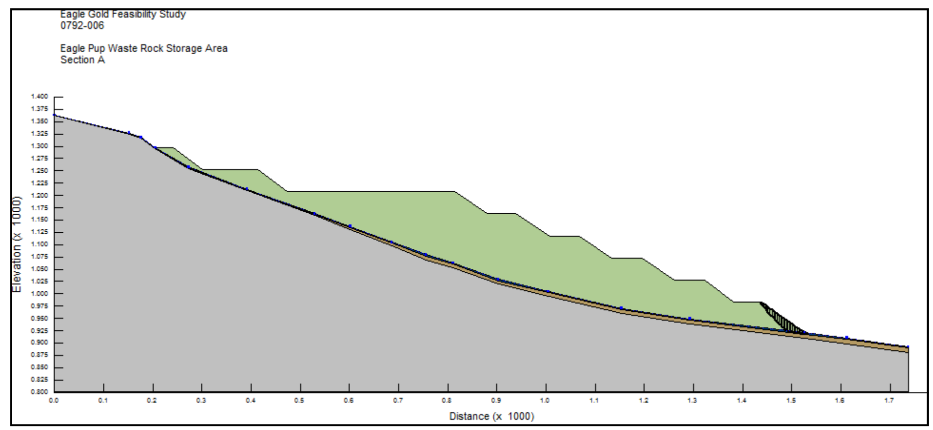
Eagle Pup WRSA - Section A - Lowest Lift
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.2



Eagle Pup WRSA - Section A - Lowest Lift
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 1.2



Eagle Pup WRSA - Section A - Lowest Lift
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

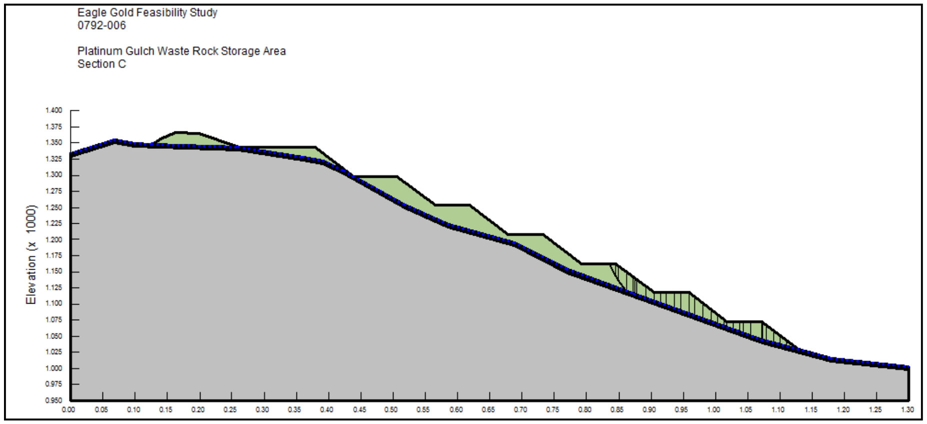
Factor of Safety: 1.1

Notes:

1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

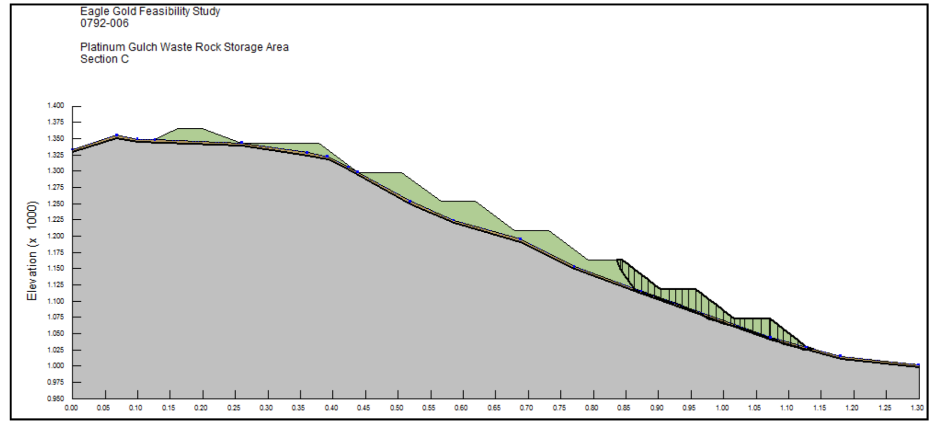
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



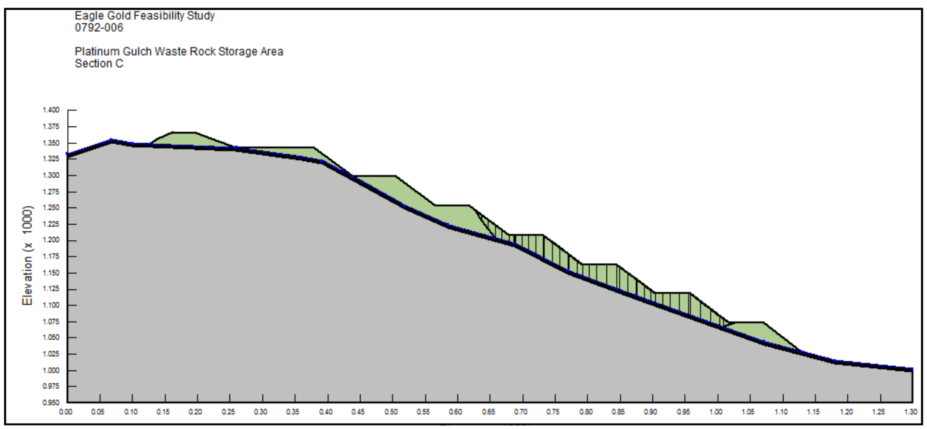
Platinum Gulch WRSA - Section C - Overall
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 1.5



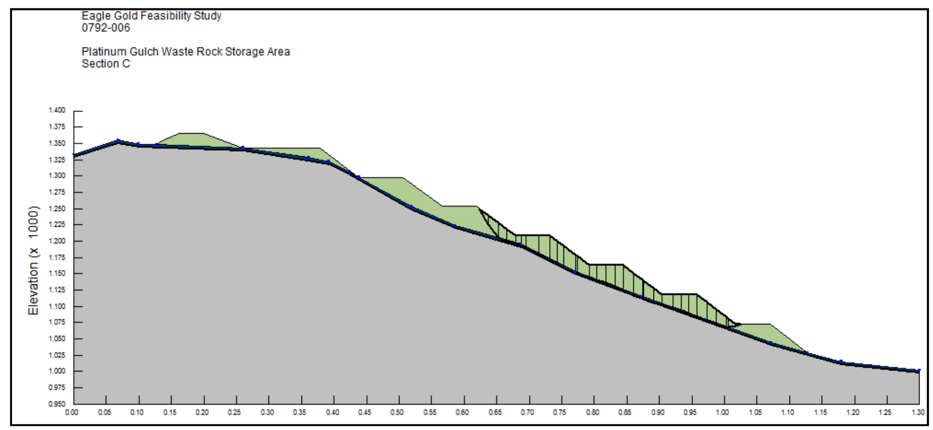
Platinum Gulch WRSA - Section C - Overall
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.2



Platinum Gulch WRSA - Section C - Overall
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 1.1



Platinum Gulch WRSA - Section C - Overall
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

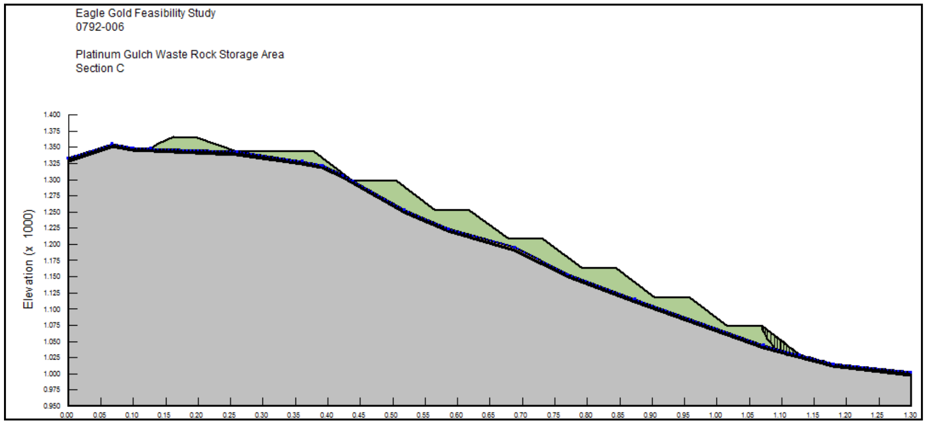
Factor of Safety: 0.9

Notes:

1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

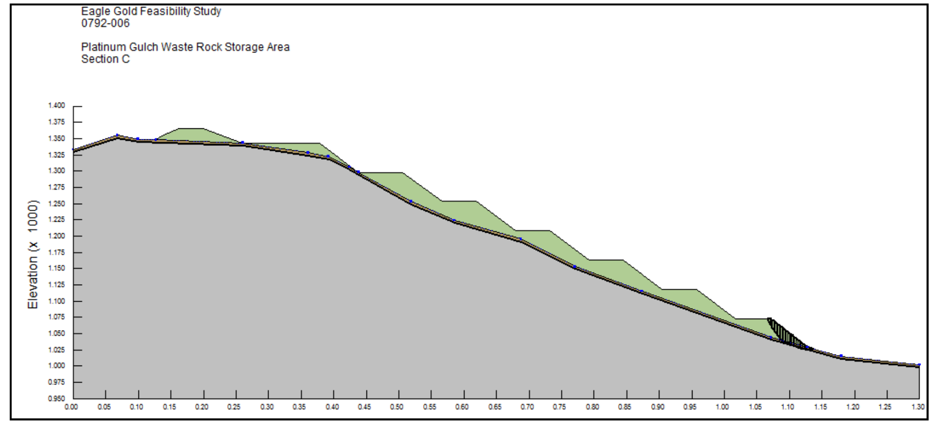
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



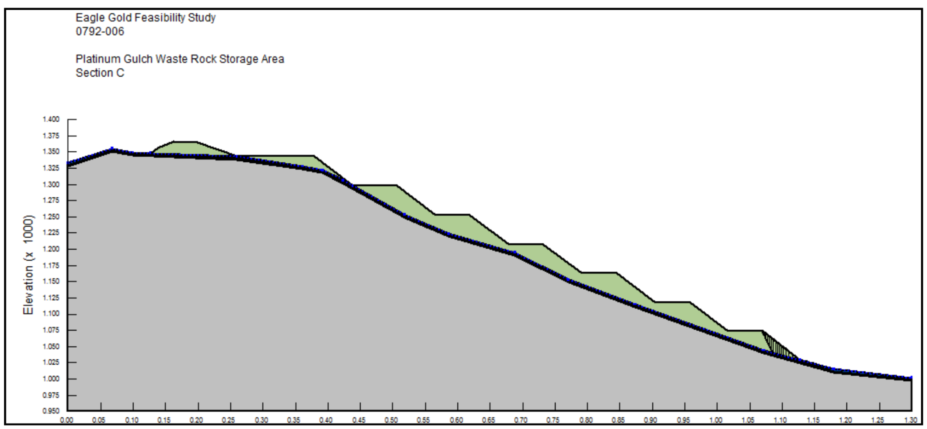
Platinum Gulch WRSA - Section C - Lowest Lift
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 1.1



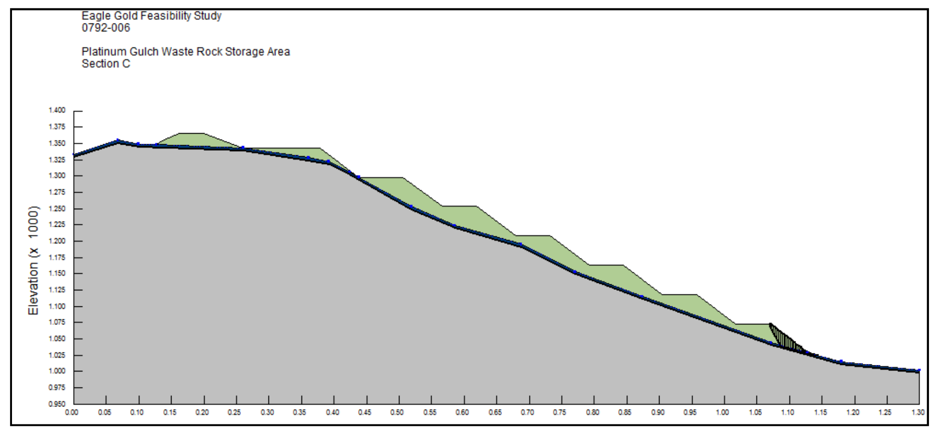
Platinum Gulch WRSA - Section C - Lowest Lift
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.0



Platinum Gulch WRSA - Section C - Lowest Lift
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 0.9



Platinum Gulch WRSA - Section C - Lowest Lift
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

Factor of Safety: 0.9

Notes:

1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.