APPENDIX 11-I
2010 OPEN PIT DEPRESSURIZATION ANALYSES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

SEABRIDGE GOLD INC.

KSM PROJECT

OPEN PIT DEPRESSURIZATION ANALYSES

FINAL

PROJECT NO:	0638-004	DISTRIBUTION:	
DATE:	April 30, 2010	SEABRIDGE	3 copies
		BGC	3 copies

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
#500-1045 Howe Street
Vancouver, B.C.
Canada V6Z 2A9
Tel: 604.684.5900
Fax: 604.684.5909

April 30, 2010

Project No.: 0638-004

Jim Smolik
Seabridge Gold Inc.
106 Front Street East
Toronto, Ontario, M5A 1E1

Dear Mr. Smolik,

Re: KSM Project Open Pit Depressurization Analyses

Please find attached the above referenced report, dated April 30, 2010.

We would like to thank you for the opportunity to work on this interesting project. Should you have any questions, please do not hesitate to contact the undersigned at the number listed above.

Yours sincerely,

BGC ENGINEERING INC.
per:

Randi Thompson, M.A.Sc., P.Eng.
Project Hydrogeological Engineer

Trevor Crozier, M.Eng., P.Eng.
Senior Hydrogeological Engineer

RT/TC:st

EXECUTIVE SUMMARY

BGC Engineering Inc. (BGC) was retained by Seabridge Gold Inc. (Seabridge) to provide open pit depressurization analyses to complement open pit slope geotechnical design studies for the Kerr-Sulphurets-Mitchell (KSM) project area. The KSM project consists of three large and undeveloped gold and copper porphyry zones: Kerr, Sulphurets, and Mitchell, and is located within a glacially modified valley in the Coast Mountain range of northern British Columbia.

In addition to the depressurization analyses, BGC concurrently prepared pre-feasibility study level geotechnical design criteria for the bench, interramp, and overall scale slopes of the Mitchell zone (BGC, 2010f) and preliminary open pit slope design criteria for the Kerr (BGC, 2010c) and Sulphurets zones (BGC, 2010d), as well as a geo-hazards assessment of the mine site area (BGC 2010e). Mine layout, environmental assessments, and engineering services for the project are being provided by Moose Mountain Technical Services (MMTS), Rescan Environmental Services Ltd. (Rescan), and Klohn Crippen Berger Ltd. (KCBL), respectively. Wardrop Engineering Inc. (Wardrop) is responsible for compiling the complete multi-component pre-feasibility study.

This report summarizes the data used to develop conceptual and numerical hydrogeologic models for the open pits and presents the predictive simulation results for open pit depressurization. Life of mine estimates of the required number of vertical dewatering wells and horizontal drains and associated groundwater extraction rates required to achieve rock mass depressurization objectives are provided together with recommendations for pumping well design and staging to assist Seabridge with developing pre-feasibility level estimates of slope depressurization costs for the Mitchell, Kerr and Sulphurets pits.

Surface topography has a pervasive influence on the groundwater flow system at the site. The elevation of the site ranges from approximately 520 meters in Sulphurets Creek valley to over 2,300 meters at the highest peaks. Measured groundwater elevations suggest that the water table is a subdued replica of topography, with depths to groundwater typically being greater in the uplands than they are in the valley bottoms. Groundwater enters the flow system from infiltration of precipitation and snowmelt, with lesser components supplied by surface water infiltration in creeks and gullies. Groundwater discharge zones are generally restricted to creeks, gullies, and breaks in slope.

The hydrostratigraphy of the site is composed of a thin layer (typically less than 10 m thick) of glacial till or colluvium underlain by bedrock. Thicker overburden deposits are confined to the valley bottom and are not present in the vicinity of the proposed open pits.

Bedrock in the KSM project area can be broadly divided into:

1. Triassic marine sedimentary and volcanic rocks of the Stuhini Group.
2. Jurassic sediments and volcanics of the Hazelton Group.

3. Early Jurassic dikes, sills, and plugs of diorite, monzonite, syenite, and granite grouped as the “Mitchell Intrusions”.

Site wide, a general trend of decreasing bedrock hydraulic conductivity with depth has been observed, though the permeability varies by typically three orders of magnitude at any given depth. Within the Mitchell pit area, the variation in permeability observed at a given depth interval appears to be influenced by location relative to the Mitchell Thrust Fault (MTF) – bedrock above the Mitchell fault generally has a higher permeability at depths greater than 125 m below ground surface (bgs) relative to bedrock below the MTF.

The conceptual model described above was used as the basis for developing a numerical hydrogeologic model in MODFLOW Surfact (version 3.0, HydroGeoLogic, 1998). The numerical model was calibrated to available site wide hydrologic data and hydrogeologic data, comprising results from 96 packer and slug tests within bedrock, tests results at seven locations within overburden, and 45 hydraulic head targets, and subsequently used to evaluate the depressurization required to satisfy geotechnical design requirements for the proposed open pit slopes.

A trial-and-error approach was used to determine the most effective dewatering scheme for the proposed Mitchell, Kerr and Sulphurets pits as they develop throughout the life of the mine. The total annual groundwater to be managed for Mitchell pit is predicted to decline from about 12,220 m^3/d when the system is turned on to about 5,580 m^3/d in the last year of mining (Year 37). The total average annual dewatering rate is predicted to be approximately 7,390 m^3/d throughout the life of mine; approximately 6,590 m^3/d of this average flow will be captured by perimeter and in-pit wells, while the remaining 800 m^3/d will need to be intercepted by horizontal drains if a dry pit is desirable for mine operations. Based on the model-predicted total flows it is estimated that approximately 29 perimeter wells (with an average length of 220 m) and 91 in-pit wells (with an average length of 235 m) will be required over the life of mine for the Mitchell Pit. The total drilling length for perimeter and in-pit wells is estimated to be approximately 6,380 m and 21,360 m, respectively. Approximately 31 km of horizontal drains will be required to aid in depressurization of the pit slopes.

The total annual groundwater to be managed for the Kerr pit is predicted to vary from 410 m^3/d up to 2,750 m^3/d. In general, the total average annual dewatering rate is predicted to be approximately 730 m^3/d; 600 m^3/d will be captured by perimeter and in-pit vertical wells, while the remaining 130 m^3/d will be captured by horizontal drains. Approximately 14 vertical wells with a length of 200 m each are estimated to be required throughout the life of mine. Approximately 8 km of horizontal drains will be required to aid in depressurization of the pit slopes.

The average annual flow to Sulphurets pit is predicted to be 130 m^3/d. Vertical wells are not expected to be effective at capturing these low inflows to the pit; therefore vertical wells were not used in simulations for the Sulphurets pit. Approximately 6 km of horizontal drains will be required to aid in depressurization of the pit slopes and to capture the seepage which would otherwise report to the pit.

The efficiency of the open pit dewatering systems is sensitive to the hydraulic parameters of the hydrogeologic units. It will be important to obtain larger scale estimates of aquifer hydraulic conductivity and storage parameters and to continue to characterize the hydraulic properties of the various hydrogeologic units. This can be carried out during the geotechnical, environmental and exploration drilling investigations required to advance the project to the next stage.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF DRAWINGS

LIST OF APPENDICES

LIMITATIONS OF REPORT

BGC Engineering Inc. (BGC) prepared this report for the account of Seabridge Gold Inc. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of report preparation. Any use which a third party makes of this report or any reliance on decisions to be based on it are 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 report.

As a mutual protection to our client, the public, and ourselves, all reports and drawings are submitted for the confidential information of our client for a specific project. Authorization for any use and/or publication of this report or any data, statements, conclusions or abstracts from or regarding our reports and drawings, through any form of print or electronic media, including without limitation, posting or reproduction of same on any website, is reserved pending BGC's written approval. If this report is issued in an electronic format, an original paper copy is on file at BGC Engineering Inc. and that copy is the primary reference with precedence over any electronic copy of the document, or any extracts from our documents published by others.

1.0 INTRODUCTION

BGC Engineering Inc. (BGC) was retained by Seabridge Gold Inc. (Seabridge) to provide open pit depressurization analyses to assist open pit slope geotechnical design studies for the Kerr-Sulphurets-Mitchell (KSM) project area (Drawing 1). The KSM project represents three large, undeveloped gold and copper porphyry zones: Kerr, Sulphurets, and Mitchell. This report summarizes data used to develop conceptual and numerical hydrogeologic models and presents the results of predictive open pit depressurization analyses. Recommended open pit depressurization systems are summarized and technical risks and opportunities related to the pit depressurization are reviewed. Recommendations for additional work at the next stage of project design are also provided.

1.1. Study Scope

BGC's scope of work included compiling hydrogeologic data collected by BGC, Klohn Crippen Berger Limited (KCBL) and Rescan Environmental Services Limited (Rescan) in the vicinity of the open pits during the 2008 and 2009 field seasons, indentifying hydrostratigraphic units, estimating hydraulic conductivity and storage parameter values, and formulating a conceptual hydrogeologic model for the project area in the vicinity of the open pits. The conceptual model was used as the basis for developing a numerical hydrogeologic model using MODFLOW Surfact (HydroGeoLogic, 1998). The calibrated numerical model was used to evaluate the effort required to depressurize the open pit slopes to satisfy geotechnical constraints identified in slope design studies for the proposed Kerr, Sulphurets, and Mitchell open pits (BGC 2010c, BGC 2010d, and BGC 2010f). Estimates of the required number of vertical dewatering wells and horizontal drains required to achieve sufficient depressurization of the rock mass, as well as associated groundwater extraction rates are provided. Recommendations for pumping well design and staging are provided to assist Seabridge with estimating pre-feasibility level project costs. Finally, recommendations for additional work to reduce uncertainties associated with hydrogeologic parameters beyond the current level of analyses are provided.

In addition to the depressurization analyses, BGC concurrently prepared pre-feasibility level geotechnical design criteria for the bench, interramp, and overall scale slopes of the Mitchell zone (BGC, 2010f) and preliminary open pit slope design criteria for the Kerr (BGC, 2010c) and Sulphurets zones (BGC, 2010d), as well as a geo-hazards assessment of the mine site area (BGC, 2010e). Mine layout, environmental assessments, and engineering services for the project are being provided by Moose Mountain Technical Services (MMTS), Rescan, and KCBL, respectively. Wardrop Engineering Inc. (Wardrop) is responsible for compiling the complete multi-component Pre-Feasibility Study (PFS).

1.2. Previous Work

Geological exploration activities have been carried out in the area of the KSM project since the 1960's (Margolis, 1993). BGC carried out a scoping level Preliminary Economic Assessment (PEA) design study for the proposed Mitchell pit in 2008 (BGC, 2008 and

2009a). Rescan conducted environmental baseline studies for the project area in 2008, which included meteorological and hydrological studies. Baseline hydrogeologic investigations prior to 2009 were limited to sampling of groundwater seeps within the KSM pit footprints (Rescan, 2009a), and packer tests and piezometer installations at three boreholes within the proposed Mitchell Waste dump footprint (KCBL, 2009a).

The 2009 field investigations carried out by BGC, Rescan and KCBL included hydrogeologic investigations in the proposed open pit and waste dump areas. The results from these investigations (including site data up to November 30, 2009) were incorporated into the pit depressurization analyses provided herein.

2.0 OVERVIEW OF SETTING

The KSM study area is located in the Coast Mountains of northwestern British Columbia approximately 65 km north-northwest of Stewart, B.C. and approximately 20 km southeast of Eskay Creek Mine, formerly operated by Barrick Gold Corp. Access to the site is by helicopter, staging from the Grand Duc road via Hyder, Alaska or Bell 2, B.C. (Drawing 1).

The project area is located within a historically active mining region of B.C. In addition to the closed Eskay Creek and Granduc Mines, multiple current and historic exploration targets are near the KSM project site.

2.1. Study Area Physiography

The property lies in the rugged Coastal Mountains, with elevations ranging from 520 meters in the Sulphurets valley to over 2,300 meters above sea level (masl) at the highest peaks (Drawing 2). The tree line lies at about 1,240 masl, below which a mature forest of mostly hemlock and balsam fir is present. Valley glaciers fill the upper portions of the larger valleys from just below the tree line and upwards.

The Mitchell zone is located in the floor of the Mitchell Creek valley, immediately downstream of the Mitchell glacier (Drawing 2). The valley trends approximately east-west and is typical of glaciated valleys of the B.C. Cordillera, with an open "U"-shaped cross section where gentle upper slopes drop into steeper valley walls which grade into broad and gently sloping valley floors. The rim elevations of the north and south valley slopes are approximately 1900 masl and 1700 masl, respectively; the valley floor in the area of the mineralized zone is at an elevation of approximately 800 masl. The total relief in the Mitchell valley in the area of the mineralized zone is 900 to 1100 m.

The Mitchell valley has been recently de-glaciated; a comparison of B.C. TRIM (1982) topography data with topography compiled in 2008 from orthophotography suggests that the Mitchell glacier has receded approximately 700 m eastward and thinned considerably (BGC 2010f).

The Kerr and Sulphurets zones are located in the upper reaches of the Sulphurets valley (Drawing 2). The Sulphurets valley has also been recently de-glaciated. Geomorphic processes typical of the B.C. Cordillera including fluvial erosion in the valley floor and mass wasting of the valley slopes can be observed in both the Mitchell and Sulphurets valleys. Evidence of avalanches is observed in the proposed pit areas. Development of the KSM deposits will therefore need to consider this geomorphic environment.

2.2. Meteorology

The climate is generally that of a temperate or northern coastal rainforest, with subarctic conditions at high elevations. Within similar mountainous terrain an orographic influence of increased precipitation with increased elevation is often observed (Loukas and Quick, 1996) and this same effect is expected within the project area, resulting in highly variable precipitation and air temperature (Rescan, 2009a). Meteorology baseline studies for the site began in September 2007 with the installation of an automated meteorological station in Sulphurets Creek at elevation 880 masl by Rescan. A second automated station was installed within the Mitchell pit area (elevation of 830 masl) in September 2008. Precipitation and climate have also been monitored within the region at the Unuk River-Eskay Creek (#1078L3D, elevation 887 masl), Bob Quinn (#1200R0J, elevation 601 masl), and Stewart Airport stations (#1067742, elevation 7 masl) (Drawing 1) operated by Environment Canada since 1989, 1977, and 1974, respectively.

The estimated mean annual precipitation for the Sulphurets meteorological station is 1,654 mm based on data collected from October 2007 to November 2009 (Rescan, 2009c). Mean monthly precipitation estimates are provided in Table 1 along with monthly normals from the nearby regional stations.

The length of the snow-free season varies from about May through November at lower elevations and from July through September at higher elevations. Table 2 summarizes the mean monthly air temperature for the KSM Project Area at the Sulphurets Creek and Mitchell Creek stations for the period of record. Average monthly temperature ranges from -13.5°C in December 2007 to 10.7°C in July 2009 at the Sulphurets station and from -6.9°C in February 2009 to 14.1°C in July 2009 at the Mitchell station. These temperatures are generally similar to regional climate normals for the Unuk River-Eskay Creek station.

2.3. Hydrology

The project area is drained by Sulphurets Creek into the Unuk River, which ultimately flows westward to the Pacific Ocean through Alaska (Drawing 1). Approximately 38% of the Sulphurets Creek watershed is glacier covered, and the surface water hydrologic system is described as primarily a glacier-augmented system (Rescan 2009a). This type of system behaves similarly to a snow-melt dominated system except that the period of high flows extends from about May to August or September, and low-flow conditions occur only when precipitation is accumulating in the snowpack, usually from December to March.

Rescan installed a series of automated hydrometric stations during 2007 and 2008 to collect continuous water level data at the major streams within the study area. Six stations are located within the Sulphurets watershed, as shown on Drawing 2 and as described in Table 3 together with mean annual, June to September and winter (December to March) low flow rates (modified from Rescan, 2009a and 2010).

Rescan began monitoring of the Mitchell Glacier in September 2008 to estimate glacier mass balance and surge potential. The Mitchell Glacier is a medium-sized alpine glacier that forms part of what is known as the Unuk Icefield or the Sulphurets Icefield. Estimates of glacier contributions to streamflow were not available at the time of this analysis.

2.4. Geology

The KSM project area lies within the Stikinia Terrane (Lechner, 2008), one of almost twenty fault-bounded crustal blocks which make up the B.C. Cordillera (Monger and Price, 2002). The Stikinia Terrane consists of Triassic and Jurassic volcanic island arcs accreted onto the Paleozoic basement of the North American continent. The resulting country rocks are combinations of deformed (folded and faulted) sediments (e.g. sandstones, siltstones), volcaniclastics (e.g. tuffs, pyroclastic breccias), and volcanics (e.g. basalts, andesite flows). Alteration and mineralization of these country rocks has occurred due to intrusions of Jurassic monzonite, granite, and diorite porphyritic rocks.

2.4.1. Regional Geology

The study area is within the Stikinia Terrane, a fault bounded block of Triassic and Jurassic volcanic arcs that were accreted onto the Paleozoic basement of the North American continental margin in the Middle Jurassic. The country rock of the Stikinia Terrane in the study area is mainly composed of deformed oceanic island arc complexes of the Triassic Stuhini and Jurassic Hazelton groups. Eastward of the study area, back-arc basins formed in the Late Jurassic and Cretaceous and the fine black clastic sediments of the Bowser Group accumulated. Early Jurassic sub-volcanic intrusive complexes are common; several host hydrothermal systems enriched with precious and base metals are present. Basalts from Quaternary eruptions can be found throughout the region.

Major folds and faults have formed due to compressional tectonics in the late Cretaceous. The McTagg Antiform occurs to the west of the study area and suggests folding on a regional scale with fold axes generally striking northwest. A major normal or strike-slip fault, the Brucejack fault, is located at the eastern limit of the study area and has been identified as a major topographic lineament. This fault strikes north and dips steeply. The Sulphurets Thrust Fault is a regional scale feature dipping gently west and striking south; it is observed at the contact of the Stuhini (hanging wall) and Hazelton group (footwall) rocks in the study area (see Drawing 3).

2.4.2. Lithologies of the Study Area

Rocks of the KSM project area can be broadly divided into:

1. Triassic marine sedimentary and volcanic rocks of the Stuhini Group.
2. Jurassic sediments and volcanics of the Hazelton Group.
3. Early Jurassic dikes, sills, and plugs of diorite, monzonite, syenite, and granite grouped as the “Mitchell Intrusions”.

The stratigraphy of the Stuhini Group includes a basal sequence of argillite (massive sedimentary rock made up of clay size particles) and sandstone, which are overlain by pillowed volcanic flows and breccias, which are overlain by a sequence of turbidites and graded sandstones similar to the basal stratigraphy. The Hazelton Group is dominated by andesitic flows and breccias deposited in an emergent volcanic chain. Distinct felsic welded tuff horizons of the Mount Dilworth Formation are an important stratigraphic marker in the Hazelton Group, as they are closely associated with the Eskay Creek deposit (Savell, 2008).

An erosional unconformity separates the Stuhini Group from the stratigraphically higher (and younger) Hazelton Group rocks. Within the study area, the spatial distribution of the Stuhini and Hazelton Groups is reversed from their stratigraphic relationships; the Stuhini Group occur at higher elevations within the Mitchell valley as these rocks have been thrust over the Hazelton Group rocks by the Sulphurets Thrust Fault (STF).

The Mitchell Intrusions occur throughout the site and make up a large portion of the north valley wall in the Mitchell valley. In the Sulphurets zone they are found above the STF on the ridge top and in the upper reaches of the proposed open pit. These rocks are difficult to differentiate from the country rock in areas of intense hydrothermal alteration, such as the lower elevations of the Mitchell valley, below the Mitchell valley floor or below the STF. Where identified, these intrusions occur as sills and plugs of coarse-grained feldspar porphyritic monzonite to low-silica granite (Savell, 2008). Mineralization generally occurs at the margins of these intrusive rocks.

2.4.3. Alteration of the Study Area

Alteration (changes in the mineralogy or texture of rocks) is commonly associated with porphyry style mineralization, such as at the KSM site. The styles of alteration of the KSM study area occur in distinct locations with respect to the main rock types or structural features. Multiple sub-types of alteration may be identified, but general groups can be defined.

Alteration styles of the mid and upper slopes of the Mitchell valley are dominantly potassic (K-feldspar and biotite common). Zones of siliceous (SI) alteration (an increase in quartz) and hornfelsing (MTH) occur adjacent to the Mitchell intrusions. These alterations may increase the intact strength of the affected rocks (BGC, 2010f).

At lower elevations of the Mitchell valley and below the valley floor the rocks are foliated and altered. Phyllic-argillic (quartz, sericite, and pyrite with some illite) or “QSP” alteration occurs in and around the main target zone of the proposed Mitchell pit. Multiple stages of quartz veins result in a stockwork (QSPSTW) in sections of the phyllic-argillic altered rock mass. This “QSP” alteration diminishes to the west in the valley bottom. Propylitic (PR) alteration (chlorite, epidote, and calcite) increases to the west.

Alteration styles within the Kerr zone are similar to those observed in the Mitchell valley below the Mitchell Thrust Fault (MTF) (see Section 2.4.4). “QSP”, as well as intermediate argillic, chloritic and propylitic alteration types are found in and around the main target zone of the proposed Kerr open pit.

Alteration styles within the Sulphurets zone are also similar to those observed in the Mitchell valley. Above the STF (see Section 2.4.4) alteration styles are dominantly “SI”, “MTH”, and “PR”; this corresponds with the alteration zones observed above the MTF and what is anticipated above the STF in the Mitchell zone. Below the STF, "QSP," as well as intermediate argillic, chloritic and propylitic alteration types are found; similar to that observed below the MTF in the Mitchell valley.

The intensity of alteration and foliation in the rocks makes the recognition of the pre-alteration rock types very difficult. This is typical of phyllic-argillic or quartz-sericite (illite)-pyrite altered rocks. Original textures can sometimes be observed in the propylitic altered rocks.

2.4.4. Major Structures of the Study Area

Major geological structures and fabrics of the study area include: north-south striking steeply dipping faults, gently dipping thrust faults, and east-west striking, moderate to steeply dipping foliation/schistosity. Bedding has been observed in some of the sedimentary and volcaniclastic rocks of the Hazelton and Stuhini Groups in the area; whereas it is typically healed due to alteration/metamorphism within the proposed Mitchell pit area, it appears to be a major fabric element of the rock mass in the Kerr and Sulphurets zones.

The Sulphurets and Mitchell thrust faults strike to the south-southwest and dip gently (<30°) west-northwest. These faults divide the Stuhini Group (hanging wall of the STF) from the Hazelton Group (footwall of the STF) and the siliceous/hornfelsed/potassic altered rocks (hanging wall of the MTF) from the foliated phyllic-argillic altered rocks (footwall of the MTF). The MTF truncates against the STF to the west. The Kerr zone is located in the footwall of the STF south of its surface trace.

The Brucejack and Snowfield faults are steeply dipping (>60°) north-south striking faults immediately east of the study area (Margolis, 1993). Other steeply dipping, approximately north-south striking faults are interpreted to the west of the proposed Mitchell pit area, and bound both the east and west sides of the Kerr zone. In addition there are two faults interpreted in the STF hanging wall in the Sulphurets zone, named Main Copper 1 and Main Copper 2.

As mentioned above, bedding appears to play a major role in the structural fabric of the Kerr zone; there are two distinct bedding orientation sets present in the area of the Kerr zone that may form the limbs of an antiformal fold. These zones are separated by a steep normal fault along which the offset is not known. The fold axis that can be interpreted from the "limbs" matches well with regional folding orientation and plunge (BGC 2010f).

Foliation is best developed in phyllic-argillic and propylitic altered rocks in the footwall of the MTF within the lower slope and floor of the Mitchell valley. The foliation typically dips to the north at moderate to steep angles (40° to 80°). The orientation of the foliation is noted to sometimes change adjacent to major faults (Margolis, 1993). The foliation has also been noted in some outcrops in the Kerr zone.

3.0 HYDROGEOLOGIC DATA

To support the development of open pit depressurization analyses, BGC has compiled hydrogeologic data available from reports, other consultants, and geologic models. The data set is summarized in the following sections.

3.1. Overview

During the 2009 summer field season BGC carried out packer tests and installed vibrating wire piezometers in eight NQ-sized geotechnical drill holes (M09-095 to M09-102a) completed within the Mitchell pit area. The hydrogeologic data from these drill holes, along with the results of field investigations carried out by Rescan and KCBL for the 2008 and 2009 field programs, comprise the hydraulic parameter and water level data currently available for the project area. Field investigations carried out by Rescan and KCBL included packer testing, standpipe piezometer installation, water level readings and slug tests at the RES-MW and KC08 and KC09 borehole locations (Drawing 2).

3.2. Bedrock Hydraulic Conductivity Data

A total of 96 hydraulic tests (packer tests and slug tests) were carried out in the bedrock at the borehole locations shown on Drawing 2. Hydraulic conductivity results for all tests carried out versus depth by location are provided on Drawing 4. The plot shows that the majority of the tests were carried out in the proposed Mitchell open pit footprint or the Mitchell or Sulphurets valleys, while little data is available for the Kerr (7 tests) or Sulphurets (7 tests) open pit areas. Tests were conducted within the Mitchell pit to depths of up to 450 m below ground surface (bgs), while the tests completed outside of the Mitchell pit area were generally conducted at depths less than 125 m bgs. Measured hydraulic conductivity results for shallow tests (carried out at 125 m depth or less) within the Mitchell pit area were often higher (i.e., up to $1x10^{-5}$ m/s at RES-MW04 and a geometric mean of $9x10^{-7}$ m/s) than those carried out elsewhere (geometric mean of $1x10^{-7}$ m/s). The test results are summarized in Table 4. It is noted that analyses of packer tests carried out by KCBL and Rescan were not reviewed in detail and that only results provided by them are plotted and summarized along with BGC test results.

The test results are also plotted by location versus average test interval Rock Quality Designation (RQD) in Drawing 5, and no clear trend can be distinguished.

Bedrock hydraulic conductivity test results versus depth by lithology (sedimentary, volcanic, intrusive or fault zone) are shown in Drawing 6. The majority of the tests were carried out in the Stuhini and Hazelton volcanic and sedimentary rocks. Test results for volcanic rocks (primarily tested in the Mitchell pit area) at depths less than 125 m were often higher than those for the other grouped units. Geometric mean values for each lithologic unit are presented in Table 4, and range from $4x10^{-7}$ m/s for volcanics to $9x10^{-8}$ m/s for instrusives at depths of 0 m to 125 m below ground.

Test results versus depth are plotted on Drawing 7 by borehole and relation (above or below) to the MTF for tests conducted within the proposed Mitchell pit only. In general, the plot shows that the hydraulic conductivity from tests conducted within or above the MTF varied from about $2x10^{-8}$ m/s to $1x10^{-6}$ m/s from ground surface to 400 m bgs (or over the depth range tested), and a meaningful decrease in permeability with depth cannot be distinguished given the small sample population at depths greater than 100 m. Hydraulic conductivity results for tests conducted below the MTF varied from $8x10^{-8}$ m/s to $1x10^{-5}$ m/s at shallow depths (0 to 125 m bgs) within the valley floor and from $3x10^{-10}$ m/s to $4x10^{-7}$ m/s at depths greater than 125 m bgs. Analyses and results for packer tests carried out in the eight NQ-sized geotechnical drill holes (M09-095 to M09-102a) in the Mitchell Pit area are provided in Appendix A.

The Mitchell pit test results versus depth are plotted on Drawing 8 by alteration type where alteration types were known. The data set is small for the number of alteration types plotted; however, test intervals conducted within bedrock of phyllic-argillic (QSPSTW and QSP), chlorite (CL), and propylitic (PR) alterations appear to be of lower hydraulic conductivity at depths greater than 125 m bgs and are typically encountered below the MTF; however, additional data are needed to evaluate if this effect is related to alteration type, confining stress (i.e., depth) or both. Complete borehole logs for the eight M09 geotechnical drill holes logged by BGC and additional details on the 2009 field program are included under separate cover (BGC 2010f).

A small data set of hydraulic testing data was available specifically for the Sulphurets pit area, and comprised seven packer tests and slug tests carried out at RES-MW-07A/B (Drawing 4) to depths up to 200 m bgs. The tests were carried out below the STF, where alteration types are similar to those observed below the MTF in the Mitchell pit area. Hydraulic conductivity testing results were on the low end of observed values and ranged from $5x10^{-10}$ m/s to $8x10^{-7}$ m/s (Table 4). The distribution and relationships of alteration types and faults in the Mitchell-Sulphurets ridge, and connections to both the Mitchell and Sulphurets zones, are not fully understood at present (BGC, 2010f).

A small data set of hydraulic testing data was available specifically for the Kerr pit area, and comprised nine packer tests and slug tests carried out at RES-MW-09A/B and RES-MW-13A/B (Drawing 4) to depths up to 100 m bgs. Test results varied from $6x10^{-9}$ m/s to $9x10^{-7}$ m/s, with a geometric mean of $1x10^{-7}$ m/s. Data was not available for RES-MW-08A, which was a dry borehole drilled to a total depth of approximately 89 m.

The general trend of decreasing hydraulic conductivity with depth (or with increasing confining stress) shown on Drawing 4 is commonly observed within bedrock, and is illustrated on Drawing 9 after Rutqvist and Stephannsson (2003). Though there is a general trend of decreasing hydraulic conductivity with depth, the hydraulic conductivity is observed to vary by over three orders of magnitude at a given depth. The variation in hydraulic conductivity observed at a given depth interval within the Mitchell pit area appears to also be influenced by the location relative to the MTF; bedrock above the MTF generally has a higher hydraulic conductivity at depths greater than 125 m bgs relative to bedrock below the MTF.

It is noted that data obtained at depths greater than approximately 125 m bgs are limited to those from the Mitchell and Sulphurets pit areas.

3.3. Overburden Hydraulic Conductivity Data

Overburden permeability data within the project area is limited to data collected from KCBL boreholes in the proposed Mitchell and Sulphurets waste dump areas (KC08-01, -02, -03, and KC09-09, -10) and within the proposed Kerr pit area (RES-MW13A/B). In general, aerial photographs and investigations carried out by others (KCBL, 2009a; KCBL, 2009c and Rescan, 2009a) suggest that the overburden consists primarily of thin glacial till or colluvium of thicknesses less than 10 m, with occasional fluvial units in the valley bottom. Surficial mapping by KCBL indicates overburden thicknesses of 10 m or greater are generally limited to low elevations within the valleys, where it may be up to 140 m thick. Overburden is generally not present in the proposed open pit footprints (see Drawing 3). Estimated hydraulic conductivity from falling head tests conducted within open boreholes and in standpipe piezometers in the overburden during the 2008 and 2009 drilling programs by Rescan and KCBL ranged from $1x10^{-5}$ m/s to $3x10^{-9}$ m/s, with a geometric mean of $2x10^{-7}$ m/s. All overburden test results are summarized in Table 5.

3.4. Hydraulic Head Data

BGC installed 11 RST Instruments vibrating wire (VW) piezometers within the eight M09 boreholes (M09-095 to M09-102a) during the 2009 field program. Dataloggers (RST single channel VW dataloggers) were installed at two piezometer nest locations (M09-100 and M09-96) where both a shallow and deep piezometer were installed to allow for continuous data collection throughout the year. Manual measurements are obtained at the remaining RST VW piezometers. The M09 VW groundwater elevation data set is provided in Appendix B.

Rescan completed a monitoring well installation field program in 2009 (RES-MW wells on Drawing 2) throughout the project area that comprised 23 monitoring wells at 12 locations, while KCBL installed a total of 11 standpipe piezometers during the 2008 and 2009 field programs. Water level data for these additional wells and piezometers collected through October 2009 were provided by Rescan (Rescan 2009f).

Water level data for the 45 piezometers and monitoring wells listed above are limited to summer 2008 or 2009 measurements; therefore seasonal trends have not yet been observed or estimated. Observed hydraulic heads ranged from at or just above ground surface (typically at lower elevations) to up to 240 m below ground surface. Hydraulic heads observed at the VW piezometers varied over the summer (see plots in Appendix B) from 1 to 80 m. Several of the piezometers have been installed in low permeability bedrock, and therefore the change in hydraulic heads observed to date could indicate that they have been stabilizing since drilling occurred (i.e., M09-097S, M09-097D, M09-099, M09-100D, M09-101). Collection of groundwater elevation data should continue year round at the M09 piezometers so that these fluctuations can be better understood. In addition, data should be collected year round at the RES-MW wells and KC08 and KC09 piezometers.

4.0 CONCEPTUAL HYDROGEOLOGIC MODEL

Hydrogeologic data collected by BGC, KCBL and Rescan in the vicinity of the proposed open pits were compiled to identify hydrostratigraphic units, assess hydraulic conductivity values, and formulate a conceptual hydrogeologic model in the vicinity of the proposed open pits. The conceptual model described below and summarized schematically in Drawing 10 formed the basis for development of the numerical hydrogeologic model.

4.1. Current Conditions

Surface topography can be expected to have a pervasive influence on the underlying mountain flow system (Forster and Smith, 1988). The elevation of the site ranges from approximately 520 meters in Sulphurets Creek valley to over 2,300 meters at the highest peaks. Measured groundwater elevations suggest that the water table is a subdued replica of topography, with depths to groundwater typically being greater in the uplands relative to the valley bottom. Groundwater enters the flow system from infiltration of precipitation and snowmelt, with lesser components supplied by surface water infiltration in creeks and gullies. Groundwater discharge zones are generally restricted to creeks, gullies, and breaks in slope. It is worth noting, that despite the steep topography of the site, only moderately artesian pressures have been observed in the valleys to date.

The hydrostratigraphy of the site is composed of a thin layer (typically less than 10 m thick) of glacial till or colluvium underlain by bedrock. The geometric mean of hydraulic conductivity data available for these units is $2x10^{-7}$ m/s. Thicker overburden deposits are confined to local sections of the valley bottom and are not present in the vicinity of the proposed open pits.

Bedrock of the KSM project area can be broadly divided into:

1. Triassic marine sedimentary and volcanic rocks of the Stuhini Group.
2. Jurassic sediments and volcanics of the Hazelton Group.
3. Early Jurassic dikes, sills, and plugs of diorite, monzonite, syenite, and granite grouped as the “Mitchell Intrusions”.

Site wide, a general trend of decreasing bedrock hydraulic conductivity with depth has been observed (see Drawing 4), though the permeability varies by typically three orders of magnitude at any given depth. However, within the Mitchell Pit area, the geometric mean of bedrock hydraulic conductivity from ground surface to 400 m bgs (or over the depth range tested) above the MTF is $2x10^{-7}$ m/s, with no meaningful decrease in permeability with depth. The geometric mean of bedrock hydraulic conductivity below the MTF is $2x10^{-6}$ m/s at shallow depths (0 to 125 m bgs) and $3x10^{-9}$ at depths greater than 125 m bgs. Therefore, the current data set suggests that variations in permeability observed at a given depth interval within the Mitchell pit area appear to be influenced by location relative to the MTF.

4.2. Dewatering and Depressurization

Slope stability analyses of the Mitchell pit indicate that depressurization targets must be achieved at the bench, interramp, and overall scales (BGC, 2010f). Depressurization must be attained for an area extending approximately 60 m behind the excavated slope face. In addition, depressurization of the overall pit slopes to minimize the potential for rock mass failures is required; specifically the north wall of the proposed pit (BGC, 2010f).

Preliminary open pit slope design criteria have also been developed for the proposed Kerr and Sulphurets pits based on slope stability analyses carried out to date (BGC, 2010c and BGC, 2010d). The analyses indicate that depressurization of the pit walls will be required, as will dewatering of the proposed pits to reduce the potential for seepage from the pit walls. Bench and interramp scale slopes will require depressurization of geological structures which may form potential failure surfaces. At this preliminary phase of analysis it is assumed that complete depressurization must be obtained for an area extending approximately 60 m behind the excavated slope face similar to that assumed for the Mitchell pit.

The basic principles in considering slope depressurization designs (Hoek and Bray, 1981) are to:

- prevent surface water (including water previously drained from the rock mass, and meteoric water) from entering the slope through open tension cracks, fissures, and discontinuities;
- reduce water pressure in the vicinity of the potential failure surfaces by selective surface and sub-surface drainage; and,
- position the drainage so that it reduces the water pressure in the immediate vicinity of the slope – there is no value gained from draining areas well away from the pit.

Dewatering and depressurization methods common for large open pits include:

- vertical perimeter wells;
- vertical in-pit wells;
- in-pit horizontal (or nearly horizontal) drains (i.e., boreholes drilled into the pit slope face); and
- drainage galleries or adits (possibly with supplemental boreholes drilled from a gallery; Atkinson, 2000; Hoek and Sharp, 1970; Brown, 1982).

The proposed Mitchell pit spans the Mitchell valley (see Drawing 2 and Drawing 3) and planned pit excavations reach a maximum depth of approximately 580 m from current ground surface. Therefore it is expected that perimeter wells, while they typically have a long life and are desirable in that respect, will have limited impacts to dewatering later in the mine life. In-pit wells are proposed to achieve the majority of the Mitchell pit depressurization. In-pit horizontal drains will be the primary depressurization method at depths below the MTF within the pit (elevations lower than approximately 1,100 masl on the south side of Mitchell valley, and elevations lower than approximately 950 masl on the north side of Mitchell valley), to intercept groundwater flows to the pit where the bedrock permeability is low and where vertical wells will not likely be effective. This concept is illustrated in Drawing 11.

Sulphurets and Kerr pits are located high on mountain ridges, and planned pit excavations reach maximum depths of approximately 390 m and 250 m, respectively, from current ground surface. It is expected that a combination of vertical perimeter wells and horizontal drains will primarily be required to achieve depressurization targets for these pits.

Drainage galleries were not considered as part of this analysis due to the low bedrock permeabilities observed at depth and the absence of identifiable large, permeable geologic structures. However, there may be some opportunity for this approach proximate to the access of the proposed diversion tunnel south to the Sulphurets valley (i.e., the Mitchell Diversion Tunnel).

5.0 NUMERICAL MODEL DEVELOPMENT

5.1. Overview

This section describes the development of the three-dimensional (3-D) numerical groundwater flow model for the KSM pit depressurization analyses. The objective during development of the numerical groundwater flow model was to simulate groundwater flow directions by incorporating controlling features of the conceptual groundwater flow model for the site, as described in Section 4.0. The numerical groundwater flow model was calibrated to best represent the following components of the hydrogeologic system under steady state conditions:

- groundwater flow within the study area;
- surface water baseflow within the study area; and
- groundwater recharge.

5.2. Numerical Model Description

Groundwater Vistas (version 5.41; ESI, 2007), a graphical user interface, was used to develop the MODFLOW Surfact groundwater flow model for the site. MODFLOW is an industry standard 3-D, finite difference groundwater flow model developed by the U.S. Geological Survey (Harbaugh *et al*, 2000). The model utilized the add-on packages available in Surfact (Version 3.0; HydroGeoLogic, 1998) in order to simulate variably saturated flow and seepage faces.

Inputs to the model include (1) hydraulic parameters that control the flow of water within the model domain, and (2) areal properties and boundary conditions that control the addition and removal of water to and from the model domain.

5.3. Numerical Model Geometry and Grid

The 3-D groundwater flow model domain encompasses the area shown in Drawing 12. The model grid consists of 132 columns and 255 rows, covering an area of approximately 21.5 km by 18 km. Nine model layers were used to discretize the domain in the vertical dimension for a total of approximately 303,000 grid blocks. Uniform 50 m by 50 m grid blocks were defined in the vicinity of the proposed open pits. The horizontal dimensions of grid blocks were expanded away from the pit area by a factor of approximately 1.5 to a maximum of 400 m by 400 m in the outer regions.

The elevation of the top layer was set at ground surface. In the vertical direction, the upper 425 m was divided into 4 layers increasing in thickness from 50 m in layer 1 to 200 m in layer 4. The underlying layers range from 50 m thick in the valley bottoms to 600 m thick below the ridge tops. The base of the model was set at a uniform elevation of -350 masl, which is approximately 600 m below the deepest extent of the proposed open pits. The model grid is shown on Drawing 13.

A groundwater divide was inferred along ridge tops lying at the edge of the hydrogeologic area of interest (see Section 5.6 for discussion of boundary conditions). Grid blocks lying outside of this region were deactivated within the model, as shown in Drawing 13.

5.4. Hydrogeologic Units and Parameters

The distribution of hydrogeologic units within the groundwater model is provided in Drawings 12 and 14 and the hydraulic parameters assigned are described in Table 6. The hydraulic conductivity within the Mitchell pit area was distributed based on proximity to the Mitchell Thrust Fault and depth. Outside of the proposed Mitchell pit area, hydraulic conductivity was assigned to decrease with depth. Due to the thin and discontinuous nature of the overburden, its similar geometric mean hydraulic conductivity to that of the shallow (<125 m bgs) bedrock unit, and general absence in the areas of interest (i.e. the proposed open pits), a distinct overburden model layer was not included. Instead it was assumed to have similar properties to that of the shallow bedrock within the upper model layer (layer 1).

The values of hydraulic conductivity assigned to each hydrogeologic unit were initially based on the results of hydraulic testing performed to date and summarized in Table 4. The hydraulic conductivity values were subsequently refined, as discussed below, during model calibration in order to better match observed hydraulic head and flow targets.

Outside of the proposed Mitchell pit area, a hydraulic conductivity of $1x10^{-7}$ m/s was used for the upper 125 m of the groundwater model, below which a hydraulic conductivity of $1x10^{-8}$ m/s was assigned. These model calibrated values are similar to the geometric mean of hydraulic conductivity with depth for the site ($2x10^{-7}$ m/s for 0 to 125 m bgs and $1x10^{-8}$ m/s for greater than 125 m bgs, see Table 4).

Within the Mitchell pit area model calibration resulted in raising the hydraulic conductivity below the MTF at depths greater than 125 m bgs to values higher than observed through testing. It also resulted in a slightly lower hydraulic conductivity at depths less than 125 m bgs than those observed through testing. In order to mimic the hydraulic heads observed in the Sulphurets pit area, a hydraulic conductivity of $2x10^{-9}$ m/s was assigned for the STF footwall.

Field data is not available for aquifer storage parameters (i.e., specific storage, Ss and specific yield, Sy); therefore the storage parameters were assigned based on representative values from the literature (Maidment, 1992).

5.5. Areal Properties - Recharge

Areal recharge was assigned to the water table to represent groundwater recharge from precipitation and runoff. To represent the anticipated orographic influence (see Section 2.2) recharge was divided into four zones; valley, mid-slope, uplands, and glacier covered areas. The areal zonation was held constant while recharge rates were modified as part of the calibration process in order to best match measured hydraulic heads and creek baseflows. The calibrated rates applied to the four zones are shown on Drawing 15 and in Table 7.

Recharge applied where glaciers are not present increased from 128 mm/yr in the valleys to 164 mm/yr in the uplands, equivalent to approximately 8% to 10% of mean annual precipitation at Sulphurets Creek.

Though sub-glacial groundwater flow has been documented in several geographic locations (Sigurdsson, 1990), little work has been done on glacier-scale groundwater flow, and models to date in the literature have not included coupled subglacial-subsurface drainage (Flowers and Clark, 2002). Rates of basal melting are unlikely to exceed the range of 1 mm/yr to 100 mm/yr over extended time periods, whereas surface melting rates in ablation areas are typically up to four orders of magnitude greater (1,000 mm/yr to 10,000 mm/yr; Boulton et al., 1995); therefore a relatively low rate of recharge of 40 mm/yr was applied to glacier covered areas.

5.6. Boundary Conditions

Three types of boundary conditions were assigned to the model domain: specified head boundaries, head-dependent boundaries and no-flow boundaries. The geometry of the pre-development boundary conditions is shown in Drawing 16.

5.6.1. Creeks

Creeks (i.e., Mitchell, McTagg, Ted Morris and Sulphurets) within the model domain were simulated using the River Package. Water levels and stream bed elevations assigned for each creek were estimated from surface topography, while the conductance was calculated based on assumed channel dimensions and an assumed hydraulic conductivity of the $1x10^{-5}$ m/s for the stream bed.

5.6.2. Lakes

Lakes lying within the model domain (i.e., Sulphurets and Bruce Jack Lake) were modeled using a specified-head boundary. The water level was set at the approximate lake elevations (590 m for Sulphurets and 1371 m for Bruce Jack) for each lake.

5.6.3. No-Flow Boundary Conditions

The ridgelines located to the north, east, west and south of the active model domain were set as no-flow boundaries. These ridges represent inferred groundwater divides. A no-flow boundary was also set to the bottom of the model at elevation -350 masl.

6.0 MODEL CALIBRATION

The groundwater model was calibrated through a trial-and-error process by manually varying hydraulic conductivity and recharge within observed and expected ranges to obtain the best match to hydraulic head measurements recorded in piezometers, and to low flow (i.e. winter months December through March) stream flows measured at available surface water gauging stations. The approach and results of the model calibration are discussed in the following sections.

6.1. Calibration Targets

6.1.1. Hydraulic Head Targets

Groundwater elevation data were available for 45 instruments at the site (see Table 8). Of these 45, 30 are VWPs, standpipe piezometers, or monitoring wells installed within the Mitchell pit and valley waste dump areas. The remaining 15 are standpipe piezometers or monitoring wells located within the Sulphurets and Kerr Pit areas, and the Sulphurets Creek valley. Groundwater elevation data for all locations are limited to summer 2008 or 2009 measurements only, and therefore the small dataset cannot be used to characterize seasonal fluctuations in groundwater elevations at the site. Calibration statistics have been calculated by comparing the most recent (generally late summer-early fall 2009) observed hydraulic heads with hydraulic heads predicted by the model.

As noted in Section 3.4, the change in hydraulic heads observed to date at several of the piezometers (see Appendix B) suggests that they have been stabilizing since drilling occurred (i.e., M09-097S, M09-097D, M09-099, M09-100D, M09-101). As a result, these data were assigned a low matching priority for model calibration.

6.1.2. Creek Flow Measurements

Data available for calibration to creek baseflows are limited to 2008 and 2009 winter low flow measurements at four locations within the site (i.e. gauging stations MC-H1, MCt-H1, SL-H1, and BJL-H1; Drawing 2).

6.2. Calibration Results

Simulated versus measured hydraulic heads for the calibrated model are shown in Drawing 17 for all available hydraulic head data and in Drawing 18 for 'stabilized' measured hydraulic heads only (i.e. removing data from M09-097S, M09-097D, M09-099, M09-100D, M09-101 from the calculation). A normalized root mean square (NRMS) of 10% is generally suggested as a guideline for the maximum difference between simulated and measured target values (NBLM, 2006). The NRMS of the calibration is 7.5% using all measurements, and 4.7% using stabilized hydraulic heads measurements only. Based on these results, the model is considered to be adequately calibrated to measured hydraulic heads.

Measured creek low flows and model simulated baseflows are provided in Table 9. Predicted baseflow to Mitchell Creek at station MC-H1 is 11,225 m^3/d, while predicted baseflow for McTagg (MCT-H1) and Ted Morris Creek (TMC-H1) is 8,997 m^3/d and 11,793 m^3/d, respectively. Predicted outflows at SL-H1 and BJL-H1 (Sulphurets and Bruce Jack Lake outlets) are 16,220 m^3/d and 5,645 m^3/d, respectively. Simulated flows are 15 to 26% of the observed 2008 winter low flows and 24 to 66% of the observed 2009 winter low flows at MCT-H1, SL-H1, and MC-H1, while simulated flows are approximately three times greater than the observed 2008 low flow at BJL-H1. The discrepancy between measured and simulated values can partially be attributed to the complexity in stream flows in these glacier-augmented systems. Future modeling efforts may focus more on matching stream baseflows when year round contributions of the glaciers to stream flows are better understood.

6.3. Pre-Development Simulation Results

A plot of simulated water table contours for the steady state calibrated model is provided in Drawing 19. In general, the water table is predicted to mimic the surface topography as described in the conceptual model of the hydrogeologic system. Within Mitchell Creek watershed, groundwater is predicted to flow from topographically higher regions towards lower lying areas in the center of the valley before discharging to Mitchell Creek. Outside of the Mitchell Creek watershed, groundwater flow is predicted to be directed towards discharge areas located at lakes, and along the McTagg, Ted Morris and Sulphurets Creeks.

7.0 PREDICTIVE DEPRESSURIZATION SIMULATIONS

Transient predictive simulations were performed using the calibrated flow model along with production pit shells provided by MMTS (2010) for ten phases of the mine life: pre-production (year -1), years 1, 2, 3, 4, 5, 10, 20, 30 and life of mine (year 37). The progression of the open pits provided by MMTS is shown on Drawings 20 and 21. It is noted that mining of Kerr and Sulphurets pits begins in years 6 and 19 (not shown), respectively, while mining of Mitchell pit takes place throughout the entire mine life. The proposed mine plan would result in pit footprints of approximately 2 km by 0.5 km for the Kerr pit, and 2 km by 1 km for the Sulphurets pit, with ultimate pit slopes approximately 500 m high. In contrast, the proposed mine plan for Mitchell pit would result in an ultimate pit footprint of approximately 3.5 km by 2.3 km, and pit slopes greater than 1200 m high. To reach the ore beneath the valley floor the Mitchell pit floor would be excavated to an approximate elevation of 270 masl.

The goals of the simulations were to predict the rate of groundwater inflow to the pits in the absence of dewatering wells, to estimate the total groundwater extraction rate required to depressurize the Mitchell, Kerr and Sulphurets pit walls using vertical wells, and to evaluate the range of groundwater inflows to the pits that will need to be collected with horizontal drains to maintain “dry” operating conditions. The results of the numerical simulations were used to estimate the number of dewatering wells and horizontal drains required to meet depressurization requirements during the proposed mine life of 37 years.

7.1. Boundary Conditions

Open pit mining operational shells were simulated using head-dependent boundaries constrained to outflow (i.e. drains) for the years specified above (see Drawings 20 and 21). Water levels within drain cells were specified at the depth of mining. Drains representing the pit (see Drawing 22) were turned on (i.e. became active) within the model between consecutive pits (i.e., Mitchell year 10 pit was turned on in year 7, year 20 pit was turned on in year 15, etc.). The conductance of the drains was set to a high value to allow water to freely drain into the simulated open pits.

For simulations using wells, drain cells were also used to represent vertical dewatering wells within the model. This representation allows the model to predict potential dewatering rates based on generated hydraulic gradients and hydraulic parameters rather than specifying well intake rates *a priori.* All wells were screened across their entire extent. Gridblocks belonging to the well screen were assigned elevated values of hydraulic conductivity. The drain was set at the bottom of the well screen, with the water level set to the desired level (i.e. at the pump intake). The conductance of these cells was also set to a high value to allow water to freely flow into the simulated wells. Perimeter dewatering wells were simulated to be installed in advance of the open pit to achieve depressurization, with the water level (i.e. pump intake) set to an approximate depth of 200 to 250 m below ground surface. In-pit dewatering wells of variable depth were introduced to the model to control groundwater inflows to the pit as benches were established with the introduction of the expanding pit shells.

7.2. Open Pit Depressurization Simulation Results

7.2.1. Unmitigated Flows

A simulation that incorporated no mitigative dewatering techniques (i.e. no wells) was performed to provide a minimum bound on the dewatering rate that would be required to keep the pit “dry” (i.e. to minimize seepage inflows). Note that predicted pit wall pore pressures are not reduced sufficiently to make this a viable development scenario. Results of this simulation are presented in Drawing 23 for the proposed Mitchell, Kerr, and Sulphurets pits. The predicted average flow to Mitchell pit throughout the life of mine is approximately 5,400 m^3/d for this simulation. Mining of Kerr pit begins in Year 6, and the average unmitigated flow is predicted to be 300 m^3/d; a fraction of the flow predicted for Mitchell pit. Mining of Sulphurets pit begins in Year 19, and the average unmitigated flow is predicted to be 170 m^3/d.

7.2.2. Mitigated Flows

A trial-and-error approach was used to determine the most effective perimeter and in-pit well scheme for the proposed open pits as each develops throughout the mine life using the pit phases provided. Plots of predicted inflows to vertical dewatering wells (both perimeter and in-pit wells) and residual inflows to horizontal drains are provided in Drawing 24 for the resulting base case dewatering system for the proposed Mitchell, Kerr and Sulphurets pits. Groundwater contours and cross sections through the open pits along model row 65 and columns 56 and 74 at the end of the mine life are provided in Drawing 25, while drawdown contours are provided in Drawing 26. Resulting well layouts for the pit phases are provided in Appendix C.

7.2.2.1. Mitchell Pit

The average annual flows to the wells and drains are presented in Table 10, along with the well development schedule for Mitchell pit using the base case dewatering system. The total annual groundwater extraction rate is predicted to decline from approximately 12,220 m^3/d when the system is turned on to about 5,580 m^3/d by year 37. The total average annual dewatering rate is predicted to be approximately 7,390 m^3/d throughout the life of mine; 6,590 m^3/d of which is captured by perimeter and in-pit wells, while the remaining 800 m^3/d will be captured by horizontal drains. At the start of mining operations when the depth of mining is shallow, perimeter wells account for all of the groundwater extracted. At later time when large portions of the pits are advanced below the depth of perimeter well intakes, of the majority of the groundwater inflow will need to be controlled by in-pit wells and horizontal drains. It is predicted that approximately 120 vertical wells will be required throughout the life of mine, of which three-quarters will be in-pit wells (see Section 8.0 for further discussion on well layouts).

7.2.2.2. Kerr Pit

The average annual flows to the wells and drains are presented in Table 11, along with the well development schedule for Kerr pit for the base case dewatering system. Flows are not predicted during the first phase of pit development. The total annual groundwater extraction rate from mine year 12 onward is predicted to vary from approximately 440 m^3/d up to 2,750 m^3/d. In general, the total average annual dewatering rate is predicted to be approximately 730 m^3/d; 600 m^3/d is captured by vertical wells, while the remaining 130 m^3/d will be intercepted by horizontal drains. Approximately 14 vertical wells are estimated to be required throughout the life of mine. Because the proposed depth of mining at Kerr pit is not as deep as that proposed at Mitchell pit, perimeter dewatering wells comprise the majority of wells (i.e., 10 of the 14 wells).

7.2.2.3. Sulphurets Pit

The average annual flows to Sulphurets pit are presented in Table 11 for the base case dewatering system. As discussed in Section 7.2.1, the average unmitigated flow is predicted to be 170 m^3/d for the proposed pit. Vertical wells are not expected to be effective at capturing the predicted low groundwater inflow rates to the pit; therefore vertical wells were not used for these simulations. The average flows to Sulphurets pit for the base case dewatering system decrease from the unmitigated case to 130 m^3/d due to the influence of depressurization in Mitchell pit. However, horizontal drains will still be needed to depressurize the pit walls and capture the seepage reporting to the pit.

7.3. Sensitivity Analyses

Sensitivity simulations were performed to evaluate changes to predicted pit inflows and dewatering rates for each pit for a reasonable range of input parameters. For each set of sensitivity simulations, hydraulic parameters were modified to investigate the impact on the base case mitigated depressurization simulation results. The following seven simulation runs were performed to compare to the base case dewatering results:

1. Hydraulic conductivity of all hydrogeologic units was increased by a factor of five
2. Hydraulic conductivity of all hydrogeologic units was decreased by a factor of five
3. Specific storage (S_s) of all units was increased by a factor of 5, while specific yield (Sy) was increased by a factor of two
4. Recharge for each recharge zone was increased by a factor of two
5. Recharge for the glacier covered areas only was increased by a factor of five
6. Hydraulic conductivity of all hydrogeologic units was increased by a factor of five and specific storage (S_s) of all units was increased by a factor of five, while specific yield (Sy) was increased by a factor of two (i.e., a combination of sensitivity runs 1 and 3)
7. As sensitivity run 6, with recharge in each zone increased by a factor of two (i.e., a combination of sensitivity runs 1, 3, and 4)

Plots of predicted inflows to the open pits, dewatering wells and horizontal drains for each sensitivity scenario relative to the base case results are provided in Appendix D, and average annual flows for each case are summarized in Table 14. Results of the sensitivity simulations demonstrate that:

- Significant changes in predicted pit inflows and well extraction rates are found for scenarios where hydraulic conductivity is increased (Runs 1, 6, and 7) or decreased (Run 2) relative to the base case. If the bulk hydraulic conductivity of the hydrogeologic units is found to be a factor of five greater than assumed in the base case (Runs 1, 6 and 7), the total predicted amount of groundwater to be handled by the Mitchell pit dewatering system would increase by a factor of 1.5 to 2.5. It is likely that additional dewatering wells would be required to manage the increased flows. Flows to both Kerr and Sulphurets nearly cease for these scenarios, due to resulting lowered hydraulic heads below the proposed pit excavations. If the bulk hydraulic conductivity is decreased by a factor of five relative to the base case (Run 2) the spacing of the vertical wells is less effective at depressurization and increased seepage reports to each pit. Total flows to the proposed pits increase relative to the base case for Kerr and Sulphurets for this scenario due to higher hydraulic heads within the ridges. Obtaining larger scale estimates of the bulk rock mass hydraulic conductivity within the proposed pit areas (i.e. pumping tests) would remove some of the uncertainty associated with this parameter. It will be important to continue to characterize the permeability of all hydrogeologic units as the mine develops and dewatering wells are installed in order to make any necessary adaptations to the dewatering program (i.e., number of wells and well spacing).
- Recharge is an important parameter for the hydrogeologic system. If recharge is increased by a factor of two everywhere relative to the base case (Run 4) the total predicted amount of groundwater to be handled by the Mitchell pit dewatering system would increase by a factor of 1.5. Total predicted flows to Kerr pit and Sulphurets pit are increased by factors of 1.9 and 2.6, respectively. Recharge was also increased for Run 5 by a factor of 5 for glacier covered areas only. The resulting flows were quite similar to the base case, indicating that the results are not overly sensitive to recharge beneath the glaciers.
- Storage is also a sensitive parameter for the hydrogeologic system. Overall groundwater inflows for Mitchell pit increase by a factor of 1.3 relative to the base case when only specific storage and specific yield are increased (Run 3). Residual flows to Kerr and Sulphurets pit increase by factors of 3.5 and 2.5, respectively. Obtaining estimates of bedrock storage properties within the proposed pit areas through pumping tests would again remove some of the uncertainty associated with this parameter.

8.0 PFS LEVEL DESIGN OF OPEN PIT DEPRESSURIZATION SYSTEMS

In order to depressurize the proposed Mitchell pit slopes, a combination of vertical perimeter wells, vertical in-pit wells and horizontal in-pit drains will be required. Perimeter wells will be used to lower the water table in advance of mining activities. In-pit wells and horizontal drains will be used to mitigate groundwater inflows as the pit develops and as benches become established. A conceptual diagram of this scenario is provided in Drawing 11. It is expected that horizontal drains will be required in the deeper portions of the pit where vertical perimeter and in-pit wells may be less effective due to the lower hydraulic conductivity of the bedrock at depth.

Perimeter and in-pit vertical wells will also be required to lower the water table in advance of mining activities for Kerr pit. To depressurize the proposed Sulphurets and Kerr pit slopes and to mitigate groundwater inflows as the pits develop, horizontal in-pit drains are also recommended.

The estimated number of perimeter and in-pit dewatering wells that will be needed to achieve depressurization objectives are provided in Tables 10 and 11. Note that the number of wells is approximate; the actual number of wells installed and their locations will need to be modified to account for such factors as:

- poor drilling conditions (i.e. lost holes);
- low (or high) yielding wells;
- topographic or structural controls (e.g. avalanche chutes and/or run-out control plans, dewatering well bench locations and access, etc.); and
- significant changes in pit development strategy

However, these factors should not substantially affect the estimates for average flow rates or the total number of operating wells provided the average spacing between wells can be generally maintained (i.e. for perimeter wells) and the density of wells is preserved (i.e. for in-pit wells). A schematic diagram showing a typical vertical pit dewatering well specification is provided in Appendix E to support cost estimating for the depressurization system.

At this level of design, BGC has not made specific recommendations on the locations of dewatering/geotechnical berms (i.e. berms that will accommodate dewatering well installation and ongoing maintenance). The distribution has been left to the discretion of the mining engineers. BGC can work with the mine planners, as required, to optimize the locations of these pit slope features. The locations of wells used in the model to achieve depressurization objectives are shown in Appendix C for the pit phases considered as guidance to mine planners for project cost estimation.

8.1. Perimeter Wells

Dewatering the bedrock in the vicinity of the Mitchell and Kerr pits will require a balance between extracting groundwater at the highest sustainable rate and thus achieving the maximum amount of drawdown, while still maintaining sufficient head within the pumping well to efficiently and continuously withdraw groundwater. In addition, the spacing between dewatering wells needs to be sufficiently close to prevent groundwater from evading capture and reporting to or pressurizing the pit walls while minimizing well interference.

Based on the modeling results for Mitchell pit, perimeter dewatering wells will be used primarily up to year 7 and it is anticipated that the perimeter wells will be able to yield sustainable flow rates ranging from 1.9 to 6.7 L/s (30 US gpm to 105 US gpm) assuming an approximate distance between wells of 200 m to 300 m. Using these parameters and the total predicted groundwater flows from the model, it is estimated that approximately 29 perimeter wells will need to be installed over the life of mine (see Table 10). The average depth of each perimeter well will be approximately 220 m, requiring a total drilling length of 6,380 m for perimeter wells.

Based on the modeling results for Kerr pit, perimeter dewatering wells will be used primarily from year 12 onward. It is anticipated that the wells will yield sustainable flow rates ranging from 0.4 to 1.1 L/s (5.7 US gpm to 20 US gpm) assuming an approximate distance between wells of 200 to 300 m. Using these parameters and the total predicted groundwater flows from the model, it is estimated that approximately 10 perimeter will need to be installed over the life of mine (Table 11), targeting the west, north, and south sides of the pit. The depth of each perimeter well will be approximately 200 m, requiring a total drilling length of 2,000 m for perimeter wells.

8.2. In-Pit Wells

In-pit wells will be required to depressurize the Mitchell pit walls as the pit develops. Simulated well yields are expected to be less than for perimeter dewatering wells due to decreasing bedrock hydraulic conductivity with depth. Anticipated yields for in-pit wells range from 1.1 L/s to 2.6 L/s (17 US gpm to 42 US gpm). The model results indicate that approximately 91 in-pit wells will be required over the life of mine (Table 10). The depths for in-pit wells will be variable and dependent upon factors such as collar elevation relative to the bottom of the pits, duration each well is active, and bedrock hydraulic conductivity. However, it is estimated that the average well depth will be approximately 235 m, requiring a total drilling length of approximately 21,360 m of in-pit wells.

The modeling results for Kerr pit indicate that 4 in-pit wells will be required. It is anticipated that the wells will yield sustainable flow rates ranging from 0.4 to 1.1 L/s (5.7 US gpm to 20 US gpm). The depth of each in-pit well will be approximately 200 m, requiring a total drilling length of 800 m for in-pit wells.

The number of wells proposed does not include any redundancy to facilitate maintenance of the wells. Some level of redundancy in the number of wells will be required to account for well and pump maintenance. The level of redundancy will depend on the ability of pump maintenance personnel to replace the pumps in a timely manner and should be determined by mine planners based on the tolerable level of risk to the operation.

8.3. Horizontal Drains

In-pit horizontal drains will be required primarily at depths below the MTF within the Mitchell pit (i.e. elevations lower than approximately 1,100 masl on the south side of Mitchell valley, and elevations lower than approximately 950 masl on the north side of Mitchell valley), to intercept flow to the pit where the bedrock permeability is low and where vertical wells will not be effective. Horizontal drain layouts will largely need to be field fit. Typically, drains will be installed at fractures along benches where seeps are observed to occur, or in response to increasing or undesirable pressure readings in the pit slope instrumentation network. To meet stability requirements, the water table should be depressurized to approximately 60 m behind the pit wall; therefore, drain lengths of 100 m are recommended. Table 12 provides a horizontal drain schedule on a yearly basis and it is estimated that approximately 31 km of horizontal drains will be required during the life of mine.

In-pit horizontal drains will be required to intercept flow to the pit where bedrock permeability is low and where vertical wells will not be effective for the Kerr and Sulphurets pits as well. To meet preliminary slope stability requirements, the water table should be depressurized to approximately 60 m behind the pit wall; therefore, drain lengths of 100 m are recommended. Table 13 provides a horizontal drain schedule on a yearly basis. It is estimated that approximately 8 km and 6 km of horizontal drains will be required for the proposed Kerr and Sulphurets pits, respectively, during the life of mine.

9.0 SUMMARY

A calibrated 3-D numerical model was used to evaluate the degree of effort required to depressurize the open pit slopes to satisfy geotechnical constraints identified as part of the Kerr, Sulphurets, and Mitchell open pit slope studies (BGC, 2010f). The current report provides estimates of the required number of vertical dewatering wells and horizontal drains required to achieve sufficient depressurization of the rock mass, as well as associated groundwater extraction rates.

The total annual groundwater extraction rate for Mitchell pit is predicted to vary from 12,220 m^3/d when the system is turned on to 5,580 m^3/d by mine year 37. The total average annual dewatering rate is predicted to be approximately 7,390 m^3/d throughout the life of mine; 6,590 m^3/d is captured by perimeter and in-pit wells, while the remaining 800 m^3/d will be captured by horizontal drains. Based on the total predicted flows in the model and hydraulic tests performed in the pit area, which primarily comprised packer tests, it is estimated that approximately 29 perimeter wells and 91 in-pit wells will be required over the life of mine. The total drilling length for perimeter and in-pit wells is estimated to be approximately 6,380 m and 21,360 m, respectively. In addition, it is estimated that approximately 31 km of horizontal drains will be required to aid in depressurization of the pit slopes.

The total annual groundwater extraction rate for Kerr pit is predicted to vary from 410 m^3/d in year 12 increasing to 2,750 m^3/d in mine year 17. In general, the total average annual dewatering rate is predicted to be approximately 730 m^3/d; 600 m^3/d will be captured by vertical wells, while the remaining 130 m^3/d will be intercepted by horizontal drains. Approximately 14 vertical wells with a length of 200 m each, for a total drilling length of 2,800 m, are estimated to be required throughout the life of mine. In addition, it is estimated that approximately 8 km of horizontal drains will be required to aid in depressurization of the pit slopes.

The average annual flows to Sulphurets pit is predicted to be 130 m^3/d. Vertical wells are not expected to be effective at capturing the low groundwater inflow rates predicted for this pit; therefore vertical wells were not used for these analyses. It is estimated that approximately 6 km of horizontal drains will be required to aid in depressurization of the pit slopes and to capture the seepage reporting to the pit.

The efficiency of the proposed pit dewatering system is sensitive to the hydraulic properties of the bedrock. It will be important to continue to characterize the hydraulic properties of the bedrock as site investigations and design advances at the next stage of the project.

10.0 RECOMMENDATIONS FOR FUTURE WORK

Numerical analyses presented in this report were based on available hydrogeologic data. Recommendations to reduce potential risks to achieving dewatering/depressurization goals are provided in the sections below.

10.1. Hydraulic Parameters of the Bedrock

It will be important to continue to characterize the permeability of all hydrogeologic units as the mine investigation activities continue and particularly during mining as the open pits develop and dewatering wells are installed. This will allow for adaptations to the dewatering program (i.e., number of wells and well spacing) as new data becomes available. Pumping tests in proto-type pit dewatering wells are recommended at the feasibility-stage to obtain bulk bedrock hydraulic conductivity as well as bedrock storage data within the proposed Mitchell and Kerr pit areas to remove some of the uncertainty associated with these parameters. Installation of proto-type dewatering wells will also help to refine the design, logistics and cost estimating for installation of vertical perimeter and in-pit wells. In addition, additional packer test data should be collected in the Sulphurets pit area during the next stage of design. Obtaining bulk hydraulic conductivity data within the proposed Sulphurets pit areas through a pumping test would remove some of the uncertainty associated with this parameter and is also recommended.

10.2. Hydraulic Head Data

Hydraulic head data is essential for calibration of the numerical model. Hydraulic head data for the piezometers and monitoring wells at the site is limited to summer 2008 or 2009 measurements; therefore seasonal trends have not yet been observed or estimated. It is important that monitoring of the hydraulic heads at the piezometers and wells continue year round (quarterly at minimum) to observe seasonal trends. Seasonal variations should now be available from dataloggers attached to vibrating wire pressure transducers installed in the proposed Mitchell pit area, and this data should be collected during upcoming field visits.

It is recommended that additional piezometers be installed within the proposed pit footprints, in particular Kerr and Sulphurets pit, where data is limited. Vibrating wire piezometers or standpipe monitoring wells equipped with pressure transducers and dataloggers should also be used to facilitate collection of year-round data in these areas.

10.3. Meteorologic and Hydrologic Data

Year-round glacier contributions to streamflow were not available at the time of this analysis. Baseflow estimates for the streams at site are based on winter low flows. Glacier contributions to the low flow measurements are uncertain, but could be significant. Focusing on collection of additional hydrologic and meteorologic data will be important moving forward for the depressurization analyses, as well as for the overall site water balance. Future groundwater modeling efforts should focus on matching stream baseflows when year round glacier contributions to stream flows are better understood.

10.4. Rates of Mining Progress

The rate of slope depressurization must lower the phreatic surface in advance of slope excavation. The proposed dewatering system is based on mining plans provided by MMTS (2010). The dewatering system should be re-evaluated if significant deviations from the proposed mining plans are expected. In addition, ten pit shells (Year -1, 1, 2, 3, 4, 5, 10, 20, 30, and LOM) were considered for these analyses. Annual pit shells should be implemented for modeling purposes at the next level of project design (i.e. feasibility study level design).

10.5. Risks and Opportunities

The in situ estimates of hydraulic conductivity available for the site are small-scale estimates (i.e. effectively point scale estimates relative to the regional scale of the model). The test methods used to date may not adequately capture the potential effects of pit-slope scale heterogeneity on groundwater flow patterns and pit depressurization needs due to the potential effects of geologic variability. Also, the range of hydraulic conductivity values used in the modeling are at the lower range over which vertical wells might prove effective at meeting the pit depressurization needs. It will therefore be important to obtain larger scale estimates of bedrock hydraulic conductivity and storage in the vicinity of the open pits (i.e. pumping tests) to confirm that vertical wells are feasible at this site.

Drainage galleries were not considered for the pit depressurization analysis due to low bedrock hydraulic conductivities observed at depth and the lack of identification of large permeable structures. However, there may be some opportunity for this approach due to the proximity of the surface water diversion tunnel which extends from the eastern Mitchell pit area southwards to the Sulphurets valley.

11.0 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,

BGC ENGINEERING INC.
per:

Randi Thompson, M.A.Sc., P.Eng.
Hydrogeological Engineer

Craig Thompson, M.Sc., G.I.T.
Hydrogeologist

Reviewed by:

Trevor Crozier, M.Eng., P.Eng.
Senior Hydrogeological Engineer

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

REFERENCES

Atkinson, L.C., 2000. The role and mitigation of groundwater in slope stability. Slope Stability in Surface Mining, W. A. Hustrulid, M K McCarter and D J A Van Zyl (eds), 89-97. SME: Littleton, Colorado.

BGC Engineering Inc. 2008. BGC Project Memorandum: Geotechnical Comments and Recommendations – KSM Project. 0638-002 December 4, 2008.

BGC Engineering Inc. 2009a. BGC Project Memorandum: PEA-Update Open Pit Slope Design Criteria – Mitchell Deposit. 0638-003 April 30, 2009.

BGC Engineering Inc. 2010a. KSM Preliminary Geohazards Overview: Upper Sulphurets & Ted Morris Valleys. DRAFT Memorandum, 0638-005 January 31, 2010.

BGC Engineering Inc. 2010b. KSM Preliminary Geohazards Overview: Highway 37 Access. DRAFT Memorandum, 0638-005 January 31, 2010.

BGC Engineering Inc. 2010e. KSM Pre-Feasibility Study - Mine Area and Access Road **Geohazards** - DRAFT, 0638-005 February 26, 2010.

BGC Engineering Inc. 2010c. KSM Project: **Kerr** Zone – Preliminary Open Pit Slope Design, 0638-003-08, April 16, 2010.

BGC Engineering Inc. 2010d. KSM Project: **Sulphurets** Zone – Preliminary Open Pit Slope Design, 0638-003-08 February 26, 2010.

BGC Engineering Inc. 2010f. KSM Project: **Mitchell** Zone - Pre-Feasibility Open Pit Slope Design, 0638-003 April 16, 2010.

Boulton, G.S., Caban, P.E., and Van Gijssel, K., 1995. Groundwater Flow Beneath Ice Sheets: Part I – Large Scale Patterns. Quaternary Science Reviews, 14, pp. 545-562.

Brown, A. 1982. Influence and control of groundwater in large slopes. In: 3rd International Conference of stability in Surface Mining (ed. C.O. Brawner). Vol 3. SIME pp. 92-42.

Environmental Simulations Inc. (ESI), 2007. Groundwater Vistas, Version 5.41, Reinholds, PA., U.S.A.

Flowers, G.E. and Clarke, G.K.C., 2002. A multicomponent coupled model of glacier hydrology 1. Theory and synthetic examples. Journal of Geophysical Research, 107, doi:10.1029/2001JB001122.

Forster, C. and Smith, L., 1988. Groundwater Flow Systems in Mountainous Terrain 2. Controlling Factors. Water Resources Research, 24, pp. 1011-1023.

Harbaugh, AW, ER Banta, MC Hill, and MG McDonald, 2000. Modflow 2000, The U.S. Geological Survey Modular Ground-Water Model – User Guide to the Modularization Concepts and the Ground-Water Flow Process. U.S. Geological Survey Open File Report 00-92, 130 p.

Hoek, E., and Bray, J.W., 1981. Rock Slope Engineering. Institution of Mining and Metallurgy, London. 358 pp.

Hoek, E., and Sharp, J.C., 1970. Improving the stability of rock slopes by drainage. In: Proceedings of the Symposium on Planning Open Pit Mines, Johannesburg 1970. A.A. Balkema, 1971. pp. 193-198.

HydroGeoLogic Inc., 1998. MODFLOW-SURFACT Version 3.0: A comprehensive MODFLOW-based flow and transport simulator. Code Documentation Report. HydroGeoLogic, Reston, VA.

Klohn Crippen Berger Ltd., 2009a. Kerr-Sulphurets-Mitchell Project 2008 Site Investigation Report. Prepared for Seabridge Gold Inc. April 2009.

Klohn Crippen Berger Ltd, 2009b. “2009 Packer Testing.xls”, an electronic data file for 2009 packer tests carried out by KBCL. Received October 15, 2009.

Klohn Crippen Berger Ltd., 2009c. “Mine Site Surficial and Structural Geology Map”. Received December 18, 2009.

Klohn Crippen Berger Ltd., 2009d. 2009 KCBL Drill Logs for Rock and Soil. Received December 4, 2009.

Lechner, M.J., 2008. Updated Mitchell Creek Technical Report, Northern British Columbia. Resource Modelling Inc.

Loukas, A. and Quick, M.C., 1996. Spatial and temporal distribution of storm precipitation in southwestern British Columbia. Journal of Hydrology, 174, pp. 37-56.

Margolis, J., 1993. Geology and intrusion-related copper-gold mineralization, Sulphurets, British Columbia: unpublished PhD dissertation, University of Oregon, Eugene, 289p, 5 maps.

Maidment, David R. 1992. Handbook of Hydrology. McGraw-Hill, New York.

Moose Mountain Technical Services, 2010. Series 6 KSM Open Pit Phase AutoCAD files, dated March 2010.

Monger, J., Price, R. 2002. The Canadian Cordillera: Geology and Tectonic Evolution. Canadian Society of Geophysicists Recorder. (27)2: 17-36

Nevada Bureau of Land Management (NBLM), 2006. Groundwater Modeling Guidance for Mining Activities, Instruction Memorandum No. NV-2006-065.

Rescan Environmental Services Ltd., 2009a. KSM Project 2008 Baseline Studies Report. Prepared for Seabridge Gold Inc. March 2009.

Rescan Environmental Services Ltd., 2009b. Project memorandum “2008 KSM Precipitation Estimate Adjustment”, prepared for Seabridge Gold Inc. June 24, 2009.

Rescan Environmental Services Ltd., 2009c. “Precipitation Summary.xls” excel data file, received December 21, 2009.

Rescan Environmental Services Ltd., 2009d. KSM Meteorological Station Data excel files, received December 21, 2009.

Rescan Environmental Services Ltd., 2009e. RES-MW borehole logs received November 27, 2009.

Rescan Environmental Services Ltd., 2009f. “Data_Transfer_Masterfile_27112009_CF.xls’, excel file received November 27, 2009.

Rescan Environmental Services Ltd., 2010. “Flow Summary for Klohn (010810).xls” excel file, received January 11, 2010.

Rutqvist, J. and Stephansson, O. (2003) The Role of Hydromechanical Coupling in Fractured Rock Engineering. Hydrogeology Journal, 11, pp. 7-40.

Savell, M. 2008. Report on Diamond Drilling at the KSM (Kerr-Sulphurets-Mitchell) Property.

Sigurdsson, F., 1990. Groundwater from glacial areas in Iceland, *Jökull*, 40, pp 119-145.

TABLES

Table 1. Mean Monthly Precipitation Estimates

Month	Sulphurets Creek (880 masl) [1] mm	Unuk River- Eskay Creek (1989-2000 climate normals) (887 masl) [2] mm	Bob Quinn AGS (1971-2000 climate normals) (610 masl) [2] mm	Stewart Airport (1971-2000 climate normals) (7 masl) [2] mm
January	193	245	60	219
February	125	212	41	143
March	83	169	27	112
April	80	93	25	85
May	71	93	29	73
June	77	68	34	67
July	92	82	57	70
August	111	142	50	109
September	201	224	86	201
October	275	243	102	298
November	168	218	62	234
December	178	260	69	232
Annual	**1,654**	**2,047**	**642**	**1,843**

Notes:

1. From Rescan, 2009c. Mean monthly precipitation as shown based on ClimateBC Precipitation Estimate.
2. From Rescan, 2009c. Mean monthly precipitation as shown based on regional meteorological station data set.

Table 2. Sulphurets Creek Station and Regional Average Temperatures (°C)

Month	Sulphurets Creek (880 masl) [1]	Mitchell Creek Station (830 masl) [1]	Unuk River-Eskay Creek (1989-2000 climate normal) (887 masl) [2]	Bob Quinn AGS (1971-2000 climate normal) (610 masl) [2]	Stewart Airport (1971-2000 climate normal) (7 masl) [2]
Oct-07	-2.6	n/a	0.7	3.9	6.3
Nov-07	-7.0	n/a	-4.4	-3.7	0.6
Dec-07	-13.5	n/a	-6.8	-8.8	-2.7
Jan-08	-11.7	n/a	-8.2	-8.5	-3.7
Feb-08	-9.8	n/a	-5.7	-6.4	-1.3
Mar-08	-4.6	n/a	-4.1	-0.3	1.9
Apr-08	-1.6	n/a	0.4	3.9	5.9
May-08	3.0	n/a	3.9	8.2	10.5
Jun-08	5.5	n/a	7.6	11.9	13.7
Jul-08	7.9	n/a	9.9	14.1	15.1
Aug-08	8.5	n/a	10.3	13.4	14.3
Sep-08	5.7 [3]	n/a	5.7	9.3	11.1
Oct-08	n/a	n/a	0.7	3.9	6.3
Nov-08	n/a	n/a	-4.4	-3.7	0.6
Dec-08	n/a	n/a	-6.8	-8.8	-2.7
Jan-09	n/a	-6.2	-8.2	-8.5	-3.7
Feb-09	n/a	-6.9	-5.7	-6.4	-1.3
Mar-09	n/a	-4.9	-4.1	-0.3	1.9
Apr-09	n/a	1.3	0.4	3.9	5.9
May-09	3.2	5.2	3.9	8.2	10.5
Jun-09	7.8	9.9	7.6	11.9	13.7
Jul-09	10.7	14.1	9.9	14.1	15.1
Aug-09	6.8	11.2	10.3	13.4	14.3
Sep-09	1.1	7.4	5.7	9.3	11.1
Oct-09	1.1	2.2	0.7	3.9	6.3
Nov-09	-3.6	0.0	-4.4	-3.7	0.6

Notes:
"n/a" indicates data not available.
1. 2009 values based on Rescan, 2009d; meteorological station data files.
2. Adapted from Table 3.6-2 of the Rescan 2008 Baseline Studies Report.
3. Missing 11 days of data due to sensor malfunction.

Table 3. Baseline Hydrometric Station Mean and Low Flow Measurements

Gauging Station	Northing (NAD 83, Zone 9)	Easting (NAD 83, Zone 9)	Median Elevation (masl)	Water-shed Area (km^2)	Median Slope (%)	% Glacier Cover	2008 Measurements [1] Mean Annual Flow (m^3/s)	2008 Measurements [1] Jun-Sep Low Flow (m^3/s)	2008 Measurements [1] Winter Low Flow (m^3/s)	2009 Measurements [1] Mean Annual Flow (m^3/s)	2009 Measurements [1] Jun-Sep Low Flow (m^3/s)	2009 Measurements [1] Winter Low Flow (m^3/s)	Location
SC-H1	6,261,490	408,256	1,481	299	47	38	31.2	13.7	5.0	23.8	11.7	2.0	Sulphurets Cr. before confluence with Unuk River
MC-H1	6,265,356	421,145	1,662	42	38	54	2.9	1.5	0.41	3.9	1.4	0.54	Mitchell Creek
MCT-H1 [3]	6,265,104	418,685	1,540	32	55	38	1.7	1.6	0.68	2.62	1.48	0.26	McTagg Creek north tributary of Mitchell Creek
TMC-H1	6,259,533	416,854	1,565	57	51	49	n/a	n/a	n/a	n/a	n/a	n/a	Ted Morris Creek south tributary of Sulphurets Creek
SL-H1 [2,3]	6,261,229	420,398	1,610	84	36	48	5.0	4.3	0.97	6.64	4.13	0.28	Sulphurets Lake at outlet of lake
BJL-H1 [2]	6,258,899	425,840	1,625	18	32	41	n/a	0.23	0.02	n/a	n/a	n/a	Bruce Jack Lake at outlet of lake

Notes:

1. Unless otherwise noted, flows are based on Rescan data file Rescan 2010.
2. 2008 flows at these stations are based on Rescan's March 2009 report "KSM Project 2008 Baseline Studies", Tables 5.2-2, 5.2-4, 5.2-7, 5.2-10 and 5.2-11.
3. 2008 winter low flow for SL-H1 is from Table 5.2-4, while 2008 low flows for MCT-H1 and BJL-H1 stations are from Table 5.2-11 of Rescan (2009a).

Table 4. Bedrock Hydraulic Conductivity Data Summary

Grouping	Depth [1] (m bgs)	Bedrock Hydraulic Conductivity (m/s)			No. of Tests
		geometric mean	maximum	minimum	
By Area					
Kerr Pit (all data)	0 to 100	1E-07	9E-07	6E-09	7
Sulphurets Pit (all data)	0 to 50	3E-07	8E-07	8E-08	2
Sulphurets Pit (all data)	> 50	2E-09	1E-08	5E-10	5
Outside Mitchell Pit Area (all data)	0 to 125	1E-07	5E-06	5E-10	51
Outside Mitchell Pit Area (all data)	> 125	2E-09	5E-09	8E-10	2
Mitchell Pit Area (all data)	0 to 125	9E-07	1E-05	2E-08	28
Mitchell Pit Area (all data)	> 125	2E-08	7E-07	3E-10	15
Mitchell Pit Area - below MTF	0 to 125	2E-06	1E-05	8E-08	18
Mitchell Pit Area - below MTF	> 125	3E-09	1E-07	3E-10	8
Mitchell Pit Area - above MTF	0 to 125	2E-07	1E-06	2E-08	11
Mitchell Pit Area - above MTF	> 125	1E-07	7E-07	2E-08	6
By Lithology					
Sedimentary	0 to 125	2E-07	5E-06	4E-09	31
Intrusive	0 to 125	9E-08	1E-06	8E-09	9
Volcanics	0 to 125	4E-07	1E-05	5E-10	34
Fault Zone	0 to 125	2E-07	3E-07	9E-08	4
No Distinction					
All Data	0 to 125	2E-07	1E-05	5E-10	79
All Data	> 125	1E-08	7E-07	3E-10	17

Notes:

1. "m bgs" indicates meters below ground surface.

Table 5. Overburden Hydraulic Conductivity Data Summary

Borehole ID	Location	Test Midpoint Depth (m)	K (m/s)	Test Type [1]	Material	Note	Reference
2009 Field Season							
KC08-01	Mitchell Waste Dump Area	19.78	2.0E-08	FH test	Till		Rescan (2009f)
KC09-10	Sulphurets Valley	4.85	1.2E-07	FH test	Overburden		KCBL (2009b)
KC09-09	Mitchell Waste Dump Area	4.35	2.6E-07	FH test [3]	Moraine		KCBL (2009b)
KC09-09	Mitchell Waste Dump Area	10.48	4.9E-07	FH test [3]	Colluvium		KCBL (2009b)
KC09-09	Mitchell Waste Dump Area	21.70	4.8E-08	FH test [3]	Colluvium		KCBL (2009b)
KC09-09	Mitchell Waste Dump Area	33.55	9.6E-08	FH test [3]	Colluvium		KCBL (2009b)
KC09-09	Mitchell Waste Dump Area	50.00	1.0E-08	FH test [3]	Colluvium		KCBL (2009b)
KC09-09	Mitchell Waste Dump Area	68.10	1.0E-06	FH test [3]	Colluvium		KCBL (2009b)
RES-MW-13A	Kerr Pit Area	41.80	6.1E-08	CH packer test	Colluvium[2]		Rescan (2009f)
RES-MW-13B	Kerr Pit Area	24.65	3.2E-09	FH test	Colluvium[2]		Rescan (2009f)
2008 Field Season							
KC08-01	Mitchell Waste Dump Area	NA	7.0E-06	FH test [3]	Colluvium	4 tests	KCBL (2009a)
KC08-02	Mitchell Waste Dump Area	NA	1.0E-05	FH test [3]	Colluvium	2 tests	KCBL (2009a)
KC08-02	Mitchell Waste Dump Area	NA	4.0E-06	FH test [3]	Till	5 tests	KCBL (2009a)
KC08-03	Mitchell Waste Dump Area	NA	3.0E-06	FH test [3]	Till	7 tests	KCBL (2009a)
KC08-03	Mitchell Waste Dump Area	NA	6.0E-08	FH test [3]	Clay	3 tests	KCBL (2009a)
2009 field season geomean			7.0E-08				
all data - geomean			2.2E-07				
All data - minimum			3.2E-09				
All data - maximum			1.0E-05				

Notes:

1. "FH" indicates falling head test.
2. Borehole logs received from Rescan (Rescan 2009e) indicated "fluvial boulders", however, this is the location of the Kerr Landslide (BGC 2010e); therefore material has been changed here to colluvium.
3. This test was carried out in an open borehole so results are approximate at best.

Table 6. Calibrated Hydraulic Parameters Assigned to Hydrogeologic Units

Hydrogeologic Unit	Model Layer(s)	Model Depth Extent (m bgs)	Hydraulic Conductivity (m/s) Horizontal	Hydraulic Conductivity (m/s) Kh:Kv	Ss [2] (1/m)	Sy [2] (-)
Till Deposits and Shallow Bedrock	1 and 2	0 to 125	1.0E-07	1	5E-06	0.10
Undifferentiated Bedrock	3 to 9	125 to model base	1.0E-08	1	1E-06	0.01
***Within Mitchell Pit Area*[1]**						
Till Deposits and Shallow Bedrock	1	0 to 50	5.0E-07	1	5E-06	0.10
Bedrock above MTF - North and South Slopes	2 to 5	50 to varied depths	1.0E-07	1	1E-06	0.01
Bedrock Below MTF - Valley Bottom	2	50 to 125	5.0E-07	1	1E-06	0.01
Bedrock Below MTF	3 to 5	125 to varied depths	1.0E-08	1	1E-06	0.01
Bedrock Below MTF	6 to 9	varied depths to model base	2.0E-09	1	1E-06	0.01
Sulphurets Zone, STF foot wall	2 to 5	50 to varied depths	2.0E-09	1	1E-06	0.01

Notes:
1. "MTF" indicates Mitchell Thrust Fault. b. "STF" indicates Sulphurets Thrust Fault.
2. "Ss" indicates specific storage, "Sy" indicates specific yield, and "n" indicates porosity.

Table 7. Calibrated Recharge Rates Applied to the Numerical Model

Recharge Zone	Rate		
	mm/yr	m/d	% of Mean Annual Precipitation at Sulphurets Creek
< 900 masl (valley bottom and no glacier coverage)	128	0.00035	7.7%
900 to 1,300 masl (mid-slope and no glacier coverage)	146	0.00040	8.8%
> 1,300 masl (uplands and no glacier coverage)	164	0.00045	9.9%
glacier coverage	40	0.00011	2.4%

Table 8. Groundwater Elevations Statistics – Observed vs. Simulated Heads

Monitoring Point ID	Easting (NAD 83, Zone 9)	Northing (NAD 83, Zone 9)	Installation Midpoint Elevation (m)	Observed Head (m)	Simulated Head (m)	Residual (m)	Observed Head Date [1]	Location	Note
M09-095	423218	6265214	587.5	892.2	995.3	-103.1	Sep-09	Mitchell Pit	5
M09-096S	423602	6265470	866.8	909.9	922.4	-12.5	Sep-09	Mitchell Pit	5
M09-096D	423684	6265472	682.6	904.2	1006.8	-102.6	Sep-09		5
M09-097S	423184	6266421	1252.1	1259.0	1191.6	67.4	Sep-09	Mitchell Pit	2, 5
M09-097D	423267	6266482	1080.3	1266.9	1210.1	56.9	Sep-09		2, 5
M09-098	422877	6266115	1111.8	1114.5	1107.8	6.6	Sep-09	Mitchell Pit	5
M09-099	422970	6265791	505.6	759.6	1018.1	-258.5	Sep-09	Mitchell Pit	2, 5
M09-100S	422341	6265243	746.8	793.7	811.3	-17.5	Sep-09	Mitchell Pit	5
M09-100D	422285	6265225	555.5	691.6	898.6	-207.0	Sep-09		5
M09-101	423471	6264732	1070.6	1155.4	1250.6	-95.3	Sep-09	Mitchell Pit	2, 5
M09-102A	422359	6264604	904.4	1087.4	1162.3	-74.9	Sep-09	Mitchell Pit	5
KC08-01	419050	6264806	645.2	659.4	672.1	-12.7	Oct-09	Mitchell Valley	
KC08-02	419148	6265217	664.8	667.6	677.8	-10.2	Oct-09	Mitchell Valley	
KC08-03	421056	6265445	689.0	762.3	772.5	-10.2	Sep-08	Mitchell Valley	
KC09-07	421734	6265576	748.5	772.0	794.1	-22.1	Aug-09	Mitchell Valley	3
KC09-08	421353	6265767	776.6	795.0	819.8	-24.8	Oct-09	Mitchell Valley	
KC09-09-OB	420759	6265394	739.2	742.5	769.0	-26.5	Oct-09	Mitchell Valley	
KC09-09-BDRK	420759	6265394	648.4	759.3	774.5	-15.3	Oct-09		
KC09-10	419477	6262095	868.7	892.3	858.4	33.9	Sep-09	Sulphurets Valley	
KC09-11	418143	6262738	761.3	783.3	746.4	36.9	Sep-09	Sulphurets Valley	3
KC09-12	417981	6264528	593.3	629.7	666.5	-36.8	Oct-09	Mitchell Valley	
KC09-13	417121	6263726	610.2	638.7	681.4	-42.7	Oct-09	Mitchell Valley	
RES-MW04A	421823	6265535	691.8	782.5	792.3	-9.8	Sep-09	Mitchell Valley	
RES-MW04B	421823	6265535	760.3	778.9	789.5	-10.6	Oct-09		
RES-MW05A'	424009	6266295	1010.1	1091.4	1070.1	21.3	Sep-09	Mitchell Pit	
RES-MW05B	424009	6266295	1051.1	1078.8	1055.5	23.3	Sep-09		
RES-MW06A	422853	6265322	749.7	830.3	834.6	-4.3	Sep-09	Mitchell Pit	
RES-MW06B	422853	6265322	803.8	830.6	830.6	0.0	Sep-09		
RES-MW07A	422108	6262881	1380.3	1446.6	1373.8	72.7	Oct-09	Sulphurets Pit	
RES-MW07B	422108	6262881	1432.2	1451.9	1403.1	48.8	Sep-09		
RES-MW08A	421652	6259482	1313.8	dry well	1306.2	NA	Oct-09	Kerr Pit	
RES-MW09A	422047	6258147	1237.5	1305.2	1246.4	58.8	Sep-09	Kerr Pit	
RES-MW09B	422047	6258147	1278.0	1302.8	1248.4	54.4	Oct-09		
RES-MW10A	423368	6264955	1103.9	1132.7	1102.8	29.8	Oct-09	Mitchell Pit	
RES-MW10B	423368	6264955	1127.5	1133.5	1107.4	26.1	Oct-09		
RES-MW11A	416559	6262585	434.4	501.3	NA	NA	Oct-09	Mitchell Creek at confluence with Sulphurets	4
RES-MW11B	416559	6262585	485.1	498.7	NA	NA	Oct-09		4
RES-MW12A	418336	6262265	624.3	681.3	687.8	-6.5	Oct-09	Sulphurets Valley	
RES-MW12B	418336	6262265	686.1	699.2	687.8	11.4	Sep-09		
RES-MW13A	421537	6260330	933.5	1011.2	1035.8	-24.6	Sep-09	Kerr Pit	
RES-MW13B	421537	6260330	995.7	1009.7	1036.2	-26.5	Oct-09		
RES-MW14A	419253	6262000	776.4	817.1	796.8	20.3	Oct-09	Sulphurets Valley	
RES-MW14B	419253	6262000	803.8	819.7	803.3	16.4	Sep-09		
RES-MW15A	417277	6263378	484.3	548.9	641.3	-92.4	Oct-09	Mitchell Valley	
RES-MW15B	417277	6263378	559.2	560.6	627.1	-66.5	Oct-09		

Notes:
1. Observed head data shown above was last available observed measurement.
2. Observed head data to date indicates water level at piezometer has not stabilized. Matching observed head data deemed of low importance.
3. Observed water level based on KCBL borehole logs (KCBL, 2009d).
4. Observation well is outside of the groundwater model domain.
5. Coordinates for these piezometers are for the VW tip locations.

Table 9. Measured Low Flows and Simulated Baseflows at Creek Gauging Stations

Gauging Station	Northing (NAD 83, Zone 9)	Easting (NAD 83, Zone 9)	2008 Measured Winter Low Flow (m^3/s)	2008 Measured Winter Low Flow (m^3/d)	2009 Measured Winter Low Flow (m^3/s)	2009 Measured Winter Low Flow (m^3/d)	Calibrated Model Simulated Baseflow (m^3/d)	Simulated Flow (% of '08 Measured Low Flow (%)	Simulated Flow (% of '09 Measured Low Flow) (%)	Location
MC-H1	6,265,356	421,145	0.50	43,200	0.54	46,829	11,225	26%	24%	Mitchell Creek
MCT-H1	6,265,104	418,685	0.68	58,752	0.26	22,118	8,997	15%	41%	McTagg Creek north tributary of Mitchell Creek
TMC-H1	6,259,533	416,854	n/a	n/a	n/a	n/a	11,793	n/a	n/a	Ted Morris Creek south tributary of Sulphurets Creek
SL-H1	6,261,229	420,398	0.97	83,808	0.28	24,538	16,220	19%	66%	Sulphurets Lake at outlet of lake
BJL-H1	6,258,899	425,840	0.02	1,728	n/a	n/a	5,645	327%	n/a	Bruce Jack Lake at outlet of lake

Table 10. Estimated Number of Vertical Wells and Overall Predicted Annual Flows for Mitchell Pit

Mine Year	Vertical Wells									Total Residual Flow to Horizontal Drains			Total Flows (Vertical Wells and Horizontal Drains)	
	Number of Operating Wells	New Well Total	New In-Pit Wells	Average New Well Length	Total Vertical Well Extraction Rate			Average Flow Per Vertical Well						
				(m)	(m^3/d)	(US gpm)	(L/s)	(L/s)	(US gpm)	(m^3/d)	(US gpm)	(L/s)	(m^3/d)	(L/s)
-2	20	20	0	200	11,490	2,110	133	6.7	105	730	130	8.4	12,220	141
-1	26	6	6	200	11,490	2,110	133	5.1	81	730	130	8.4	12,220	141
1	26	0	0	--	11,490	2,110	133	5.1	81	730	130	8.4	12,220	141
2	26	0	0	--	8,960	1,640	104	4.0	63	690	130	8.0	9,650	112
3	26	0	0	--	6,430	1,180	74	2.8	45	650	120	7.5	7,080	82
4	26	0	0	--	5,710	1,050	66	2.5	40	810	150	9.4	6,520	75
5	26	0	0	--	4,980	910	58	2.2	35	970	180	11.2	5,950	69
6	26	0	0	--	4,240	780	49	1.9	30	1,140	210	13.2	5,380	62
7	40	30	24	230	6,650	1,220	77	1.9	31	1,080	200	12.5	7,730	89
8	40	0	0	--	9,060	1,660	105	2.6	42	1,030	190	11.9	10,090	117
9	40	0	0	--	7,920	1,450	92	2.3	36	850	160	9.8	8,770	102
10	40	0	0	--	6,770	1,240	78	2.0	31	680	120	7.9	7,450	86
11	40	0	0	--	5,590	1,030	65	1.6	26	500	90	5.8	6,090	70
12	40	0	0	--	6,470	1,190	75	1.9	30	460	80	5.3	6,930	80
13	40	0	0	--	7,350	1,350	85	2.1	34	430	80	5.0	7,780	90
14	42	35	32	240	8,260	1,520	96	2.3	36	390	70	4.5	8,650	100
15	42	0	0	--	8,310	1,520	96	2.3	36	850	160	9.8	9,160	106
16	42	0	0	--	8,360	1,530	97	2.3	37	1,160	210	13.4	9,520	110
17	42	0	0	--	7,790	1,430	90	2.1	34	1,590	290	18.4	9,380	109
18	42	0	0	--	7,210	1,320	83	2.0	31	740	140	8.6	7,950	92
19	42	0	0	--	6,620	1,210	77	1.8	29	300	60	3.5	6,920	80
20	42	0	0	--	6,440	1,180	75	1.8	28	290	50	3.4	6,730	78
21	42	0	0	--	6,250	1,150	72	1.7	27	280	50	3.2	6,530	76
22	42	0	0	--	6,060	1,110	70	1.7	26	270	50	3.1	6,330	73
23	42	0	0	--	5,930	1,090	69	1.6	26	320	60	3.7	6,250	72
24	42	0	0	--	5,800	1,060	67	1.6	25	380	70	4.4	6,180	72
25	50	21	21	240	5,620	1,030	65	1.3	21	880	160	10.2	6,500	75
26	50	0	0	--	5,430	1,000	63	1.3	20	1,370	250	15.9	6,800	79
27	50	0	0	--	5,240	960	61	1.2	19	1,890	350	21.9	7,130	83
28	50	0	0	--	5,170	950	60	1.2	19	1,580	290	18.3	6,750	78
29	50	0	0	--	5,090	930	59	1.2	19	1,260	230	14.6	6,350	73
30	50	0	0	--	5,020	920	58	1.2	18	950	170	11.0	5,970	69
31	50	0	0	--	4,950	910	57	1.1	18	640	120	7.4	5,590	65
32	50	0	0	--	4,910	900	57	1.1	18	680	120	7.9	5,590	65
33	50	8	8	240	4,870	890	56	1.1	18	710	130	8.2	5,580	65
34	50	0	0	--	4,830	890	56	1.1	18	750	140	8.7	5,580	65
35	50	0	0	--	4,800	880	56	1.1	18	780	140	9.0	5,580	65
36	50	0	0	--	4,760	870	55	1.1	17	820	150	9.5	5,580	65
37	50	0	0	--	4,720	870	55	1.1	17	860	160	10.0	5,580	65
TOTAL		120	91											
AVERAGE	41			230	6,590	1,210	76	2.1	33	800	150	9.3	7,390	86

Notes:
1. End of period pits considered included pre-production (year -1), year 1, year 2, year 3, year 4, year 5, year 10, year 20, year 30, and LOM (year 37) provided by MMTS March 2010, and correspond to the mine year listed above.

Table 11. Estimated Number of Vertical Wells and Overall Flows for Kerr and Sulphurets Pits

	KERR PIT														SULPHURETS PIT	
	Vertical Wells									Total Residual Flow to Pit (Horizontal Drain Flow)		Total Flows to Pit (Vertical Wells and Horizontal Drains)		Residual Flow to Pit (Horizontal Drain Flow)	
	Number of Operating Wells	New Well Total	New In-Pit Wells	Average New Well Length	Total Vertical Wells Extraction Rate			Average Flow Vertical Well							
Mine Year				(m)	(m^3/d)	(US gpm)	(L/s)	(L/s)	(US gpm)	(m^3/d)	(L/s)	(m^3/d)	(L/s)	(m^3/d)	(L/s)
6	0	0	0	--	0.0	0.0	0.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
7	0	0	0	--	0.0	0.0	0.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
8	0	0	0	--	0.0	0.0	0.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
9	0	0	0	--	0.0	0.0	0.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
10	0	0	0	--	0.0	0.0	0.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
11	0	0	0	--	0.0	0.0	0.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0
12	7	7	2	200	410	80	5.0	0.7	11	0	0.0	410	4.7	0.0	0.0
13	14	7	2	200	810	150	9.0	0.6	10	0	0.0	810	9	0.0	0.0
14	14	0	0	--	1,230	230	14	1.0	16	0	0.0	1,230	14	0.0	0.0
15	14	0	0	--	1,380	250	16	1.1	18	490	5.7	1,870	22	0.0	0.0
16	14	0	0	--	1,530	280	18	1.3	20	970	11.2	2,500	29	0.0	0.0
17	14	0	0	--	1,350	250	16	1.1	18	1,400	16.2	2,750	32	0.0	0.0
18	14	0	0	--	1,170	210	14	1.0	16	530	6.1	1,700	20	0.0	0.0
19	14	0	0	--	980	180	11	0.8	12	90	1.0	1,070	12	130	1.5
20	14	0	0	--	910	170	11	0.8	12	80	0.9	990	11	90	1.0
21	14	0	0	--	830	150	10	0.7	11	70	0.8	900	10	50	0.6
22	14	0	0	--	750	140	9.0	0.6	10	60	0.7	810	9.4	0.0	0.0
23	14	0	0	--	690	130	8.0	0.6	9.1	50	0.6	740	8.6	40	0.5
24	14	0	0	--	630	120	7.0	0.5	7.9	40	0.5	670	7.8	60	0.7
25	14	0	0	--	600	110	7.0	0.5	7.9	40	0.5	640	7.4	200	2.3
26	14	0	0	--	580	110	7.0	0.5	7.9	40	0.5	620	7.2	310	3.6
27	14	0	0	--	550	100	6.0	0.4	6.8	30	0.3	580	6.7	410	4.7
28	14	0	0	--	540	100	6.0	0.4	6.8	30	0.3	570	6.6	300	3.5
29	14	0	0	--	520	100	6.0	0.4	6.8	30	0.3	550	6.4	210	2.4
30	14	0	0	--	500	90	6.0	0.4	6.8	30	0.3	530	6.1	140	1.6
31	14	0	0	--	480	90	6.0	0.4	6.8	30	0.3	510	5.9	100	1.2
32	14	0	0	--	470	90	5.0	0.4	5.7	20	0.2	490	5.7	100	1.2
33	14	0	0	--	460	80	5.0	0.4	5.7	20	0.2	480	5.6	90	1.0
34	14	0	0	--	450	80	5.0	0.4	5.7	20	0.2	470	5.4	80	0.9
35	14	0	0	--	440	80	5.0	0.4	5.7	20	0.2	460	5.3	80	0.9
36	14	0	0	--	430	80	5.0	0.4	5.7	20	0.2	450	5.2	70	0.8
37	14	0	0	--	420	80	5.0	0.4	5.7	20	0.2	440	5.1	70	0.8
TOTAL		14	4												
AVERAGE				200	600	110	6.9	0.6	9.9	130	1.5	730	8.4	130	1.5

Notes:
1. End of period pits considered included pre-production (year -1), year 1, year 2, year 3, year 4, year 5, year 10, year 20, year 30, and LOM (year 37) provided by MMTS March 2010, and correspond to the mine year listed above.
2. Mining begins in year 6 for Kerr pit and year 19 for Sulphurets pit.
3. Average flows for Kerr pit are from year 6 to year 37. Average flows for Sulphurets pit are from year 19 to year 37.

Table 12. Mitchell Pit Horizontal Drain Estimate

Mine Year	Number of New Drains	Length of New Horizontal Drains (m)
-1	0	0
1	5	500
2	5	500
3	5	500
4	5	500
5	5	500
6	5	500
7	5	500
8	5	500
9	5	500
10	5	500
11	5	500
12	5	500
13	10	1,000
14	10	1,000
15	10	1,000
16	10	1,000
17	10	1,000
18	10	1,000
19	10	1,000
20	10	1,000
21	10	1,000
22	10	1,000
23	10	1,000
24	10	1,000
25	10	1,000
26	10	1,000
27	10	1,000
28	10	1,000
29	10	1,000
30	10	1,000
31	10	1,000
32	10	1,000
33	10	1,000
34	10	1,000
35	10	1,000
36	10	1,000
37	10	1,000
Total	310	31,000

Notes:
1. Horizontal drain lengths of 100 m are assumed.

Table 13. Kerr and Sulphurets Pits Horizontal Drain Estimate

Mine Year	KERR PIT [1]		SULPHURETS PIT [2]	
	Number of New Drains	Length of New Horizontal Drains (m)	Number of New Drains	Length of New Horizontal Drains (m)
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	10	1,000	0	0
14	10	1,000	0	0
15	10	1,000	0	0
16	10	1,000	0	0
17	10	1,000	0	0
18	10	1,000	0	0
19	10	1,000	5	500
20	10	1,000	5	500
21	0	0	5	500
22	0	0	5	500
23	0	0	5	500
24	0	0	5	500
25	0	0	5	500
26	0	0	5	500
27	0	0	5	500
28	0	0	5	500
29	0	0	5	500
30	0	0	5	500
Total	80	8,000	60	6,000

Notes:

1. Mining begins in Year 6 for Kerr Pit and is in completed by Year 20.
2. Mining begins in Year 19 for Sulphurets Pit and is completed by Year 30.

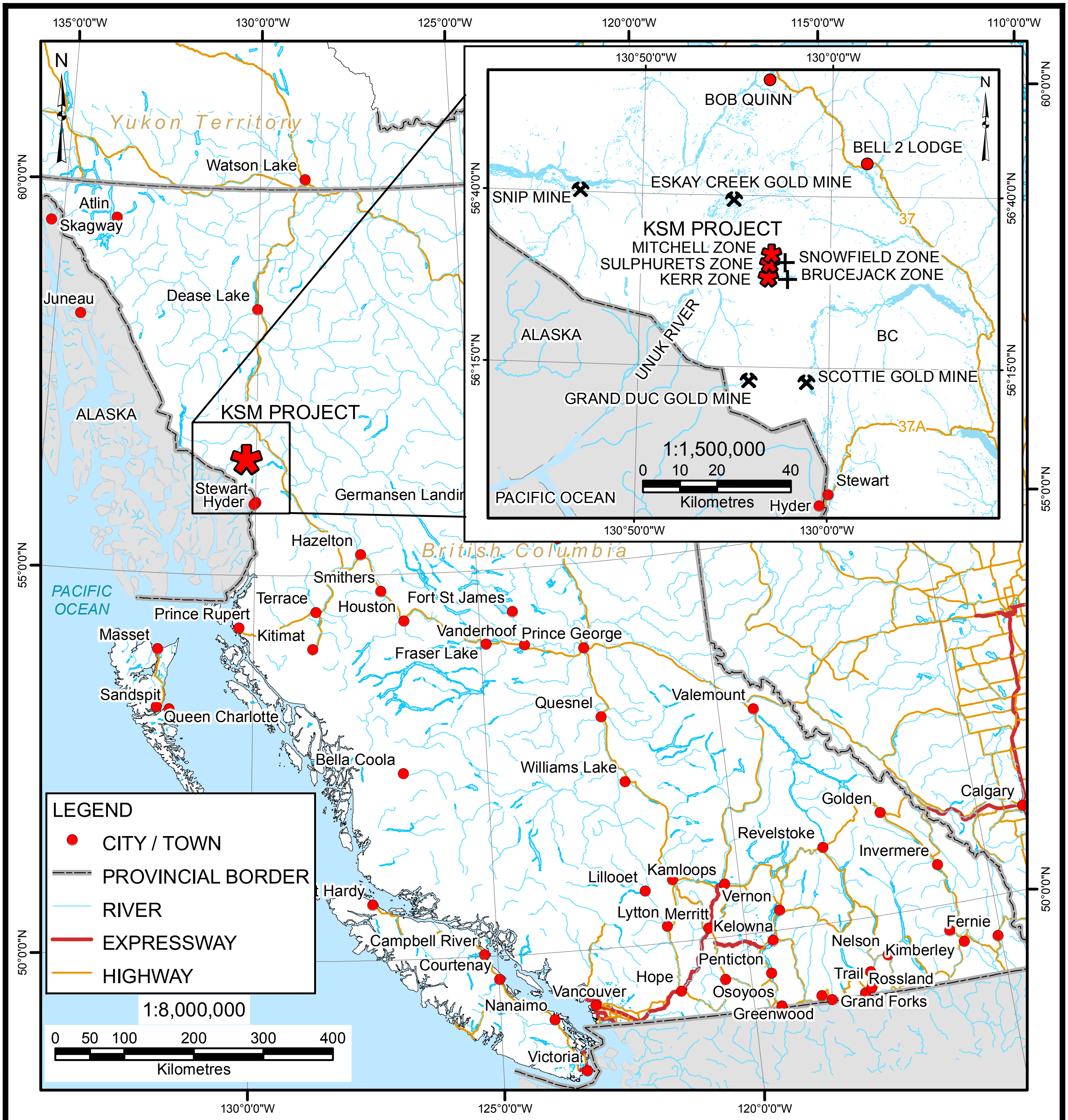
Table 14. Sensitivity Analysis - Summary of Results

Simulation [1]	Description [2]	Average Annual Flows (m^3/d)				
		Mitchell Pit		Kerr Pit		Sulphurets Pit
		Wells	Residual to Pit	Wells	Residual to Pit	Residual to Pit
Base case	Calibrated model	6,590	800	600	130	130
S.A. Run 1	Raised all K's half order of magnitude (x5)	10,100	1,130	60	0.0	0.0
S.A. Run 2	Lowered all K's half order of magnitude (x5)	4,170	1,940	560	750	800
S.A. Run 3	Raised Ss by half order of magnitude (x5) and Sy by factor of 2	7,980	1,620	700	450	320
S.A. Run 4	Raised recharge by factor of 2	9,610	1,160	1,040	320	340
S.A. Run 5	Raised recharge by factor of 5 for glacier covered areas only	6,970	860	610	160	130
S.A. Run 6	Raised K's and Ss half order of magnitude (x5) and Sy by factor of 2	11,680	1,520	90	0.0	0.0
S.A. Run 7	Raised K's and Ss half order of magnitude (x5), Sy by factor of 2, and recharge by factor of 2	16,120	2,120	550	10.0	4.0

Notes:

1. "S.A." indicates "sensitivity analysis". These runs were modified as described above relative to the base case simulations for dewatering.
2. "K" indicates hydraulic conductivity. "Ss" indicates specific storage, and "Sy" indicates specific yield.

DRAWINGS



X:\Projects\0638\004\Workspace\20090827_Geology\Project_Location.mxd

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC, AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THIS REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

SCALE:	1:8,000,000	DESIGNED:	MAB
DATE:	APRIL 2010	CHECKED:	DK
DRAWN:	WKL	APPROVED:	DK

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

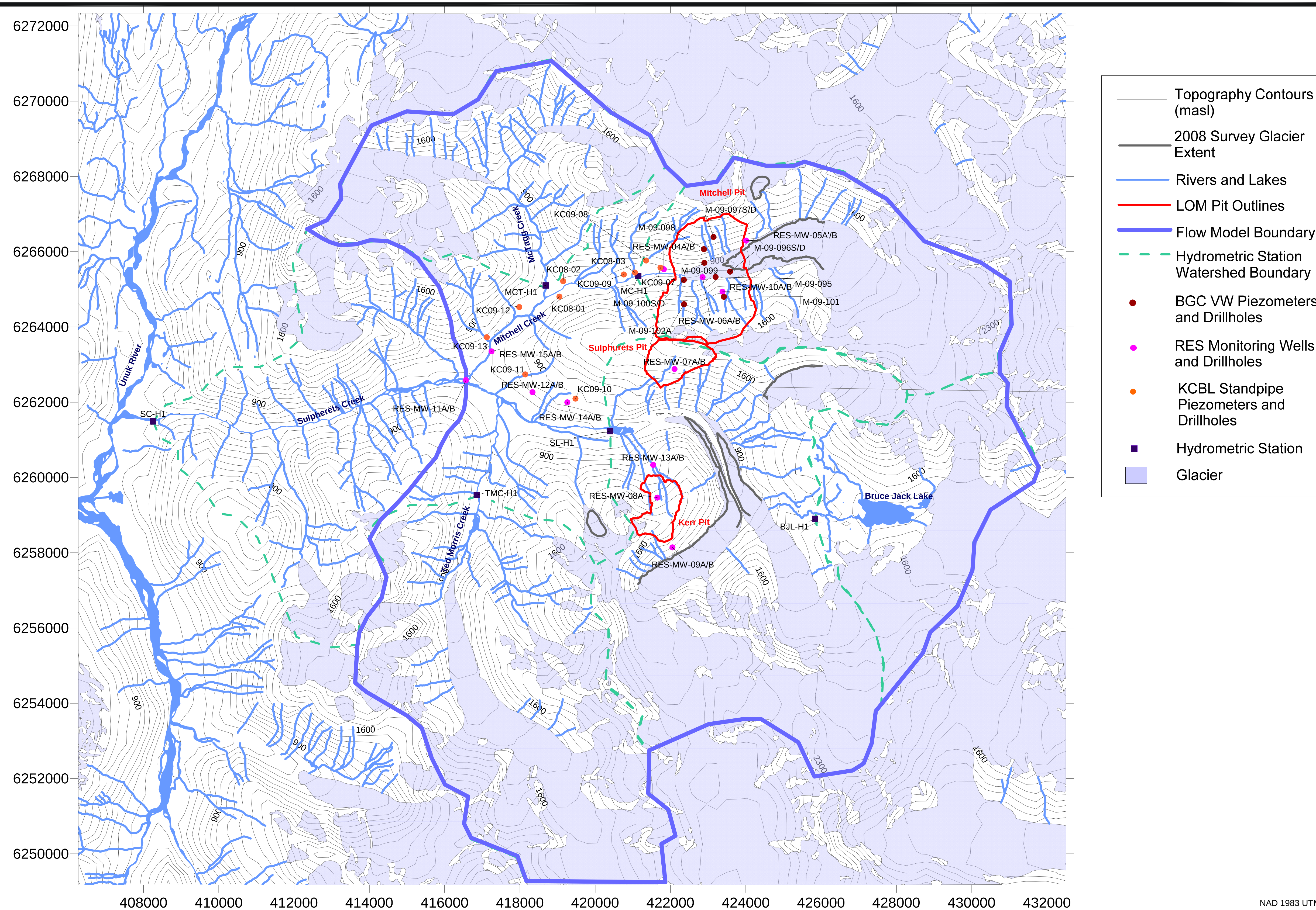
PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
PROJECT LOCATION

CLIENT:
SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-004	01	A

FIG TO BE READ WITH BGC REPORT TITLED "KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES" DATED APRIL 2010



AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC, AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THIS REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	AS SHOWN
DATE:	APRIL 2010
DRAWN:	RT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

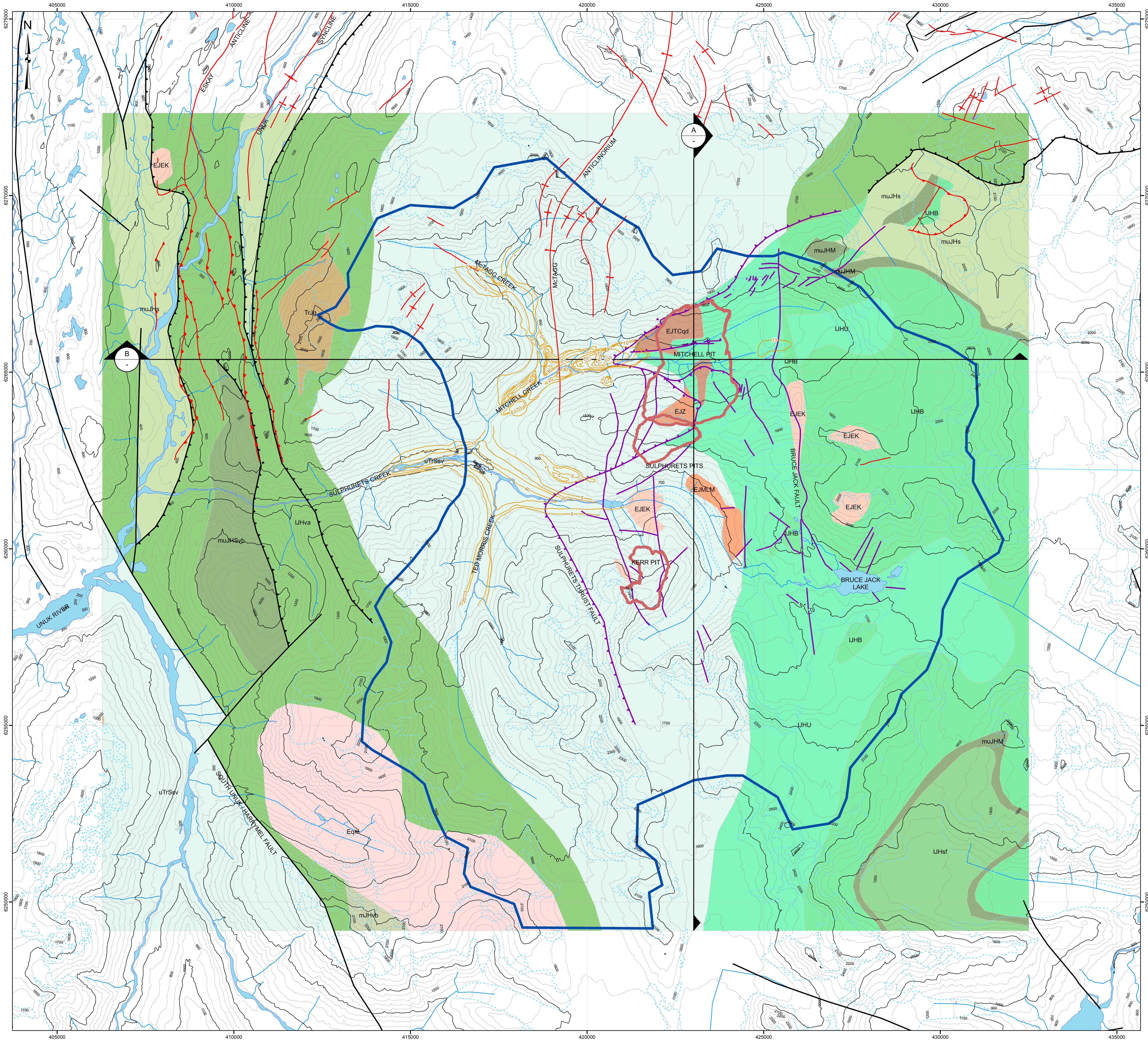
CLIENT: SEABRIDGE GOLD INC.

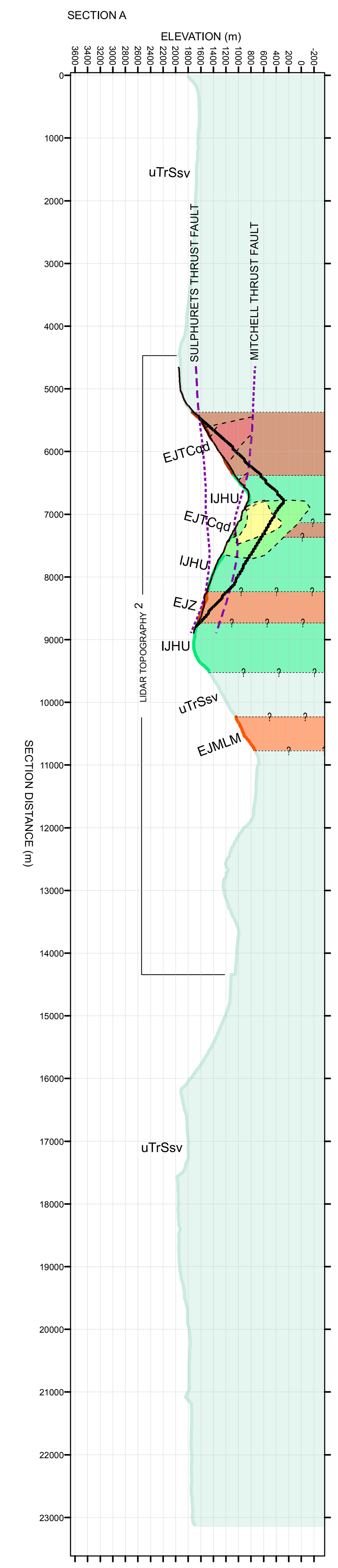
PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: SITE PLAN

PROJECT No.:	DWG No.:	REV.:
0638-004	2	REV

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/KSM_SitePlanMap.srf





GEOLOGY LEGEND

HAZELTON GROUP

- muJHSvb - MESOZOIC - SALMON RIVER FORMATION BASALTIC VOLCANIC ROCKS
- muJHM - MESOZOIC - MOUNT DILWORTH FORMATION CALC-ALKALINE VOLCANIC ROCKS
- lJHB - MESOZOIC - BETTY CREEK FORMATION VOLCANICLASTIC ROCKS
- lJHU - MESOZOIC - UNUK RIVER FORMATION ANDESITIC VOLCANIC ROCKS
- lJHva - MESOZOIC ANDESITIC VOLCANIC ROCKS
- lJHsf - MESOZOIC MUDSTONE, SILTSTONE, SHALE FINE CLASTIC SEDIMENTARY ROCKS
- mJHvb - MESOZOIC BASALTIC VOLCANIC ROCKS
- muJHs UNDIVIDED SEDIMENTARY ROCKS

STUHINI GROUP

- uTrSsv - MESOZOIC MARINE SEDIMENTARY AND VOLCANIC ROCKS

INTRUSIVE ROCKS

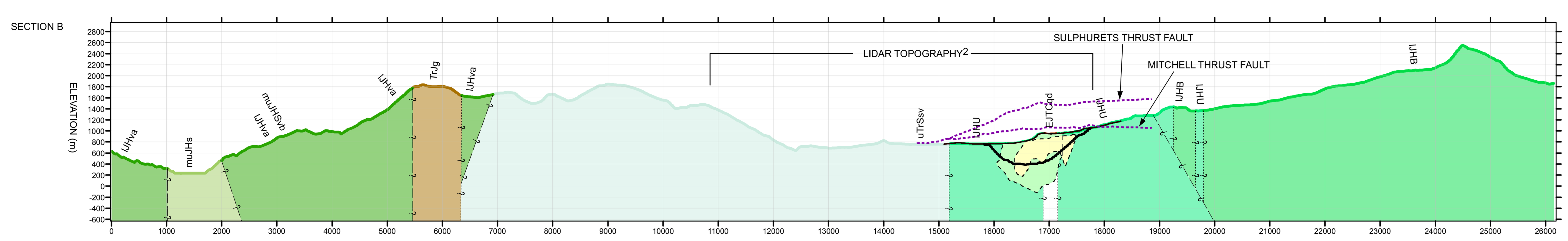
- Eqm - CENOZOIC - COAST PLUTONIC COMPLEX (?) QUARTZ MONZONITIC INTRUSIVE ROCKS
- EJEK - MESOZOIC ESKAY PORPHYRY, KNIPPLE PORPHYRY OR INEL STOCK FELDSPAR PORPHYRITIC INTRUSIVE ROCKS
- EJMLM - MESOZOIC - MELVILLE AND LEHTO PLUTONS, MITCHELL INTRUSIONS, RED BLUFF PORPHYRY STOCK MONZODIORITIC TO GABBROIC INTRUSIVE ROCKS
- EJZ - MESOZOIC - ZIPPA MOUNTAIN PLUTONIC COMPLEX DIORITIC INTRUSIVE ROCKS
- EJTCqd - MESOZOIC - TEXAS CREEK PLUTONIC SUITE QUARTZ DIORITIC INTRUSIVE ROCKS
- TrJg - MESOZOIC UNNAMED INSTRUSIVE ROCKS, UNDIVIDED
- LTrSMK - MESOZOIC - STIKINE, McQUILAN OR KATETE MOUNTAIN PLUTONIC SUITES DIORITIC INTRUSIVE ROCKS

ALTERATION

- QSP ALTERATION
- CHLORITIC / PROPYLITIC ALTERATION
- MONZONITE INTRUSIVE

LEGEND

- SECTION LINE
- OPEN PIT CRESTS
- GROUNDWATER MODEL AREA
- OVERBURDEN THICKNESS ISOPACH
- FAULT / FOLD STRUCTURES (MRDU)
- NORMAL FAULT (SEABRIDGE)
- THRUST FAULT (SEABRIDGE)
- NORMAL FAULT (BCGS)
- THRUST (BCGS)
- FAULT (BCGS)
- PERMANENT SNOW / ICE
- 500m ELEVATION CONTOUR
- 100m ELEVATION CONTOUR
- FAULT - INFERRED (BGC)
- CONTACT - INFERRED (BGC)
- THRUST FAULT - INTERPRETED (SEABRIDGE)
- THRUST FAULT - INFERRED (SEABRIDGE)



Scale 1:50,000

Kilometers

NOTES:

1. GEOLOGICAL BOUNDARIES ACQUIRED FROM BRITISH COLUMBIA GEOLOGICAL SURVEY GEOFILE GF2005-9.
2. TOPOGRAPHIC INFORMATION OUTSIDE LIDAR BOUNDARIES BASED ON GEOBASE DATA, NATURAL RESOURCES CANADA.
3. ALTERATION DEFINED ONLY IN MITCHELL PIT AREA, BASED ON SEABRIDGE GOLD INC. INTERPRETATIONS.
4. OPEN PIT CRESTS WERE PROVIDED BY MMTS MARCH 10, 2010.
5. OVERBURDEN THICKNESS CONTOURS BASED ON MINESITE_STRUCTURAL_GEOLOGY.pdf PROVIDED BY KCBL 12/18/2009.

NAD 1983 UTM Zone 9N

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:50,000
DATE:	APRIL 2010
DRAWN:	MIB, WKL
DESIGNED:	RT, DK
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

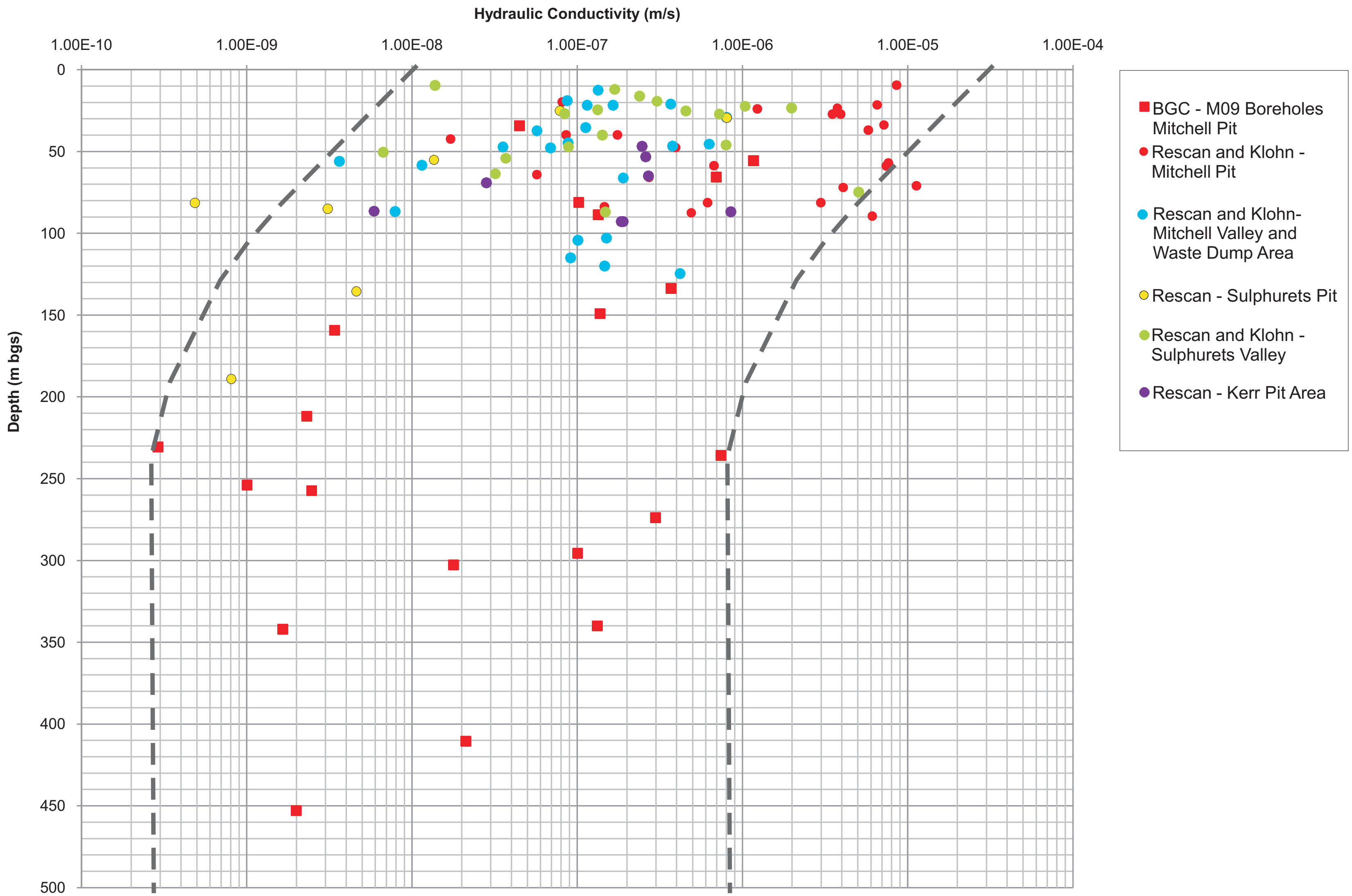
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT PIT DEPRESSURIZATION ANALYSES

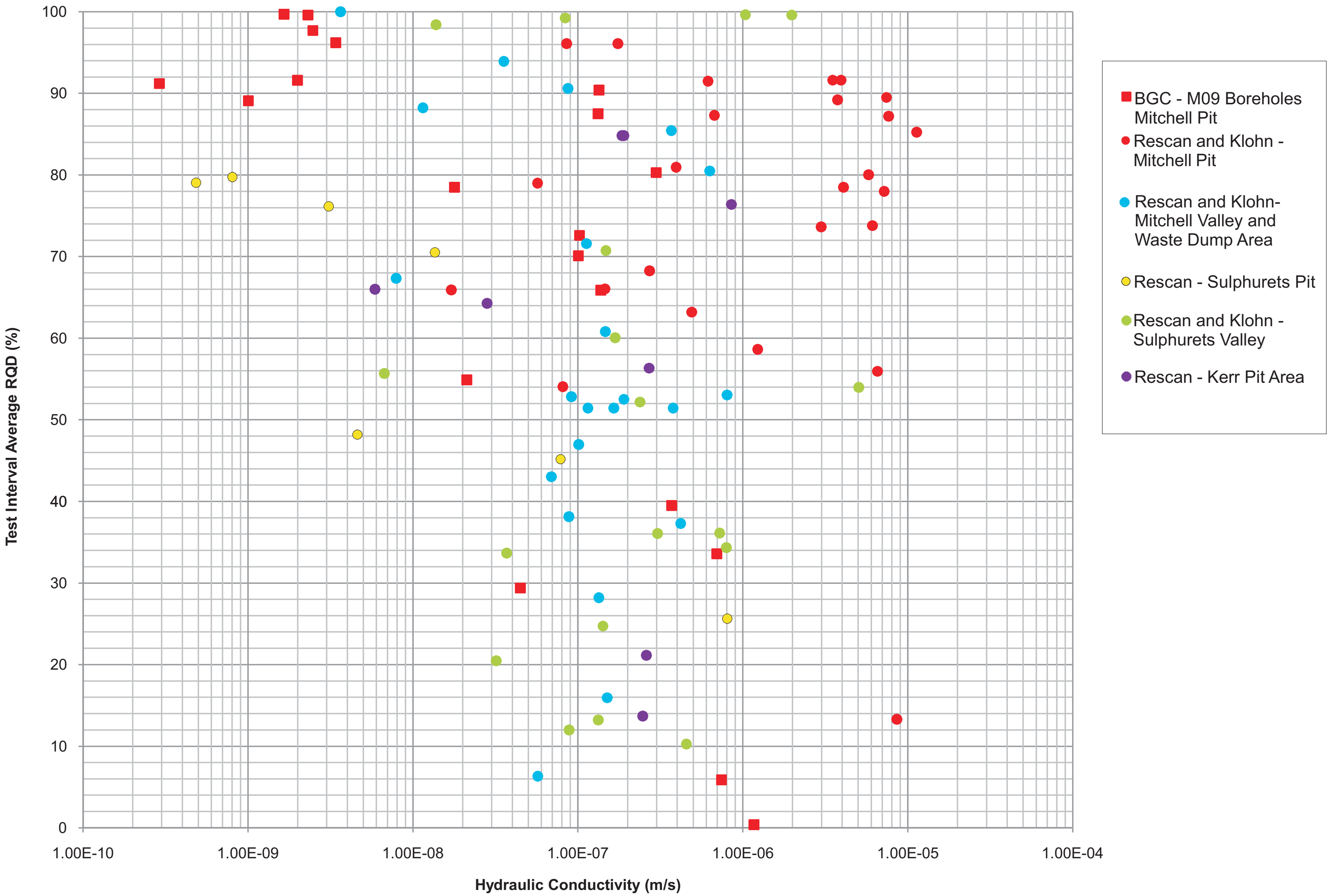
TITLE: SITE GEOLOGY AND CROSS-SECTIONS

PROJECT No.:	DWG No.:	REV.:
0638-004	3	A

DWG TO BE READ WITH BGC REPORT TITLED "KSM PROJECT PIT DEPRESSURIZATION ANALYSES" DATED APRIL 2010



SCALE: NTS	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES	
DATE: APRIL 2010	CHECKED: RT		TITLE: HYDROGEOLOGIC TEST RESULTS VS DEPTH BY LOCATION	
DRAWN: RT	APPROVED: TC	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004	DWG No.: 4 REV.: 0



SCALE: NTS	DESIGNED: RT		
DATE: APRIL 2010	CHECKED: RT		
DRAWN: RT	APPROVED: TC		

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

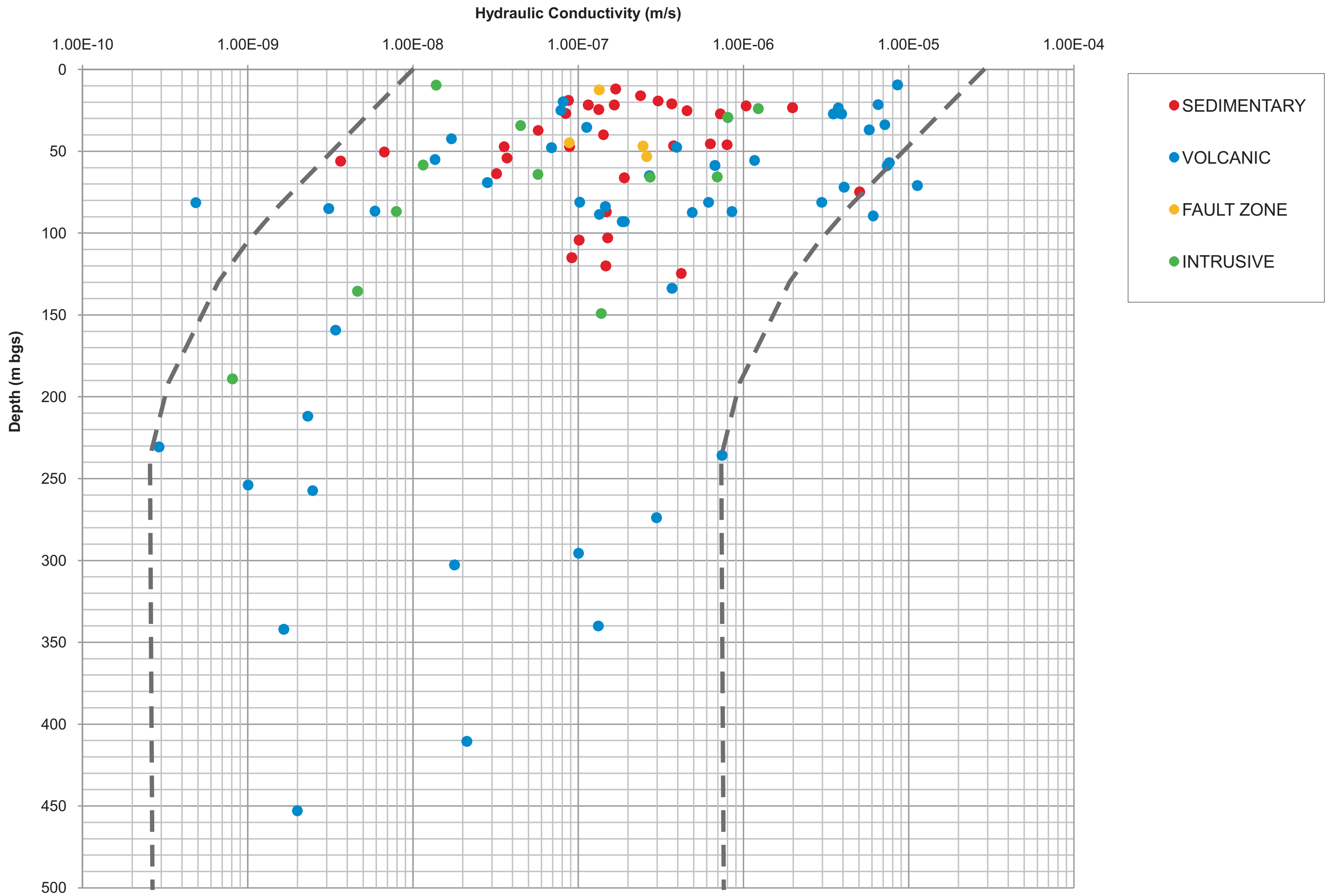
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
HYDROGEOLOGIC DATA VS.
RQD BY LOCATION

PROJECT No.:	DWG No.:	REV.:
0638-004	5	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE:	NTS	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	RT	APPROVED:	TC

BGC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

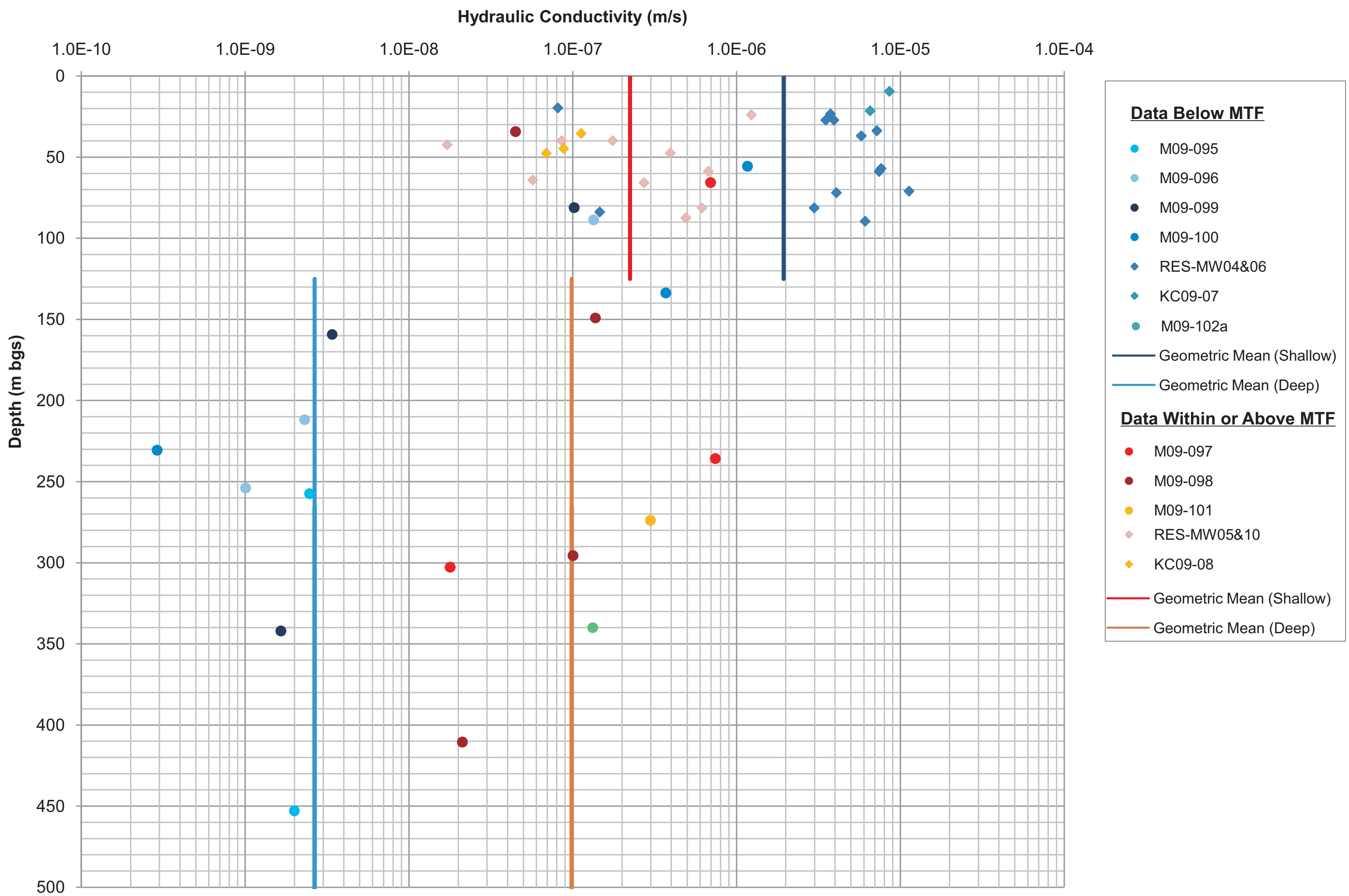
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
HYDROGEOLOGIC TEST RESULTS VS. DEPTH BY LITHOLOGY

PROJECT No.:	DWG No.:	REV.:
0638-004	6	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE:	NTS	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	RT	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

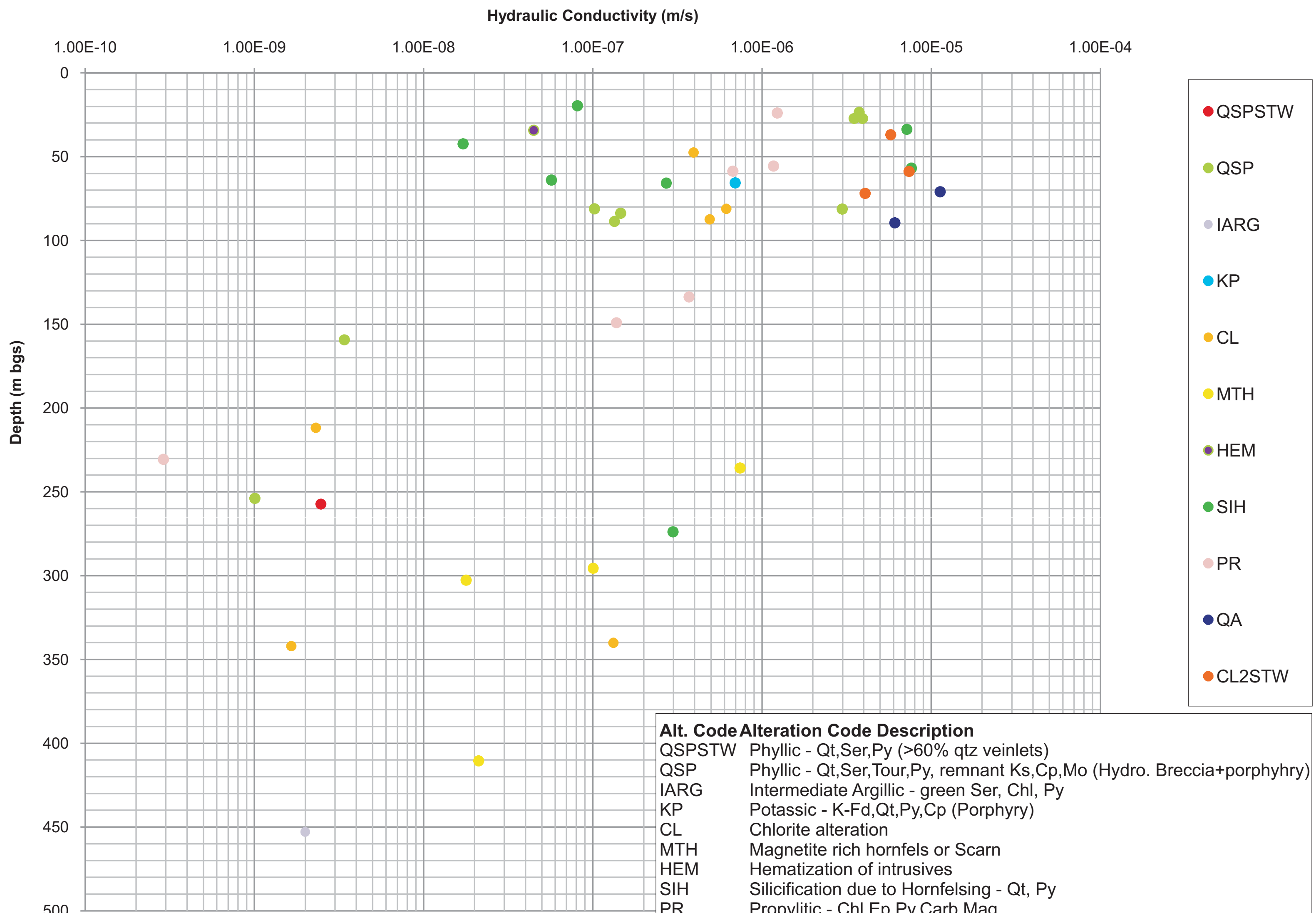
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
MITCHELL PIT HYDRAULIC CONDUCTIVITY DATA VS. DEPTH

PROJECT No.:	DWG No.:	REV.:
0638-004	7	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



Alt. Code	Alteration Code Description
QSPSTW	Phyllic - Qt,Ser,Py (>60% qtz veinlets)
QSP	Phyllic - Qt,Ser,Tour,Py, remnant Ks,Cp,Mo (Hydro. Breccia+porphyhry)
IARG	Intermediate Argillic - green Ser, Chl, Py
KP	Potassic - K-Fd,Qt,Py,Cp (Porphyry)
CL	Chlorite alteration
MTH	Magnetite rich hornfels or Scarn
HEM	Hematization of intrusives
SIH	Silicification due to Hornfelsing - Qt, Py
PR	Propylitic - Chl,Ep,Py,Carb,Mag
QA	Albitic (core area) - Ab,Cb,Chl,Py,Cp,Ser (Porphyry)
CL2STW	Chlorite alteration with Mag/Carbonate, no Ep (>60% qtz veining)

SCALE:	NTS	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	RT	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

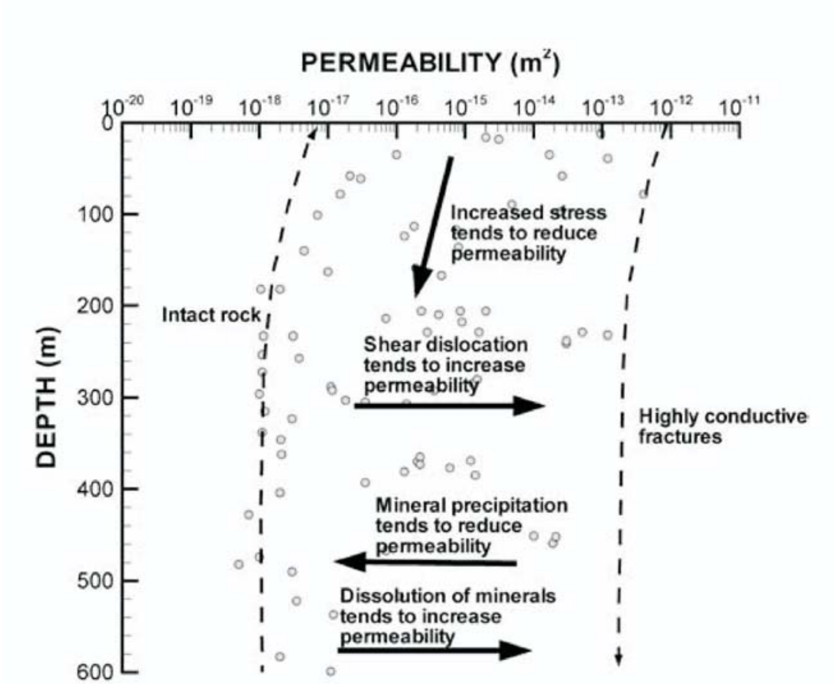
CLIENT:
SEABRIDGE GOLD INC.

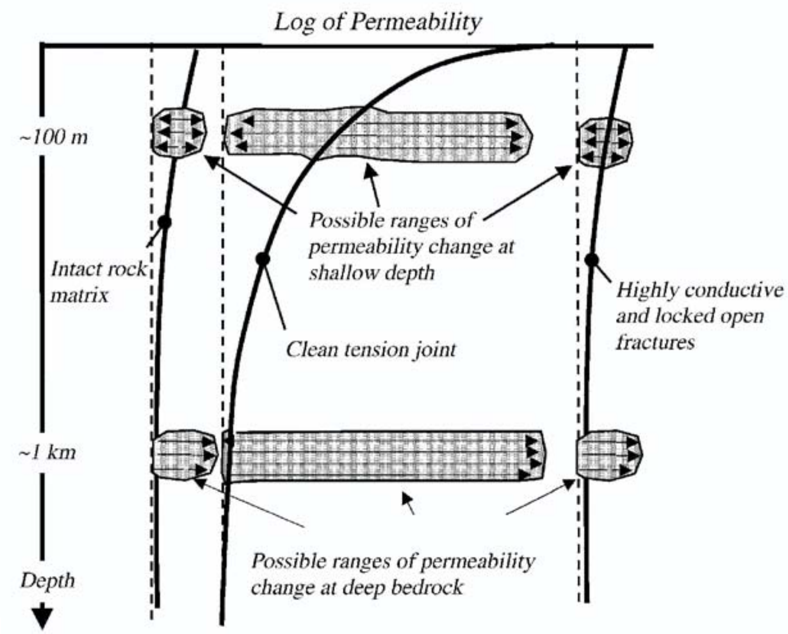
PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
MITCHELL PIT HYDROGEOLOGIC TEST RESULTS VS DEPTH GROUPED BY ALTERATION TYPE

PROJECT No.:	DWG No.:	REV.:
0638-004	8	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr





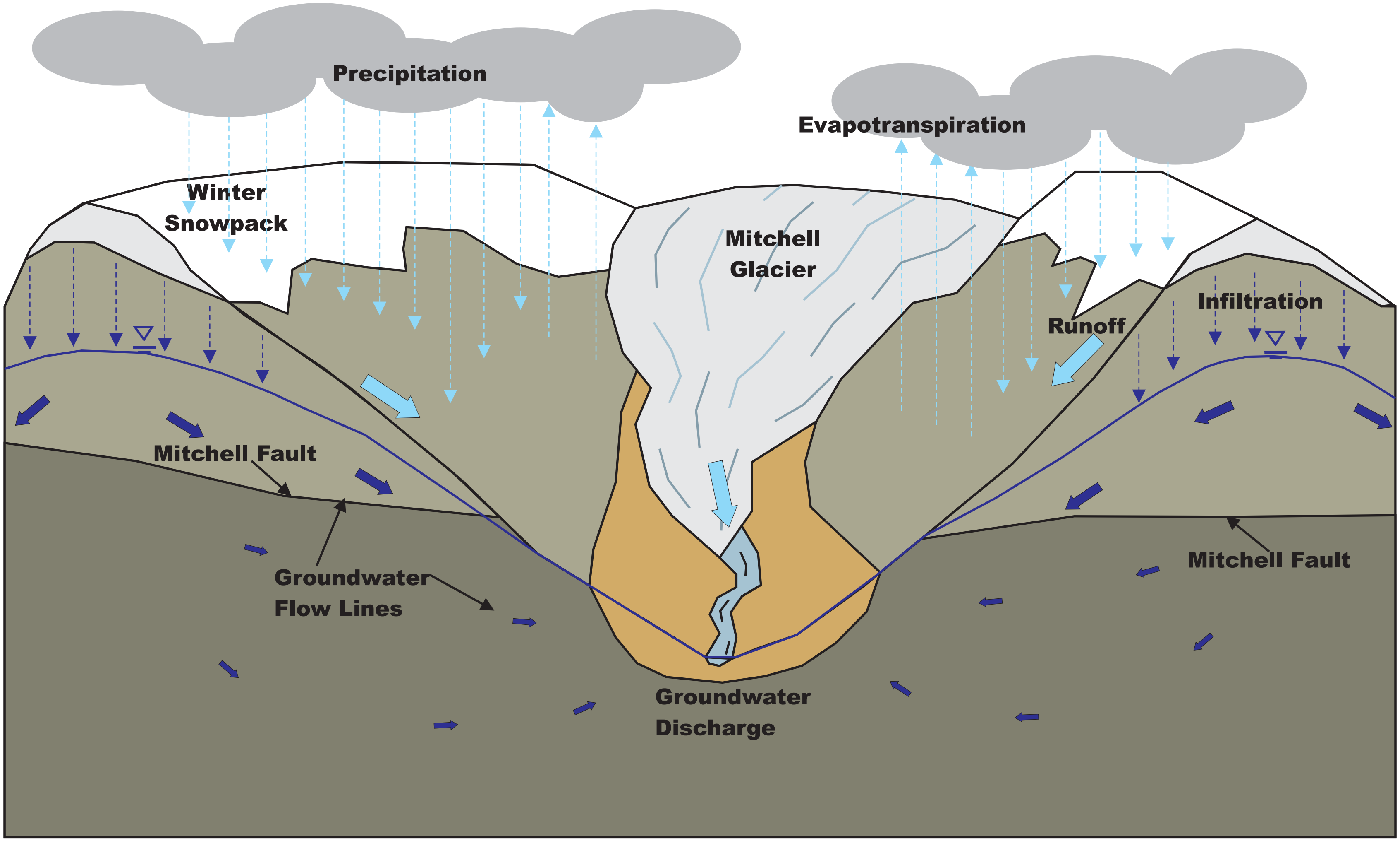
From Rutqvist and Stephansson, 2003.
Figure 11. Permeability measured in short-interval well tests in fractured crystalline rocks in Gidea, Sweden (data points from Wladis et al., 1997). Effects of shear dislocation and mineral precipitation/dissolution processes obscure the dependency of permeability on depth (stress). The permeability values on the left-hand side represent intact rock granite (or flow feature 5 in Figure 7 of paper), whereas the permeability values on the right-hand side represent highly conductive fractures (possibly flow feature 1 in Figure 7 from paper).

Wladis D, Jonnson P, Wallroth T (1997). Regional characterization of hydraulic properties of rock using well test data.Swedish Nuclear Fuel Waste Management Co (SKB) Tech Rep 97-29.

Figure 23. Schematic representation of possible permeability changes at shallow and deep locations in fractured bedrock. The *solid lines* represent the depth- (or stress-) permeability function for intact rock, clean tension joint and highly conductive and locked-open fractures.

SCALE: NTS	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT		TITLE: PERMEABILITY VS. DEPTH FIGURES FROM RUTQVIST AND STEPHANSSON (2003)
DRAWN: RT	APPROVED: TC	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 / DWG No.: 9 / REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE: NOT TO SCALE	DESIGNED: RT
DATE: APRIL 2010	CHECKED: TC
DRAWN: RT	APPROVED: TC

BGC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

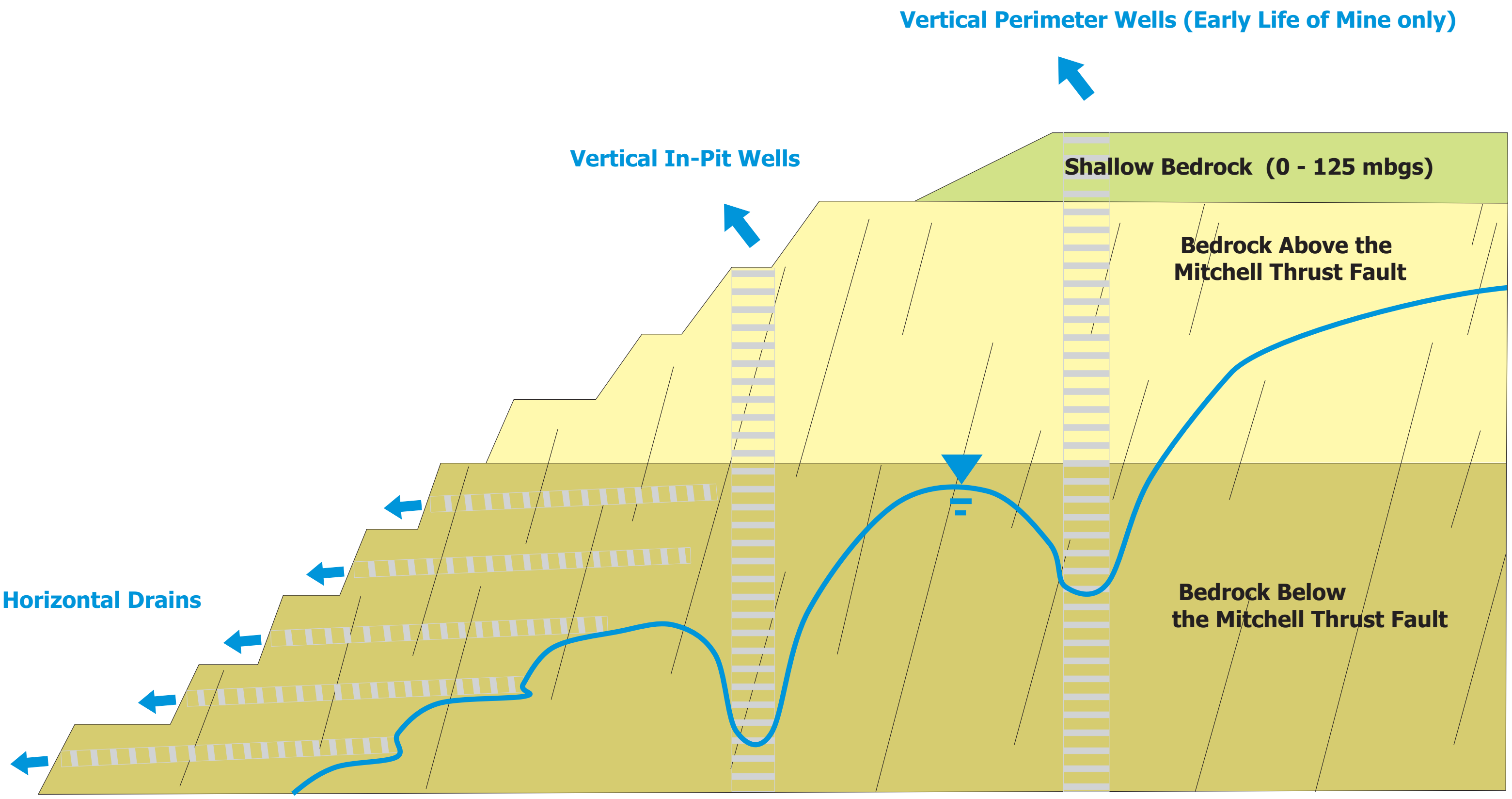
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: CONCEPTUAL HYDROGEOLOGICAL MODEL

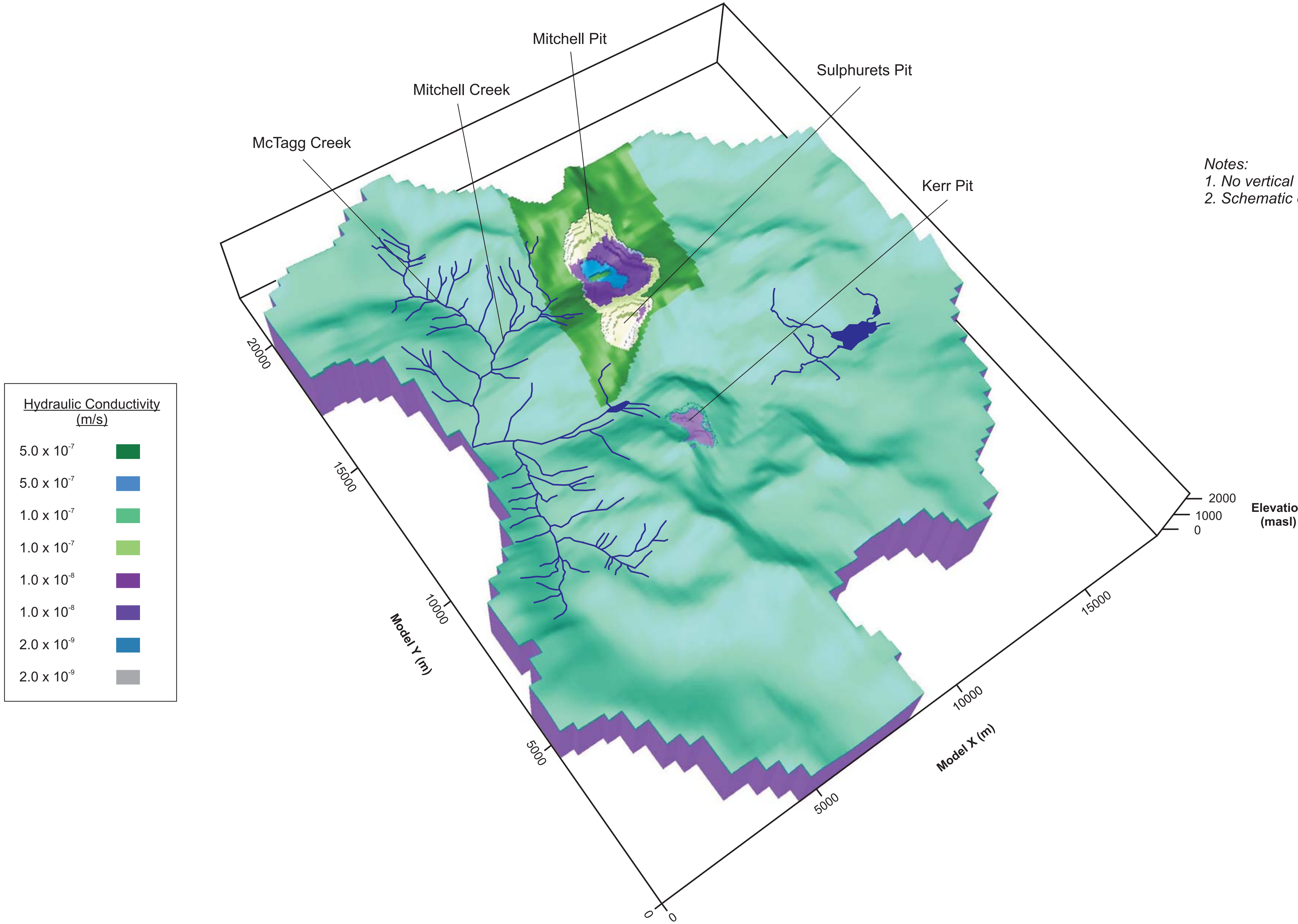
PROJECT No.:	DWG. No.:	REV.:
0638-004	10	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\KSM_Conceptual Model.cdr



SCALE: NOT TO SCALE	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: TC		TITLE: CONCEPTUAL DEPRESSURIZATION DESIGN
DRAWN: RT	APPROVED: TC	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 / DWG. No.: 11 / REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\KSM_Conceptual Model.cdr



Notes:
1. No vertical exaggeration.
2. Schematic only. Scale approximate.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	NTS
DATE:	APRIL 2010
DRAWN:	CT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

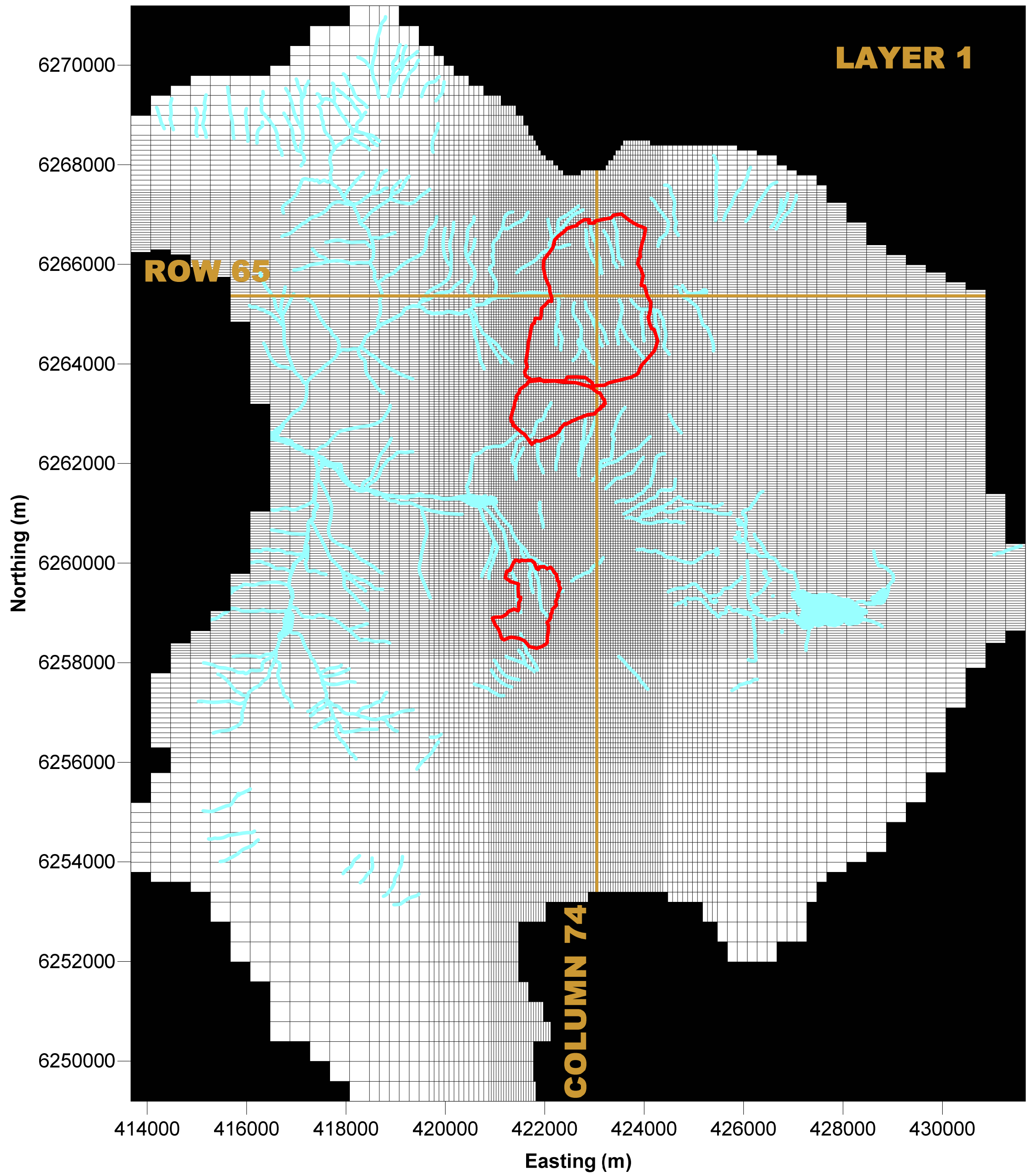
CLIENT: SEABRIDGE GOLD INC.

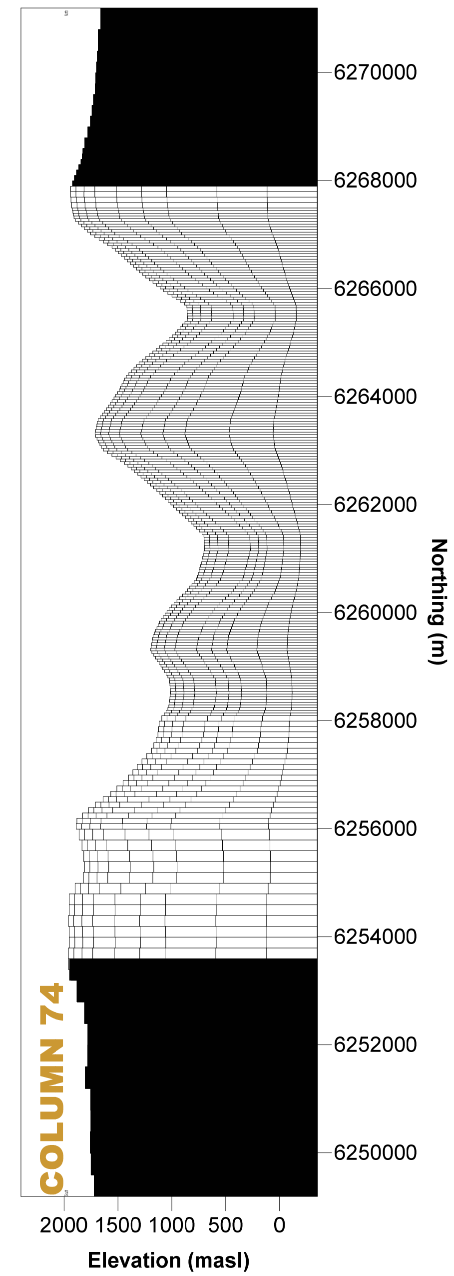
PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

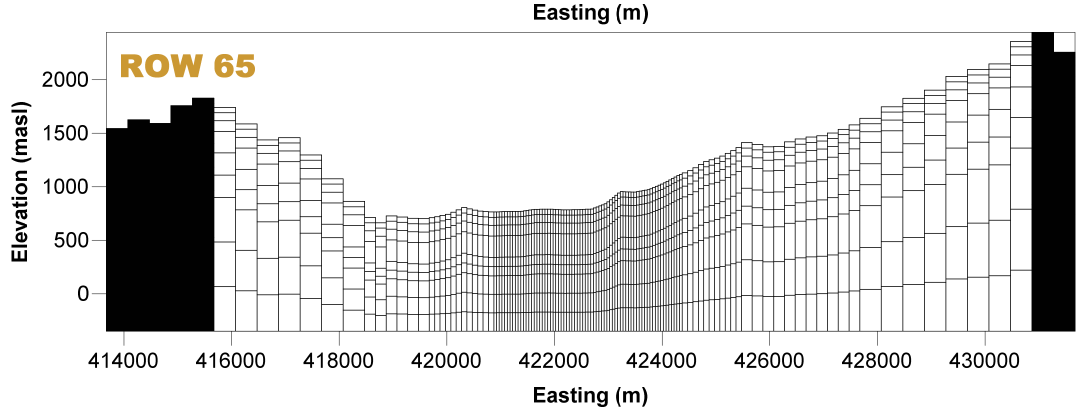
TITLE: MODEL THREE-DIMENSIONAL LAYOUT

PROJECT No.:	DWG No.:	REV.:
0638-004	12	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\3D Model Layout.cdr [Page 2]







OPEN PITS	(red line)
HYDROLOGY	(cyan)
INACTIVE CELLS	(black)

NOTES:

1. CROSS-SECTION VERTICAL EXAGGERATION 2X.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	AS SHOWN
DATE:	APRIL 2010
DRAWN:	CT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

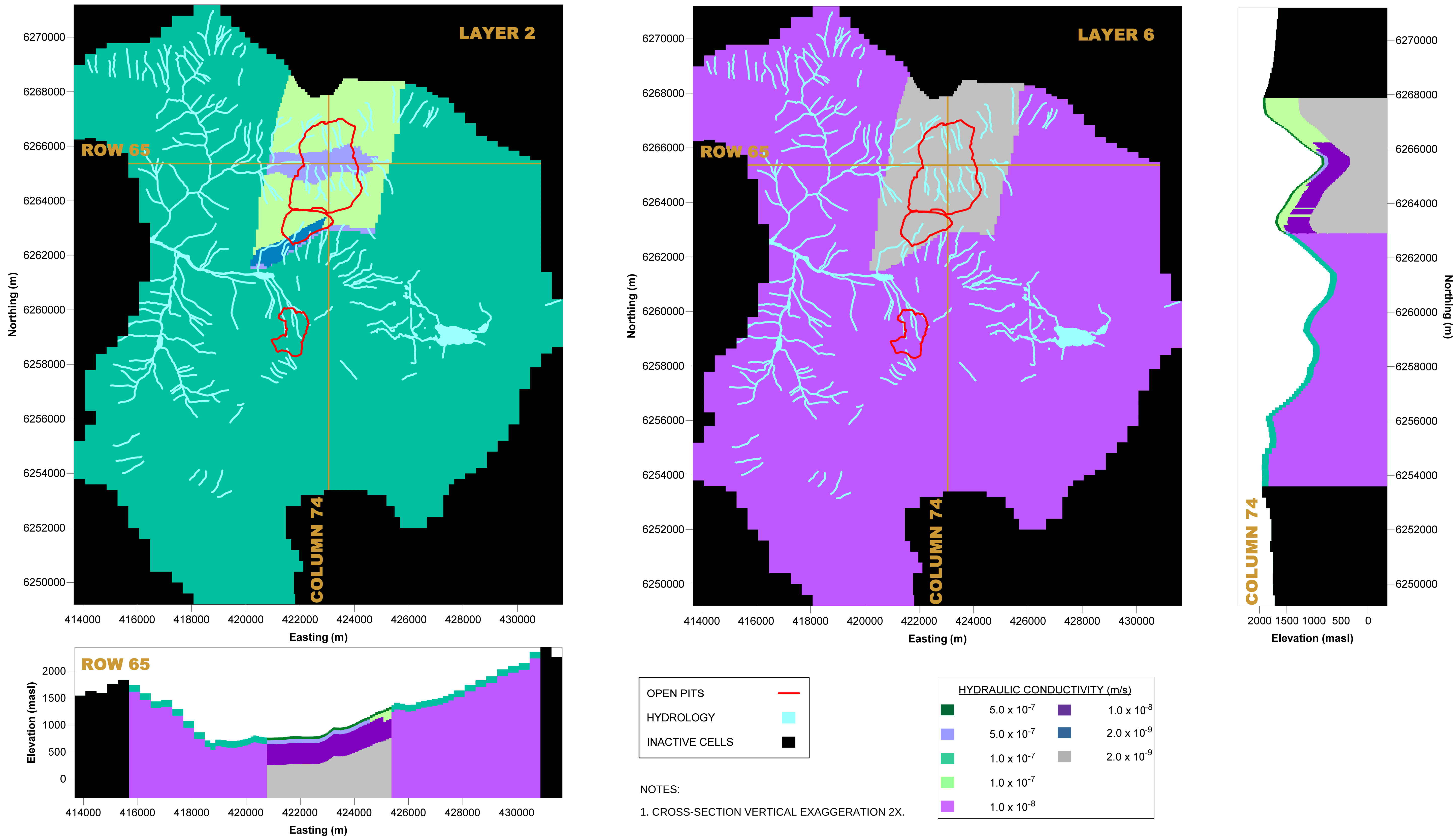
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MODEL GRID

PROJECT No.:	DWG No.:	REV.:
0638-004	13	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Files for Figures/RefinedModel/Grid.srf



REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	AS SHOWN
DATE:	APRIL 2010
DRAWN:	CT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

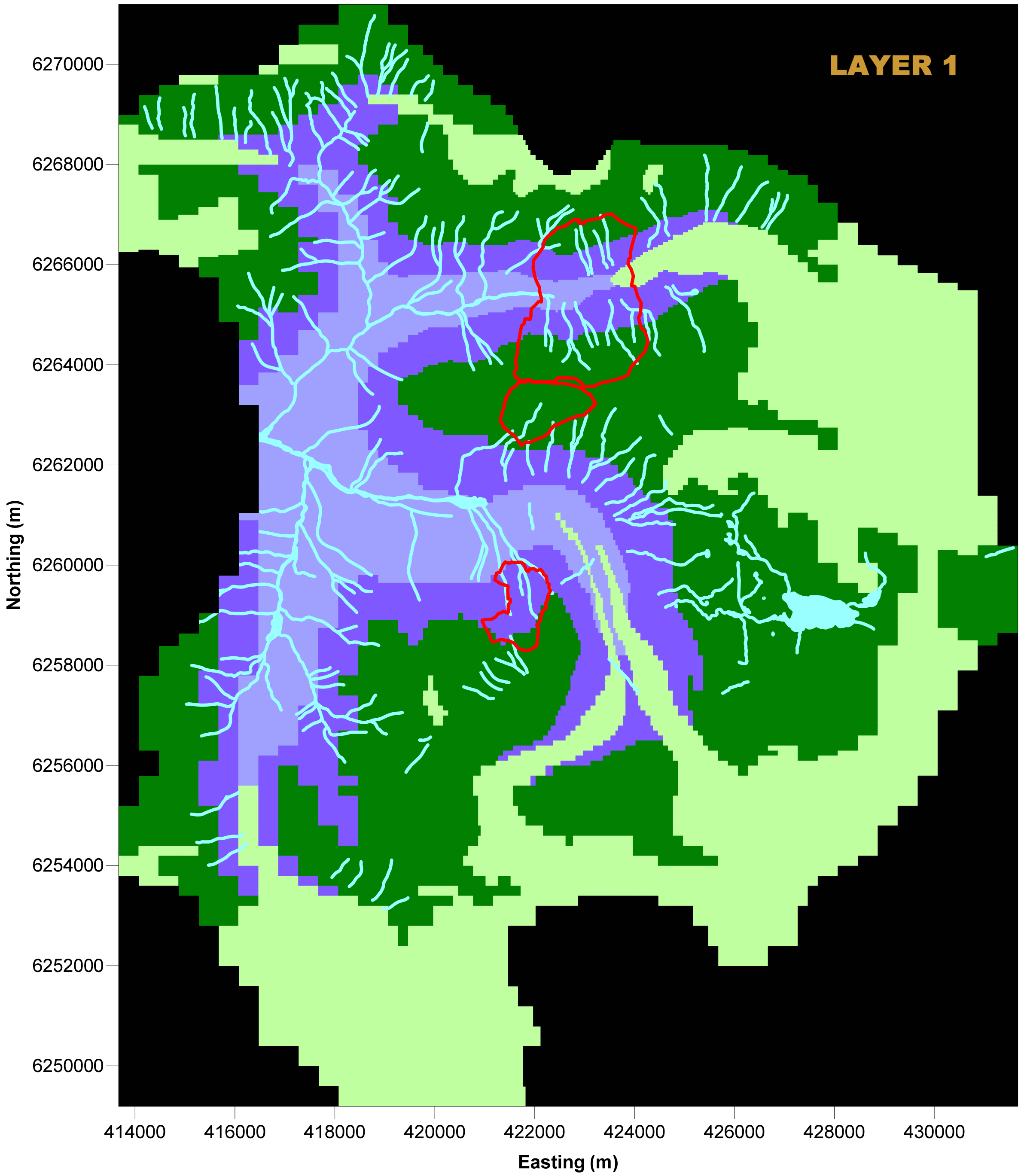
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MODEL HYDRAULIC CONDUCTIVITY

PROJECT No.:	DWG No.:	REV.:
0638-004	14	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Hydraulic Conductivity.srf



OPEN PITS
HYDROLOGY
INACTIVE CELLS
RECHARGE ZONE: 40 mm/yr
RECHARGE ZONE: 128 mm/yr
RECHARGE ZONE: 146 mm/yr
RECHARGE ZONE: 164 mm/yr

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	CT	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

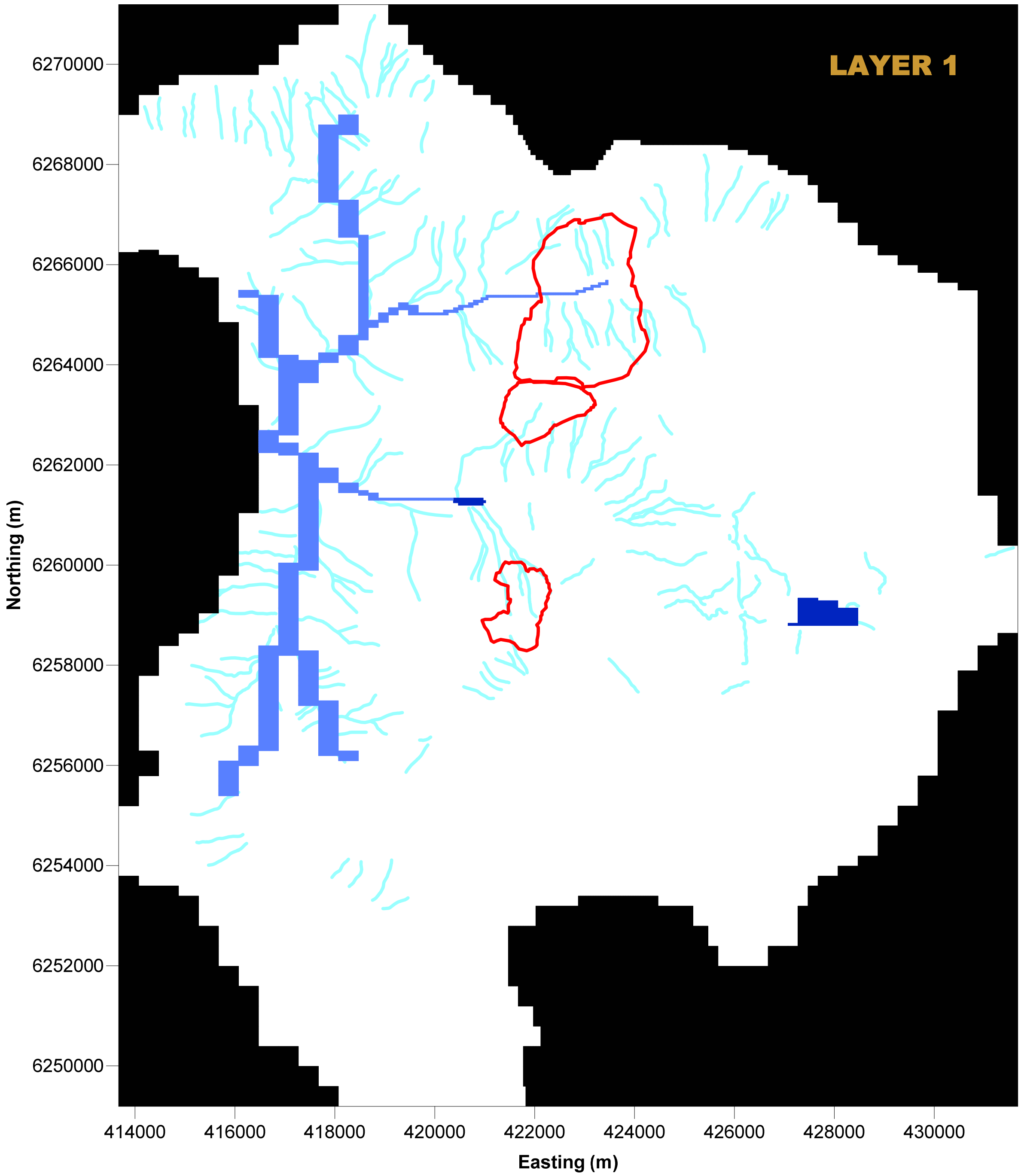
PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MODEL PRE-DEVELOPMENT RECHARGE DISTRIBUTION

CLIENT: SEABRIDGE GOLD INC.

PROJECT No:	DWG No:	REV.
0638-004	15	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Pre_Development Recharge.srf



OPEN PITS	(red line)	RIVERS	(light blue fill)
HYDROLOGY	(cyan line)	SPECIFIED HEADS	(blue fill)
INACTIVE CELLS	(black fill)		

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Pre_Development BCs.srf

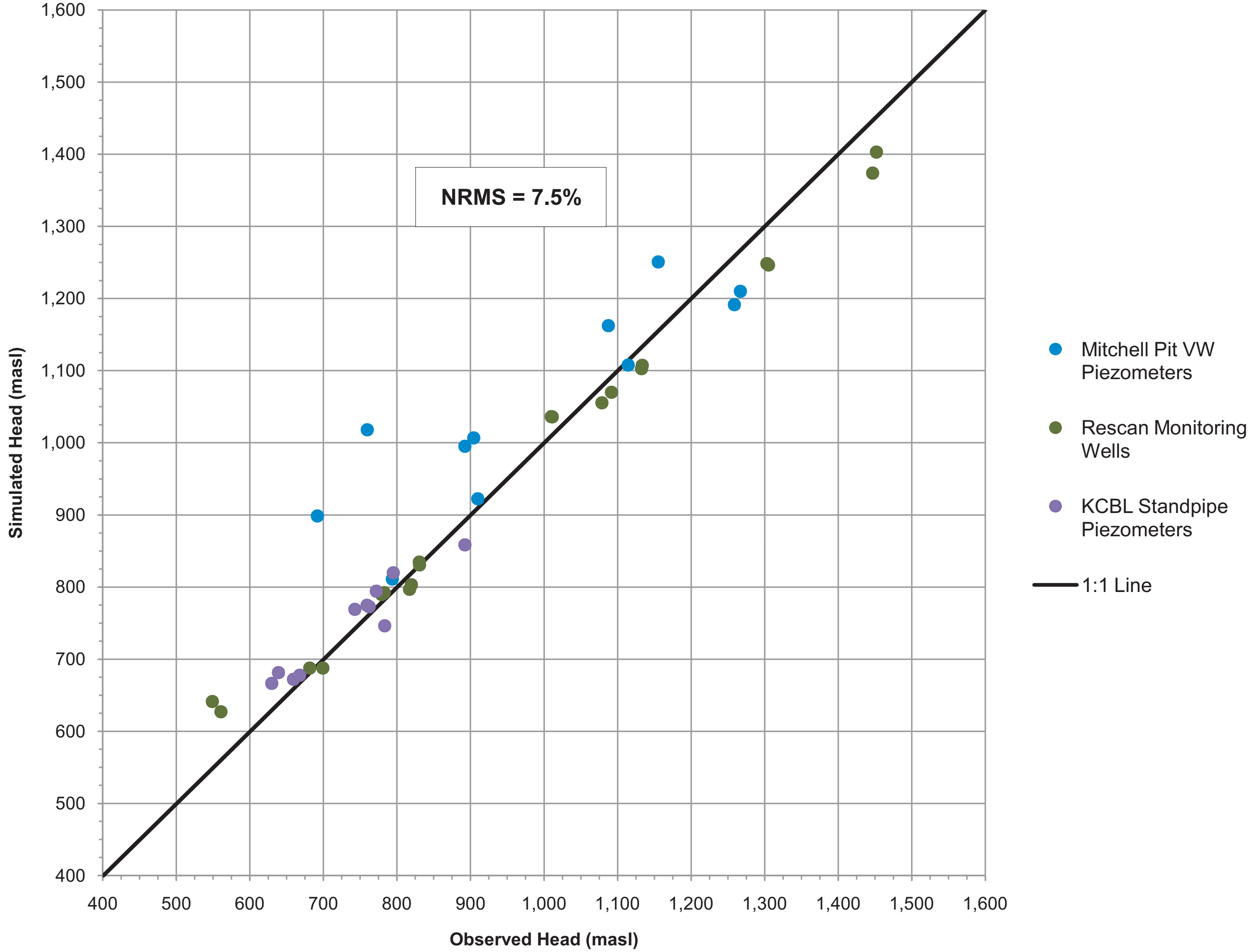
SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	CT	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: PRE-DEVELOPMENT FLOW BOUNDARY CONDITIONS

CLIENT	PROJECT No:	DWG No:	REV.
SEABRIDGE GOLD INC.	0638-004	16	0



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

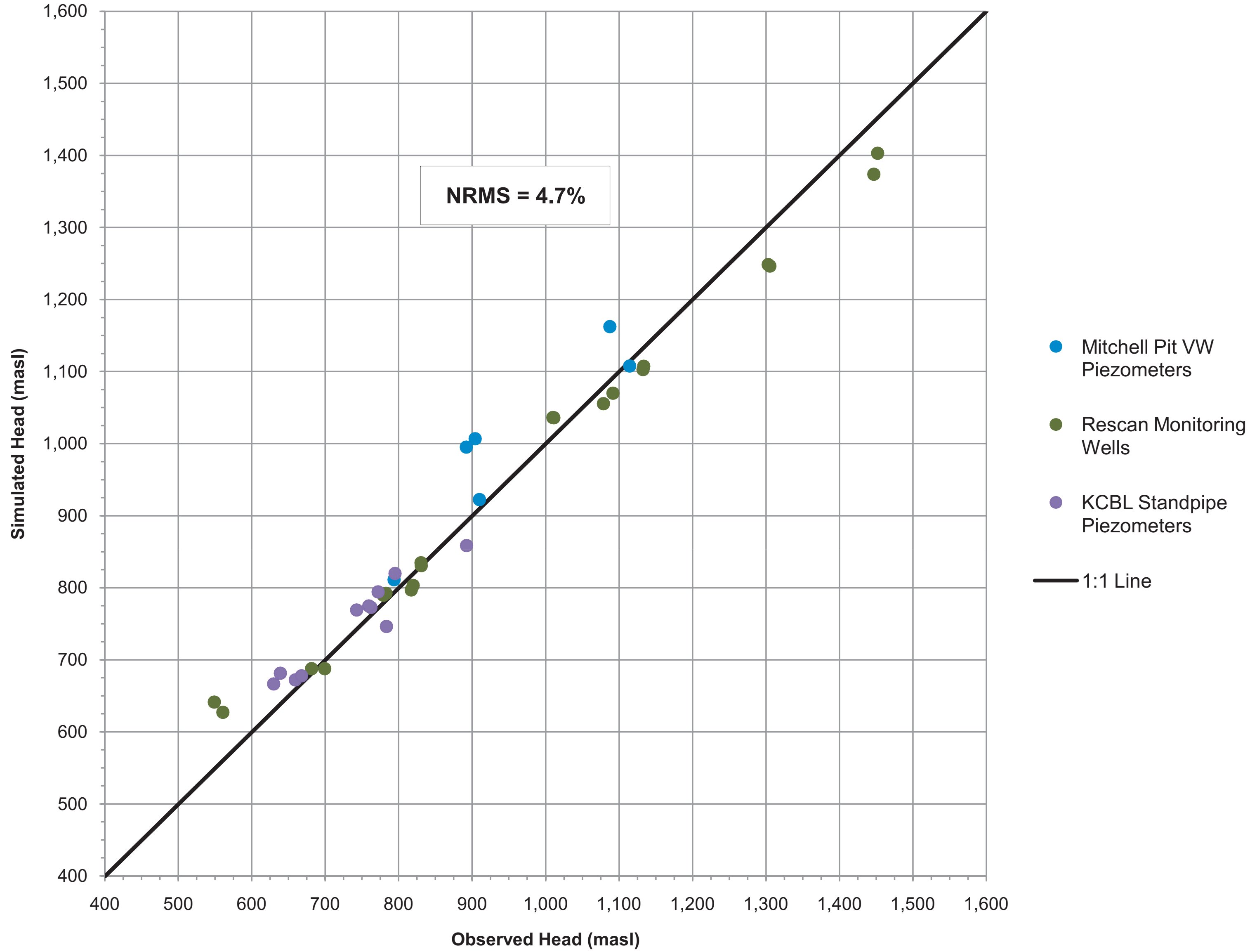
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
STEADY STATE CALIBRATION RESULTS FOR HYDRAULIC HEAD TARGETS (OBSERVED VS. SIMULATED)

PROJECT No.:	DWG No.:	REV.:
0638-004	17	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE:	NTS	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	RT	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

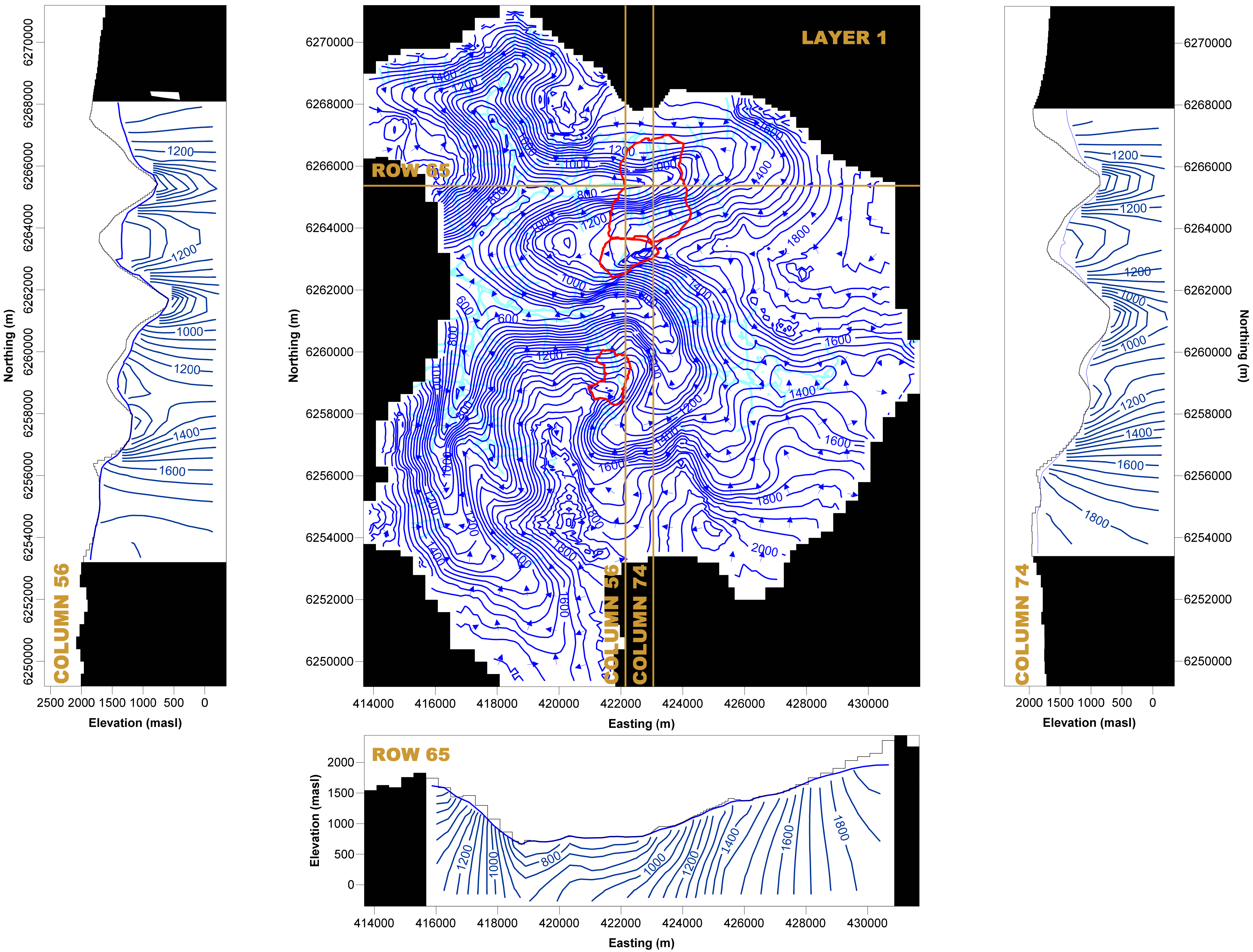
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
STEADY STATE CALIBRATION RESULTS FOR HYDRAULIC HEAD TARGETS - STABILIZED WELLS ONLY (OBSERVED VS. SIMULATED)

PROJECT No.:	DWG No.:	REV.:
0638-004	18	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



WATER TABLE CONTOURS (masl)
GROUNDWATER VELOCITY VECTORS (NOT TO SCALE)
HYDRAULIC HEAD CONTOURS (masl)
OPEN PITS
HYDROLOGY
INACTIVE CELLS

NOTES:

1. CROSS-SECTION VERTICAL EXAGGERATION 2X.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	AS SHOWN
DATE:	APRIL 2010
DRAWN:	CT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

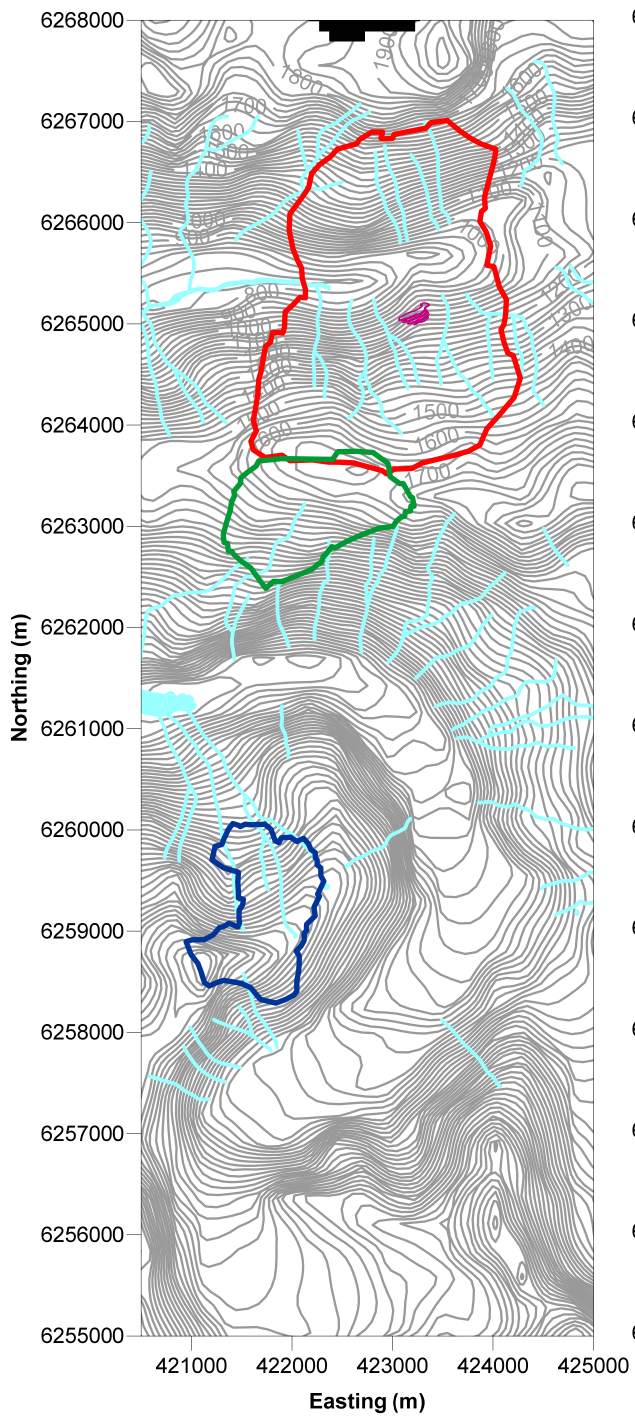
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

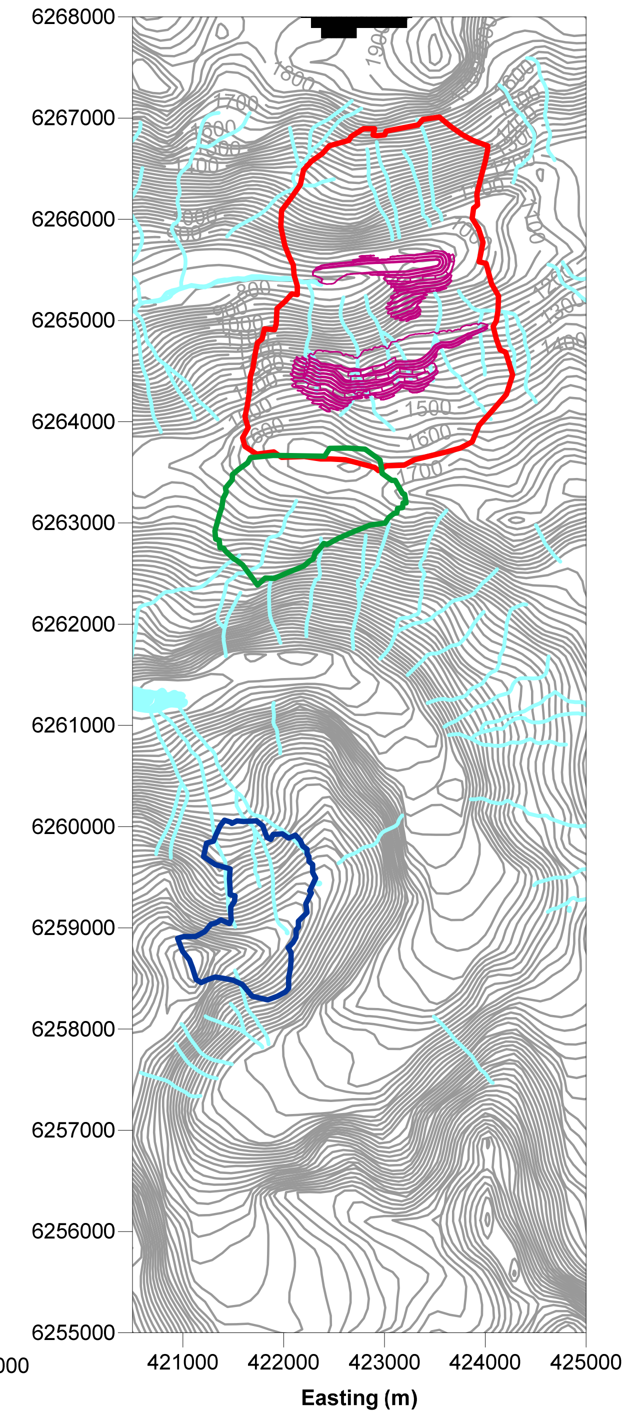
TITLE: SIMULATED PRE-DEVELOPMENT GROUNDWATER CONTOURS AND HYDRAULIC HEADS

PROJECT No.:	DWG No.:	REV.:
0638-004	19	0

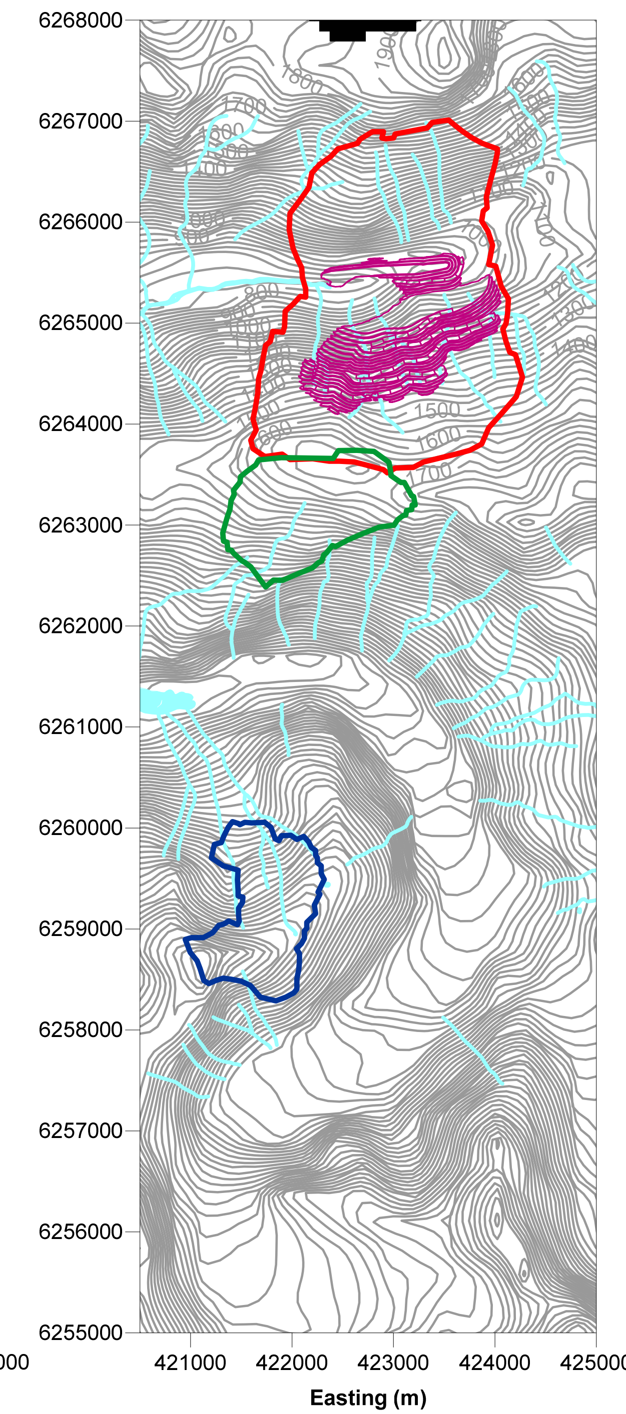
K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Pre_Development WT and Head.srf



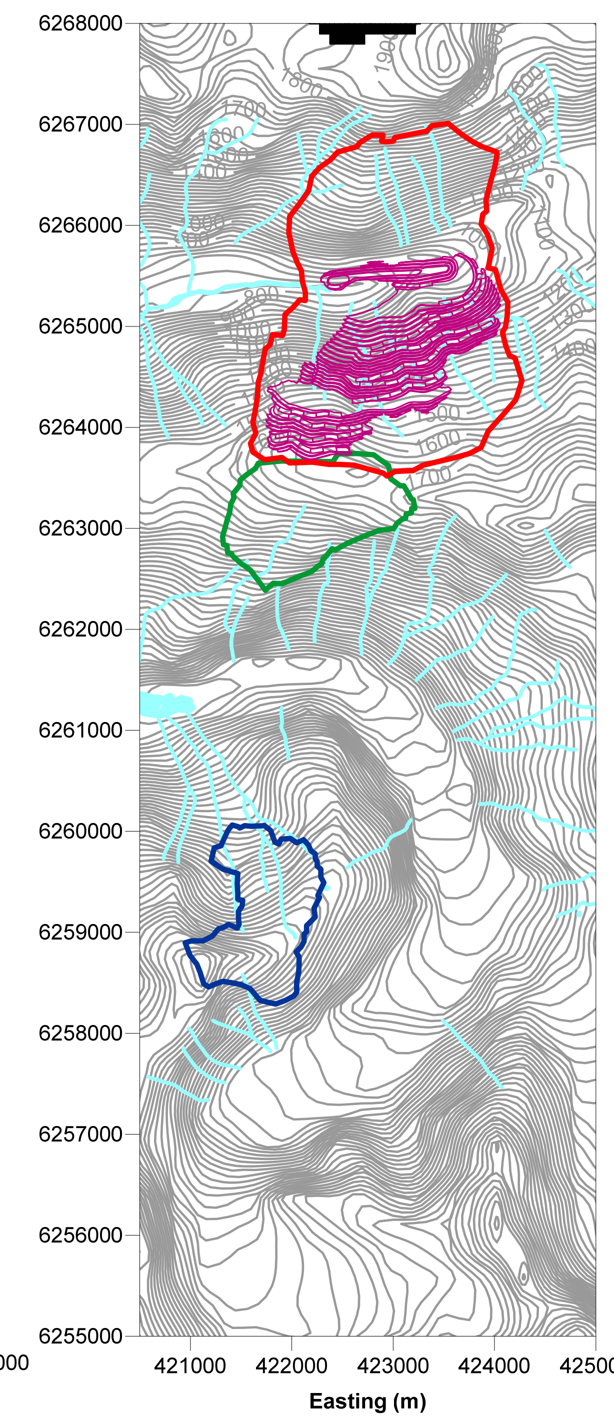
PRE-PRODUCTION EOP



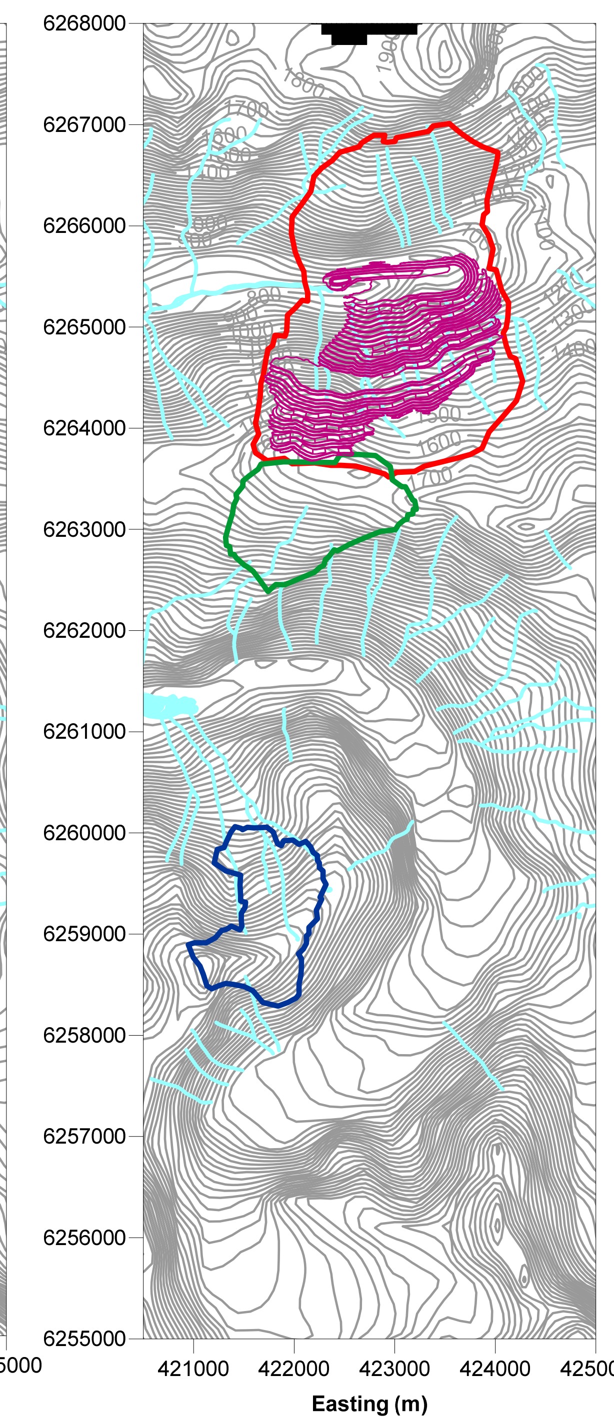
YEAR 1 EOP



YEAR 2 EOP



YEAR 3 EOP



YEAR 4 EOP

MITCHELL PIT OUTLINE (FINAL)	TOPOGRAPHIC CONTOURS (masl)	EOP OPEN PIT CONTOURS
SULPHURETS PIT OUTLINE (FINAL)	HYDROLOGY	
KERR PIT OUTLINE (FINAL)	INACTIVE CELLS	

Note: KSM End of Period (EOP) pits shown were provided by MMTS March 2010 (Series 6).

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	AS SHOWN
DATE:	APRIL 2010
DRAWN:	RT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

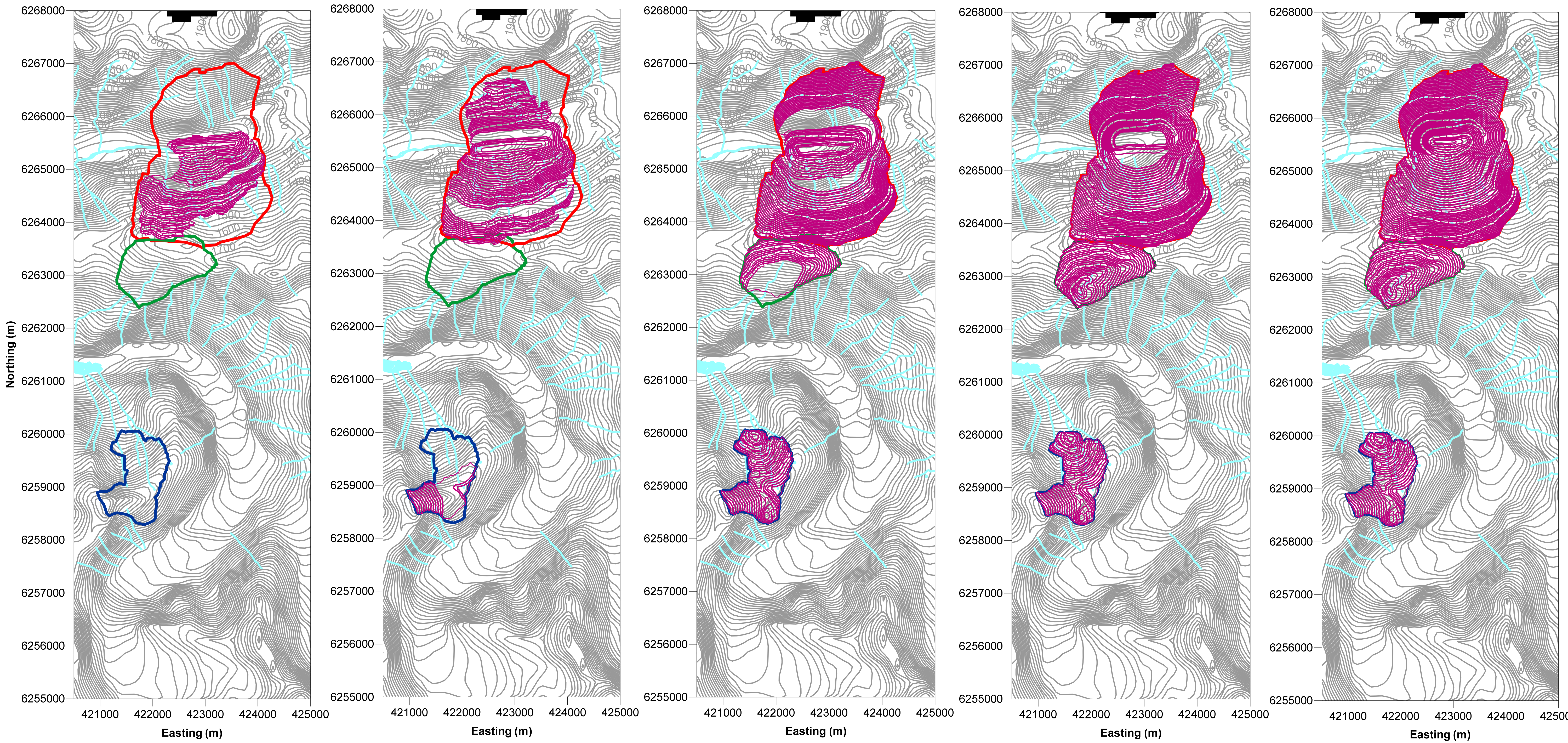
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
OPEN PIT DEVELOPMENT PLAN FOR
YEARS -1, 1, 2, 3, and 4

PROJECT No.:	DWG No.:	REV.:
0638-004	20	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Pit_Development_Plan.srf



Year 5 EOP | **YEAR 10 EOP** | **YEAR 20 EOP** | **YEAR 30 EOP** | **LIFE OF MINE YEAR 37**

MITCHELL PIT OUTLINE (FINAL)	(red line)	TOPOGRAPHIC CONTOURS (masl)	(grey line)	EOP OPEN PIT CONTOURS	(magenta line)
SULPHURETS PIT OUTLINE (FINAL)	(green line)	HYDROLOGY	(cyan)		
KERR PIT OUTLINE (FINAL)	(blue line)	INACTIVE CELLS	(black)		

Note: KSM End of Period (EOP) pits shown were provided by MMTS March 2010 (Series 6).

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	AS SHOWN
DATE:	APRIL 2010
DRAWN:	RT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

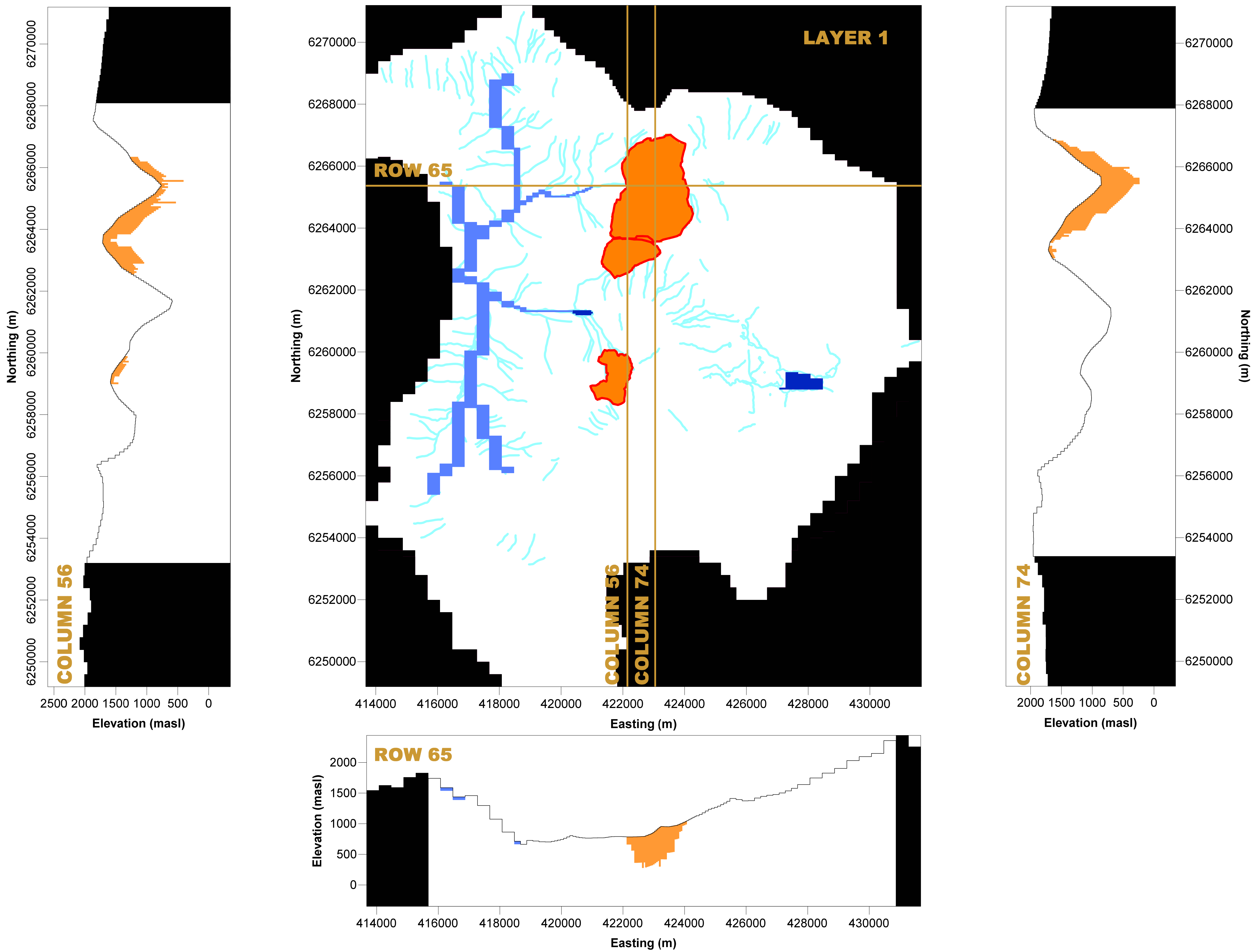
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: OPEN PIT DEVELOPMENT PLAN FOR YEARS 5, 10, 20, 30, and LOM

PROJECT No.:	DWG No.:	REV.:
0638-004	21	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Pit_Development_Plan2.srf



OPEN PITS	
HYDROLOGY	
INACTIVE CELLS	
RIVER (ALL YEARS)	
SPECIFIED HEAD (ALL YEARS)	
DRAINS (LIFE OF MINE SHOWN)	

NOTES:

1. CROSS-SECTION VERTICAL EXAGGERATION 2X.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	AS SHOWN
DATE:	APRIL 2010
DRAWN:	CT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

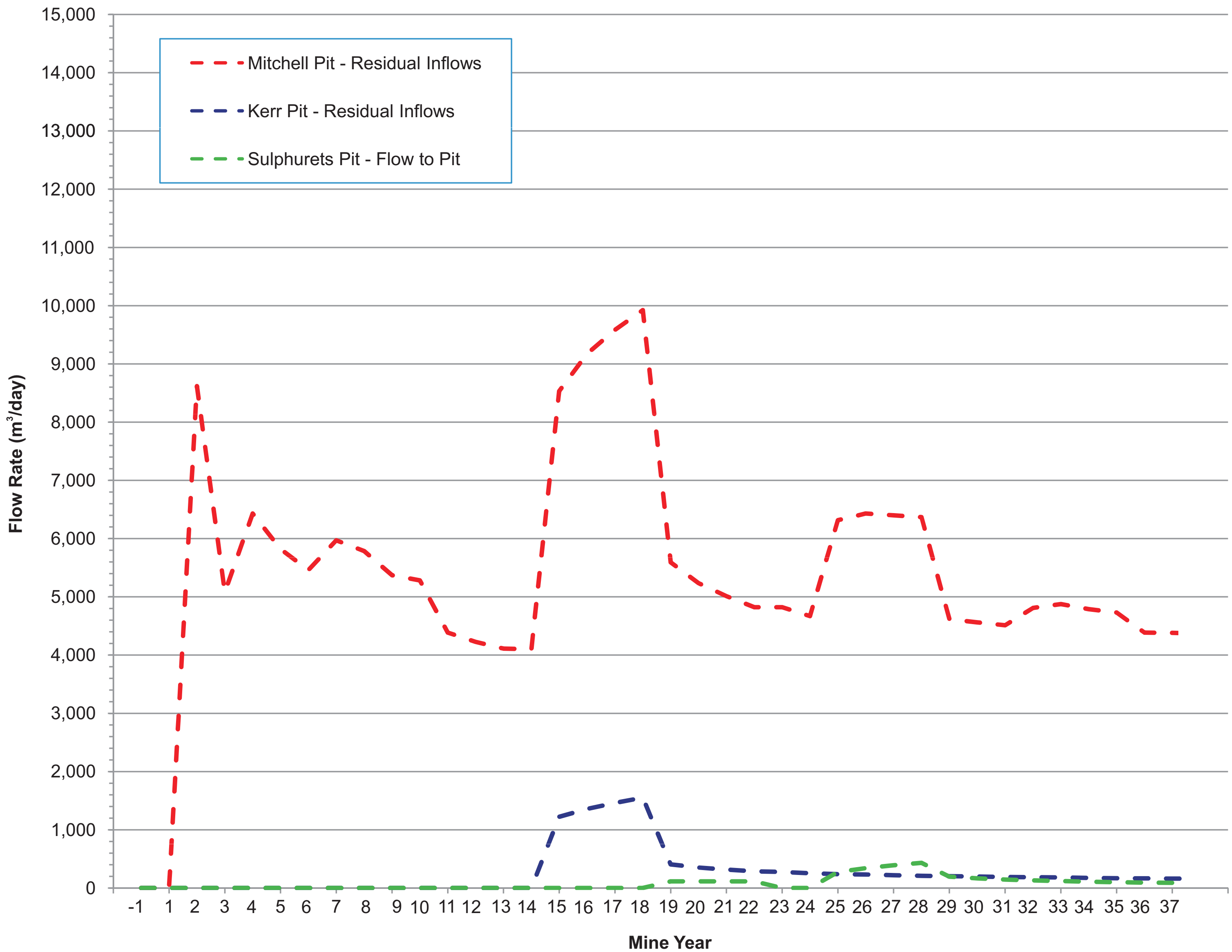
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: PREDICTIVE SIMULATIONS: BOUNDARY CONDITIONS

PROJECT No.:	DWG No.:	REV.:
0638-004	22	0

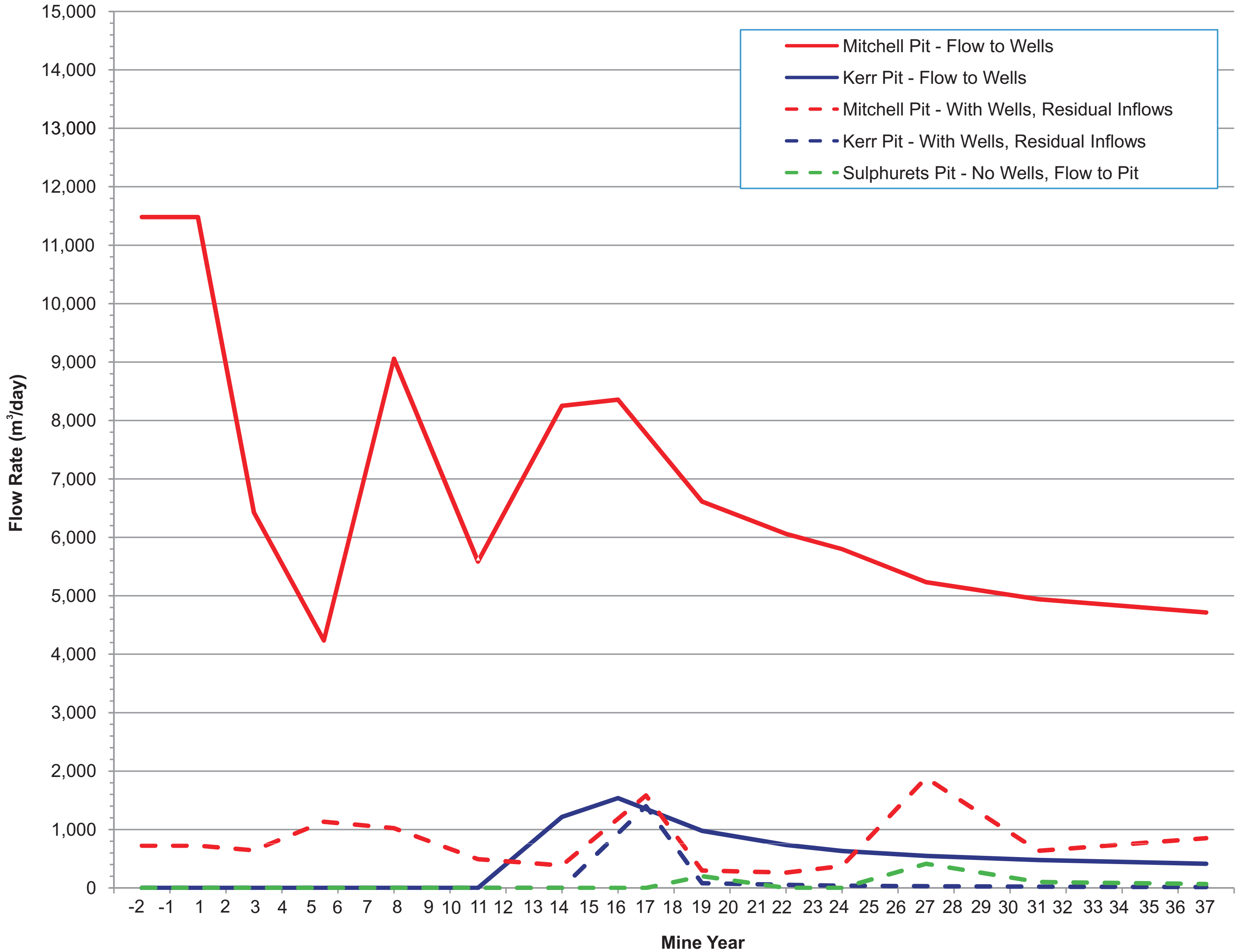
N:/BGC/Projects/0638 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Post Development BCs.srf



SCALE: NTS	DESIGNED: RT		PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	TITLE: OPEN PIT FLOW RESULTS - NO WELLS
DRAWN: RT	APPROVED: TC		

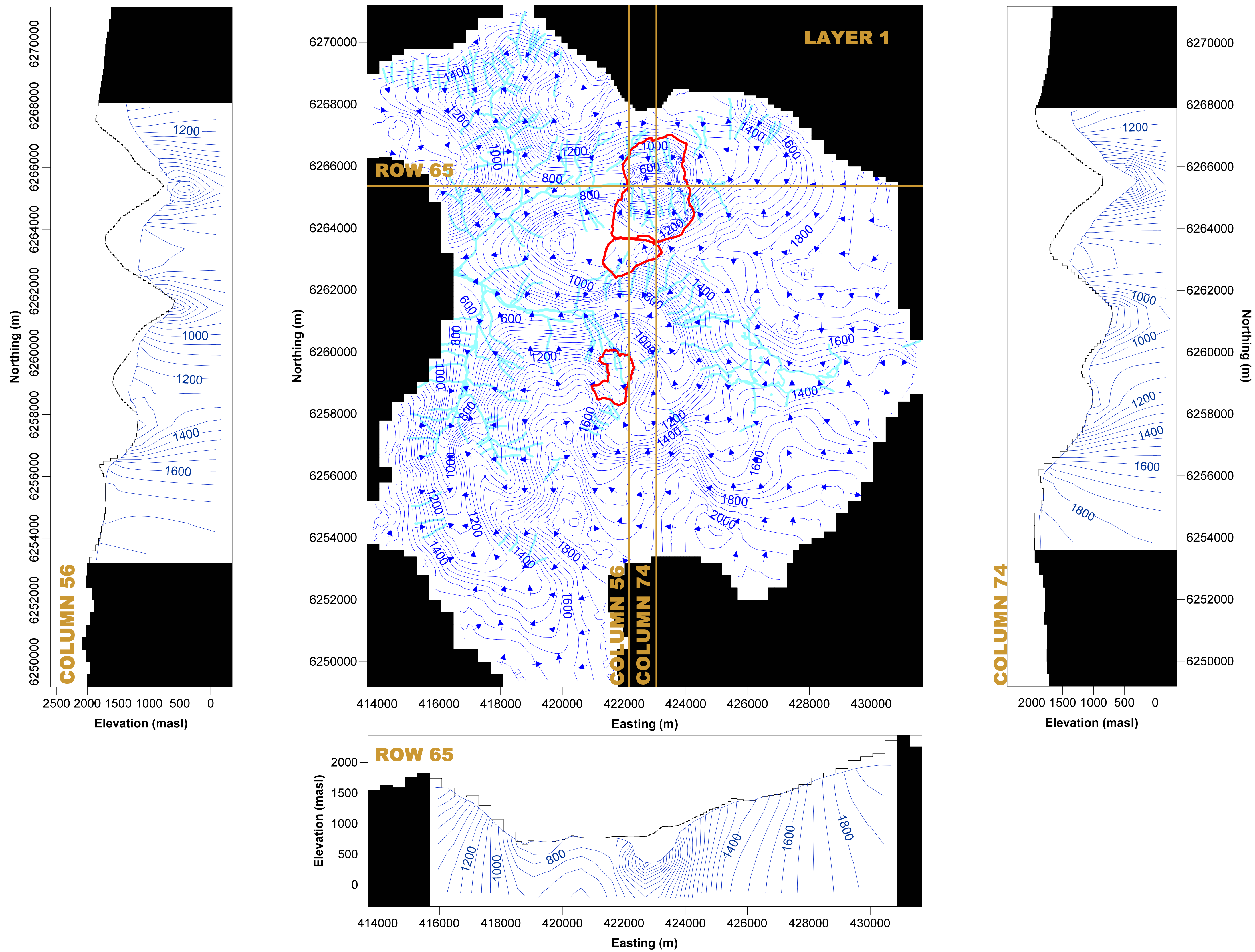
CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004	DWG No.: 23	REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr

SCALE: NTS	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT		TITLE: OPEN PIT DEPRESSURIZATION FLOW RESULTS
DRAWN: RT	APPROVED: TC		
		CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 · DWG No.: 24 · REV.: 0



WATER TABLE CONTOURS (masl)	
GROUNDWATER VELOCITY VECTORS (NOT TO SCALE)	
HYDRAULIC HEAD CONTOURS (masl)	
OPEN PITS	
HYDROLOGY	
INACTIVE CELLS	

NOTES:

1. CROSS-SECTION VERTICAL EXAGGERATION 2X.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	AS SHOWN
DATE:	APRIL 2010
DRAWN:	RT
DESIGNED:	RT
CHECKED:	RT
APPROVED:	TC

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

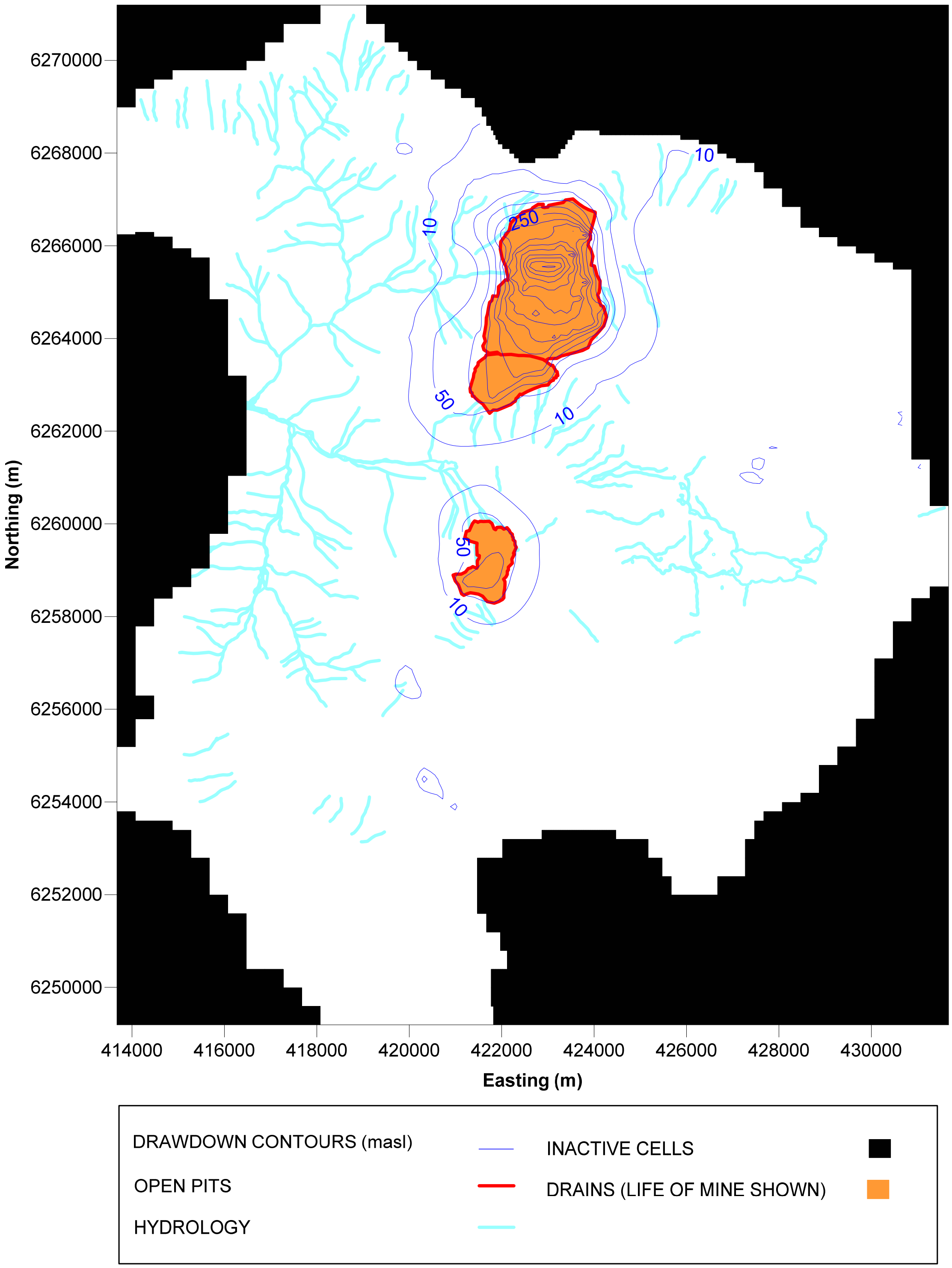
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: SIMULATED END OF MINE LIFE WATER TABLE AND HYDRAULIC HEADS

PROJECT No.:	DWG No.:	REV.:
0638-004	25	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/Run1_34_16 Dewatering WT and Head.srf



SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	CT	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: PIT DEWATERING DRAWDOWN CONTOURS
AT LIFE OF MINE (37 YEARS)

CLIENT: SEABRIDGE GOLD INC.

PROJECT No:	DWG No:	REV.
0638-004	26	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Figures/LOM Drawdown Contours.srf

APPENDIX A
M09 PACKER TEST DATA SUMMARY

Table A1. M09 Packer Test Summary

Region	Drill hole ID	Drill hole Collar Easting (m)	Drill hole Collar Northing (m)	Collar Surface Elev. (masl)	Hole Plunge	Hole Trend	Packer Test Depth from (mah)	Packer Test Depth to (mah)	Midpt Depth (mah)	Midpt Elev. (m)	Vertical Depth from Collar Elev. (m bgs)	Hydraulic Conductivity (m/s)	Head Loss Adjusted Hydraulic Conductivity (m/s)	Test Type	Lithology Description	Alt'n1 Code
Mitchell Pit	M-09-095	423198	6265329	970	-73	159	101.05	130.05	115.55	859.50	110.50	-	-	CH	Volcanic, unknown protolith (intensely altered)	QSPSTW
Mitchell Pit	M-09-095	423198	6265329	970	-73	159	225.85	276.85	251.35	729.63	240.37	2.5E-09	2.5E-09	CH	Volcanic, unknown protolith (intensely altered)	QSPSTW
Mitchell Pit	M-09-095	423198	6265329	970	-73	159	391.10	440.10	415.60	572.56	397.44	2.1E-09	2.0E-09	CH	Volcanic, unknown protolith (intensely altered)	IARG
Mitchell Pit	M-09-096	423582	6265470	911	-66	89	83.98	114.02	99.00	820.56	90.44	1.3E-07	1.3E-07	CH	Intermediate Volcanics, Massive Flows/Tuffs	QSP
Mitchell Pit	M-09-096	423582	6265470	911	-66	89	162.00	199.50	180.75	745.88	165.12	very low*	very low*	CH	Intermediate Volcanics, Massive Flows/Tuffs	QSP
Mitchell Pit	M-09-096	423582	6265470	911	-66	89	222.00	250.50	236.25	695.17	215.83	2.4E-09	2.3E-09	CH	Intermediate Volcanics, Massive Flows/Tuffs	CL
Mitchell Pit	M-09-096	423582	6265470	911	-66	89	270.05	300.05	285.05	650.59	260.41	1.0E-09	1.0E-09	CH	Intermediate Volcanics, Massive Flows/Tuffs	QSP
Mitchell Pit	M-09-097	423144	6266392	1334	-59	54	30.00	49.50	39.75	1299.93	34.07	-	-	CH	Intermediate Volcanics, Massive Flows/Tuffs	KP
															Porhyritic Monzonite Intrusive	KP
Mitchell Pit	M-09-097	423144	6266392	1334	-59	54	57.00	70.50	63.75	1279.36	54.64	6.8E-07	6.9E-07	CH	Porhyritic Monzonite Intrusive	KP
Mitchell Pit	M-09-097	423144	6266392	1334	-59	54	237.00	253.50	245.25	1123.78	210.22	6.4E-07	7.4E-07	CH	Intermediate Volcanics, Massive Flows/Tuffs	MTH
Mitchell Pit	M-09-097	423144	6266392	1334	-59	54	325.50	340.50	333.00	1048.56	285.44	1.8E-08	1.8E-08	CH	Intermediate Volcanics, Massive Flows/Tuffs	MTH
															Porhyritic Monzonite Intrusive	PR
															Intermediate Volcanics, Massive Flows/Tuffs	SIH
Mitchell Pit	M-09-098	422888	6266069	1201	-62	346	21.40	39.00	30.20	1174.33	26.67	4.5E-08	4.5E-08	CH	Porhyritic Monzonite Intrusive	HEM
Mitchell Pit	M-09-098	422888	6266069	1201	-62	346	114.40	144.40	129.40	1086.75	114.25	1.4E-07	1.4E-07	CH	Porhyritic Monzonite Intrusive	PR
															Porhyritic Monzonite Intrusive	PR
Mitchell Pit	M-09-098	422888	6266069	1201	-62	346	259.90	267.40	263.65	968.21	232.79	1.0E-07	1.0E-07	CH	Volcanic, unknown protolith (intensely altered)	MTH
															Porhyritic Monzonite Intrusive	HEM
															Volcanic, unknown protolith (intensely altered)	MTH
Mitchell Pit	M-09-098	422888	6266069	1201	-62	346	345.40	366.40	355.90	886.76	314.24	2.2E-08	2.1E-08	CH	Volcanic, unknown protolith (intensely altered)	MTH
Mitchell Pit	M-09-099	422900	6265705	892	-74	39	60.00	88.50	74.25	820.63	71.37	1.0E-07	1.0E-07	CH	Volcanic, unknown protolith (intensely altered)	QSP
Mitchell Pit	M-09-099	422900	6265705	892	-74	39	132.00	160.50	146.25	751.42	140.58	3.4E-09	3.4E-09	FH	Volcanic, unknown protolith (intensely altered)	QSP
Mitchell Pit	M-09-099	422900	6265705	892	-74	39	294.00	322.50	308.25	595.69	296.31	1.7E-09	1.7E-09	CH	Volcanic, unknown protolith (intensely altered)	CL
															Volcanic, unknown protolith (intensely altered)	QSP
															Volcanic, unknown protolith (intensely altered)	CL
															Volcanic, unknown protolith (intensely altered)	QSP
Mitchell Pit	M-09-100	422354	6265247	793	-73	252	43.50	67.40	55.45	739.97	53.03	1.1E-06	1.2E-06	CH	Intermediate Volcanics, Massive Flows/Tuffs	PR
Mitchell Pit	M-09-100	422354	6265247	793	-73	252	85.28	175.50	130.39	668.31	124.69	2.9E-07	3.7E-07	CH	Intermediate Volcanics, Massive Flows/Tuffs	PR
															Intermediate Volcanics, Massive Flows/Tuffs	QSP
															Intermediate Volcanics, Massive Flows/Tuffs	PR
Mitchell Pit	M-09-100	422354	6265247	793	-73	252	214.50	234.00	224.25	578.55	214.45	2.9E-10	2.9E-10	CH/FH	Intermediate Volcanics, Massive Flows/Tuffs	PR
Mitchell Pit	M-09-101	423418	6264798	1252	-65	141	267.40	289.90	278.65	999.46	252.54	2.8E-07	3.0E-07	CH	Andesite Ash Tuff	SIH
Mitchell Pit	M-09-102a	422387	6264664	1247	-79	205	303.00	315.00	309.00	943.68	303.32	1.3E-07	1.3E-07	CH	Andesite Ash Tuff	CL

Notes:
"mah" indicates meters along hole. "m bgs" indicates meters below ground surface.
"CH" indicates constant head test. "FH" indicates falling head test.
FH test results are based on short duration tests and actual bedrock hydraulic conductivity could be lower than result presented above
"-" indicates packer test failed because broken bedrock could not be sealed off with packer.
*During CH test water could not be injected at 130 psi

Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-095
Design Test Interval: 257.35 to 276.85
Test #: 2 (try 2)

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: JW/BMM

Collar El.:
Trend: 159
Plunge: 73 deg
Date: 7-Jun-09

Packer Setup Type: Single

Pressure Interval 110

Minutes	Pressure	Volume	Δ Volume
0	110	2046.20	--
1	110	2046.40	0.20
2	112	2046.62	0.22
3	110	2046.85	0.23
4	112	2047.05	0.20
5	112	2047.25	0.20
6	112	2047.45	0.20
7	114	2047.65	0.20
8	116	2047.85	0.20
9	116	2048.05	0.20
10	118	2048.25	0.20
Stable Ave.	113		0.20

Pressure Interval 130

Minutes	Pressure	Volume	Δ Volume
0	130	2048.90	--
1	130	2049.10	0.20
2	130	2049.32	0.22
3	130	2049.52	0.20
4	130	2049.70	0.18
5	132	2049.95	0.25
6	132	2050.12	0.17
7	132	2050.35	0.23
8	132	2050.55	0.20
9	132	2050.75	0.20
10	132	2050.95	0.20
Stable Ave.	131		0.20

Pressure Interval 146

Minutes	Pressure	Volume	Δ Volume
0	146	2051.80	--
1	146	2051.95	0.15
2	146	2052.15	0.20
3	146	2052.40	0.25
4	148	2052.60	0.20
5	148	2052.80	0.20
6	148	2053.05	0.25
7	148	2053.25	0.20
8	148	2053.45	0.20
9	148	2053.70	0.25
10	148	2053.90	0.20
Stable Ave.	147		0.21

Pressure Interval 135

Minutes	Pressure	Volume	Δ Volume
0	135	2054.10	--
1	138	2054.30	0.20
2	138	2054.50	0.20
3	135	2054.65	0.15
4	138	2054.85	0.20
5	135	2055.00	0.15
6	138	2055.20	0.20
7	138	2055.35	0.15
8	138	2055.55	0.20
9	138	2055.70	0.15
10	138	2055.90	0.20
Stable Ave.	137		0.18

Pressure Interval 110

Minutes	Pressure	Volume	Δ Volume
0	110	2056.20	--
1	112	2056.40	0.20
2	112	2056.55	0.15
3	114	2056.70	0.15
4	112	2056.80	0.10
5	112	2057.00	0.20
6	112	2057.10	0.10
7	112	2057.25	0.15
8	112	2057.40	0.15
9	112	2057.55	0.15
10	114	2057.70	0.15
Stable Ave.	112		0.15

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup: 21.63 m
Top of Packer Interval: 225.85 m
Bottom of Packer Interval (or Bottom of Hole): 276.85 m
Packer Inflation Pressure: 725 psi
Rod Stickup Height: 1.9 m
Water Flushed (Vol./Time/Until Clean): 30 minutes
Packer Pipe ID/ or Drill Rod ID (circle one): NQ
Borehole Outside Diameter: 0.076
Vertical height of gauge above ground: 1.9 m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 1:00 PM
End Flushing:
Start Packer Testing:
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments:

First tried with 21 m interval. It wouldn't take any water, so interval was increased to 51 m

Hole #: **M-09-095**
Test #: **2 (try 2)**

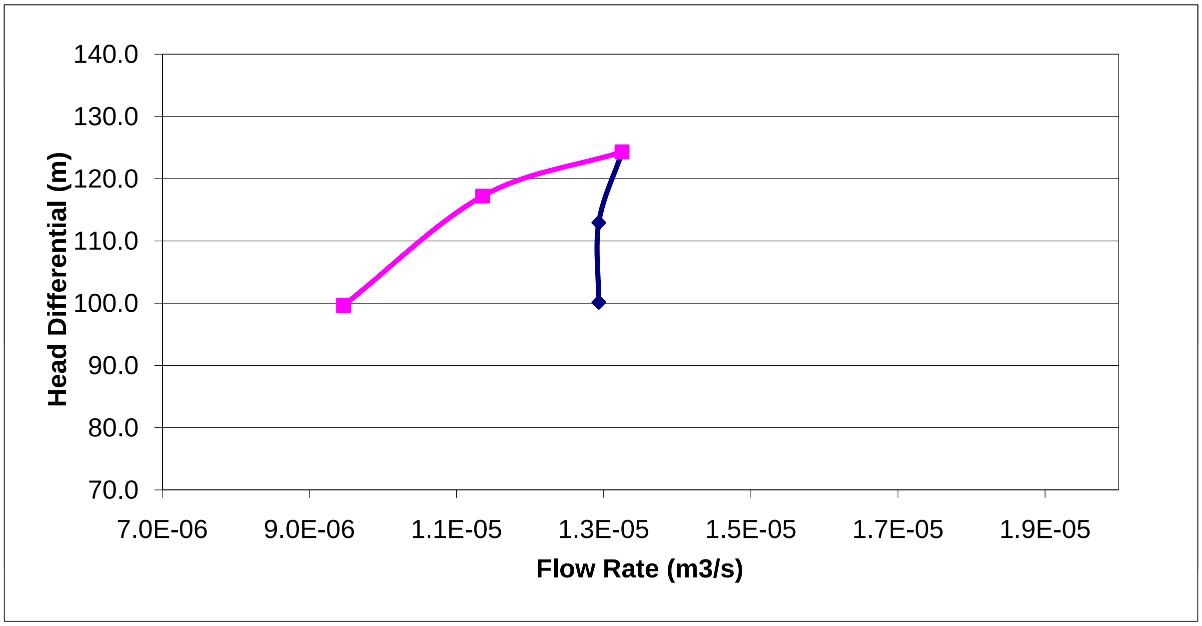
Calculation Input Parameters

Top of Packer Test Interval (mah):	225.9
Bottom of Packer Test Interval (mah):	276.9
L: Length of Test Interval (mah)	51.0
Test Interval Midpoint (mah):	251
Stickup Height (mah):	1.90
Pressure Gauge Height (m above ground):	1.90
Depth to Water Table (mah):	21.63
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	73

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L \sin(A)}{r}\right)}{2 \times \pi \times L \sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
112.9	1.3E-05	79.4	100.2	3.0E-09
131.1	1.3E-05	92.2	112.9	2.7E-09
147.3	1.3E-05	103.5	124.3	2.5E-09
137.2	1.1E-05	96.5	117.2	2.3E-09
112.2	9.5E-06	78.9	99.6	2.2E-09
			Geo Mean	**2.5.E-09**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-095
Design Test Interval:
Test #: 3

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: JW

Collar El.:
Trend: 159
Plunge: 73 deg
Date: 10-Jun-09

Packer Setup Type: Single

Pressure Interval 110

Minutes	Pressure	Volume	Δ Volume
0	110	2076.90	--
1	110	2077.10	0.20
2	108	2077.25	0.15
3	110	2077.40	0.15
4	110	2077.55	0.15
5	110	2077.75	0.20
6	110	2077.90	0.15
7	112	2078.05	0.15
8	110	2078.20	0.15
9	112	2078.35	0.15
10	112	2078.50	0.15
Stable Ave.	110		0.16

Pressure Interval 135

Minutes	Pressure	Volume	Δ Volume
0	135	2079.10	--
1	135	2079.30	0.20
2	137	2079.48	0.18
3	137	2079.65	0.17
4	137	2079.80	0.15
5	137	2080.00	0.20
6	137	2080.15	0.15
7	140	2080.35	0.20
8	140	2080.52	0.17
9	137	2080.70	0.18
10	140	2080.90	0.20
Stable Ave.	137		0.18

Pressure Interval 156

Minutes	Pressure	Volume	Δ Volume
0	155	2082.20	--
1	160	2082.45	0.25
2	160	2082.60	0.15
3	160	2082.75	0.15
4	160	2082.95	0.20
5	160	2083.10	0.15
6	160	2083.30	0.20
7	160	2083.45	0.15
8	160	2083.60	0.15
9	160	2083.75	0.15
10	160	2083.95	0.20
Stable Ave.	160		0.18

Pressure Interval 135

Minutes	Pressure	Volume	Δ Volume
0	140	2084.10	--
1	140	2084.25	0.15
2	145	2084.42	0.17
3	145	2084.60	0.18
4	145	2084.75	0.15
5	148	2084.90	0.15
6	148	2085.08	0.18
7	148	2085.20	0.12
8	148	2085.40	0.20
9	148	2085.52	0.12
10	148	2085.65	0.13
Stable Ave.	146		0.16

Pressure Interval 110

Minutes	Pressure	Volume	Δ Volume
0	105	2086.00	--
1	105	2086.10	0.10
2	105	2086.20	0.10
3	105	2086.32	0.12
4	105	2086.45	0.13
5	105	2086.55	0.10
6	105	2086.70	0.15
7	105	2086.80	0.10
8	105	2086.90	0.10
9	105	2087.00	0.10
10	105	2087.15	0.15
Stable Ave.	105		0.12

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	20.40	m
Top of Packer Interval:	389.10	m
Bottom of Packer Interval (or Bottom of Hole):	440.10	m
Packer Inflation Pressure:	1040	psi
Rod Stickup Height:	1.9	m
Water Flushed (Vol./Time/Until Clean):	12:20	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	1.9	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 12:20 PM
End Flushing: 12:50 PM
Start Packer Testing:
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST --->
FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: Ptest: 205 PSI but gauge max out at 160 PSI. On second run 130 PSI was changed to 140 PSI to be more consistent with the first run.
Generally pressure gauge wandered irregularly.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900

Hole #: **M-09-095**
Test #: **3**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

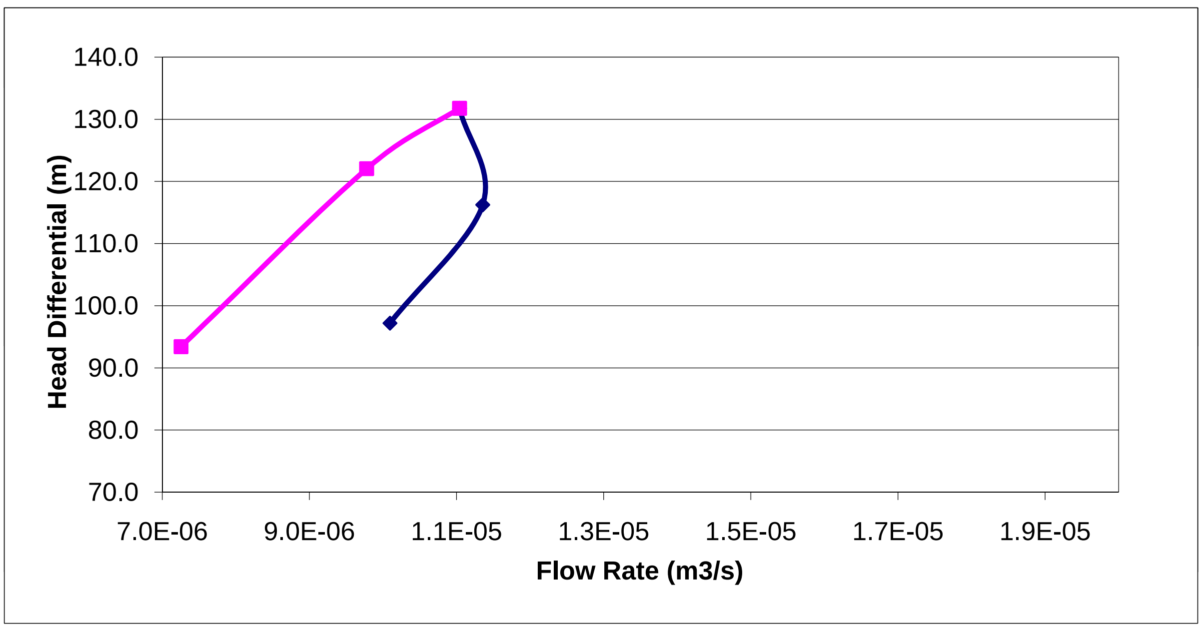
Calculation Input Parameters

Top of Packer Test Interval (mah):	389.1
Bottom of Packer Test Interval (mah):	440.1
L: Length of Test Interval (mah)	51.0
Test Interval Midpoint (mah):	415
Stickup Height (mah):	1.90
Pressure Gauge Height (m above ground):	1.90
Depth to Water Table (mah):	20.40
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	73

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
110.4	1.0E-05	77.6	97.2	2.4E-09
137.5	1.1E-05	96.6	116.2	2.3E-09
159.5	1.1E-05	112.2	131.8	2.0E-09
145.7	9.8E-06	102.5	122.1	1.9E-09
105.0	7.3E-06	73.8	93.4	1.8E-09
			Geo Mean	**2.1.E-09**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-096
Design Test Interval: 83.98-114.02 m
Test #: 1

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: EEL/BMM

Collar El.:
Trend: 89
Plunge: 66 deg
Date: 10-Jun-09

Packer Setup Type: Single

Pressure Interval 65

Minutes	Pressure	Volume	Δ Volume
0	63	170.00	--
1	62	175.50	5.50
2	63	179.50	4.00
3	63	183.50	4.00
4	63	187.50	4.00
5	65	191.50	4.00
6	65	195.50	4.00
7	67	199.50	4.00
8	67	203.00	3.50
9	67	207.00	4.00
10	68	211.00	4.00
Stable Ave.	65		4.10

Pressure Interval 98

Minutes	Pressure	Volume	Δ Volume
0	97	225.00	--
1	98	231.50	6.50
2	99	238.00	6.50
3	102	245.00	7.00
4	103	251.00	6.00
5	96	256.50	5.50
6	94	261.50	5.00
7	95	266.50	5.00
8	94	271.30	4.80
9	97	276.10	4.80
10	96	281.10	5.00
Stable Ave.	97		5.61

Pressure Interval 130

Minutes	Pressure	Volume	Δ Volume
0	128	296.00	--
1	130	305.00	9.00
2	133	314.00	9.00
3	135	322.60	8.60
4	129	330.30	7.70
5	129	337.50	7.20
6	129	344.00	6.50
7	130	350.90	6.90
8	131	357.70	6.80
9	132	364.50	6.80
10	132	371.20	6.70
Stable Ave.	131		7.52

Pressure Interval 98

Minutes	Pressure	Volume	Δ Volume
0	95	377.50	--
1	97	380.30	2.80
2	101	383.70	3.40
3	101	387.10	3.40
4	101	390.40	3.30
5	102	393.80	3.40
6	103	397.20	3.40
7	102	400.60	3.40
8	104	404.00	3.40
9	104	407.30	3.30
10	105	410.50	3.20
Stable Ave.	101		3.30

Pressure Interval 65

Minutes	Pressure	Volume	Δ Volume
0	70	407.50	--
1	69	408.20	0.70
2	69	409.00	0.80
3	69	409.90	0.90
4	69	410.75	0.85
5	68	411.70	0.95
6	68	412.60	0.90
7	67	413.60	1.00
8	67	414.60	1.00
9	67	415.60	1.00
10	67	416.60	1.00
Stable Ave.	68		0.91

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup: -0.08 m
Top of Packer Interval: 83.98 m
Bottom of Packer Interval (or Bottom of Hole): 114.02 m
Packer Inflation Pressure: 486 psi
Rod Stickup Height: 1.5 m
Water Flushed (Vol./Time/Until Clean): 30 min (clean)
Packer Pipe ID/ or Drill Rod ID (circle one): NQ
Borehole Outside Diameter: 0.076
Vertical height of gauge above ground: 1.0 m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 10:15 AM
End Flushing: 10:45 AM
Start Packer Testing: 1:40 PM
End Packer Testing: 2:40 PM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: On 5th interval @ ~70 psi no water coild be injected down the hole.

No grease or polymer was used in drilling this hole.

Hole #: **M-09-096**
Test #: **1**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

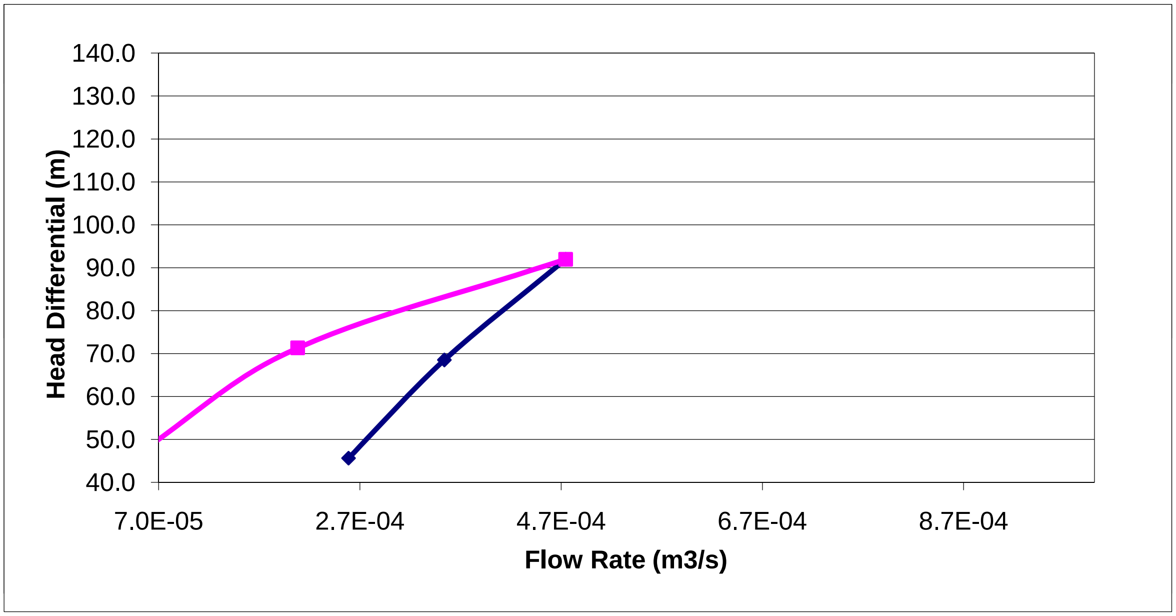
Calculation Input Parameters

Top of Packer Test Interval (mah):	84.0
Bottom of Packer Test Interval (mah):	114.0
L: Length of Test Interval (mah)	30.0
Test Interval Midpoint (mah):	99
Stickup Height (mah):	1.48
Pressure Gauge Height (m above ground):	1.48
Depth to Water Table (mah):	-0.08
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	66

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
64.8	2.6E-04	45.6	45.6	2.2E-07
97.4	3.5E-04	68.5	68.5	2.0E-07
130.7	4.7E-04	91.9	92.0	2.0E-07
101.4	2.1E-04	71.3	71.3	1.1E-07
68.2	5.7E-05	47.9	48.0	4.6E-08
			Geo Mean	**1.3.E-07**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-096
Design Test Interval: 162 to 199.5
Test #: 2

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: EEL/BMM

Collar El.:
Trend: 86
Plunge: 70 deg
Date: 10-Jun-09

Packer Setup Type: Single

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2	test not able to be complete		0.00
3	because could not inject		0.00
4	water at up to 130 psi		0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00

Stable Ave. 0.00

Pressure Interval 98

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00

Stable Ave. 0.00

Pressure Interval 128

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00

Stable Ave. 0.00

Pressure Interval 98

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00

Stable Ave. 0.00

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00

Stable Ave. 0.00

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup: -1.50 m
Top of Packer Interval: 162.00 m
Bottom of Packer Interval (or Bottom of Hole): 199.50 m
Packer Inflation Pressure: 604 psi
Rod Stickup Height: 1.5 m
Water Flushed (Vol./Time/Until Clean): 30 min
Packer Pipe ID/ or Drill Rod ID (circle one): NQ
Borehole Outside Diameter: 0.076
Vertical height of gauge above ground: 1.0 m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 1:00 PM
End Flushing: 1:30 PM
Start Packer Testing: 2:40 PM
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments:

Grease was used on drill rod while drilling.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900

Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-096
Design Test Interval: 28.5
Test #: 3

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: EEL/BMM/MD

Collar El.:
Trend: 89
Plunge: 66 deg
Date: 12-Jun-09

Packer Setup Type: Single

Pressure Interval 125

Minutes	Pressure	Volume	Δ Volume
0	126	322.10	--
5	129	322.60	0.50
10	123	323.00	0.40
15	124	323.45	0.45
20	125	323.88	0.43
25	130	324.28	0.40
30	130	324.65	0.38

Stable Ave. 127 0.08

Pressure Interval 125

Minutes	Pressure	Volume	Δ Volume
0			--
1			
2			
3	could not inject below 125 psi.		
4			
5			
6			
7			
8			
9			
10			

Stable Ave.

Pressure Interval 128

Minutes	Pressure	Volume	Δ Volume
0			--
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Stable Ave.

Pressure Interval 125

Minutes	Pressure	Volume	Δ Volume
0			--
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Stable Ave.

Pressure Interval 125

Minutes	Pressure	Volume	Δ Volume
0			--
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Stable Ave.

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	1.80	m
Top of Packer Interval:	222.00	m
Bottom of Packer Interval (or Bottom of Hole):	250.50	m
Packer Inflation Pressure:	686	psi
Rod Stickup Height:	1.5	m
Water Flushed (Vol./Time/Until Clean):	30 min (clean)	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	1.5	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing:	4:15 AM
End Flushing:	5:15 AM
Start Packer Testing:	10:50 AM
End Packer Testing:	11:45 AM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: test started by Mike Davies. Leak test performed by EEL. Test run by EEL/BMM

No grease or polymer was used in drilling this hole.

Hole #: **M-09-096**
Test #: **3**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

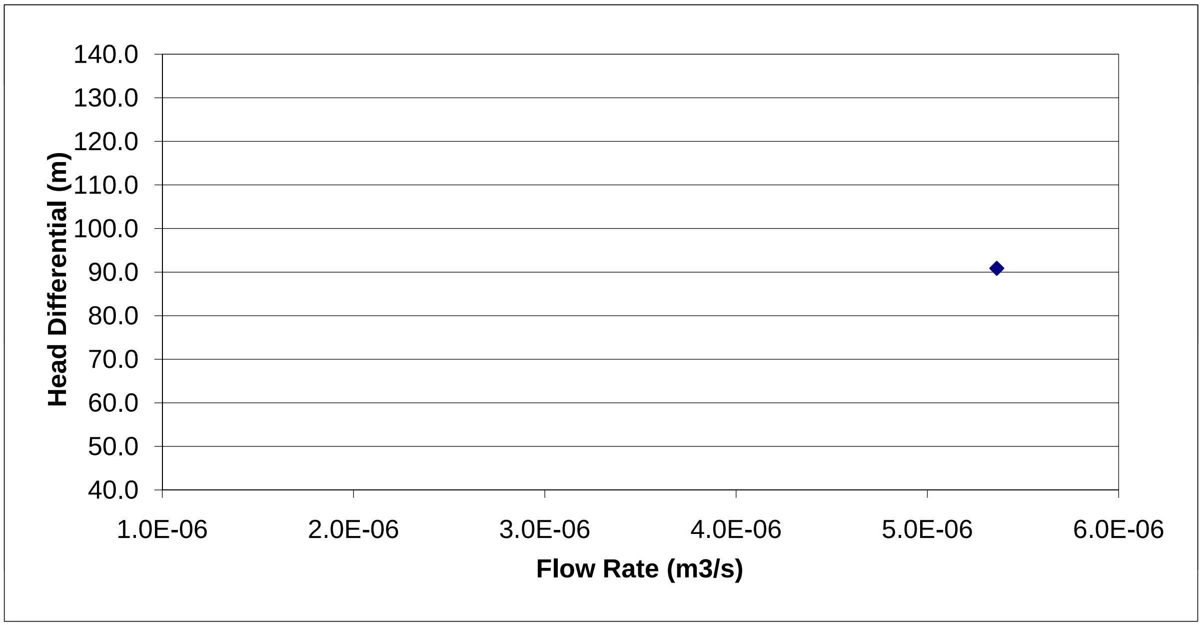
Calculation Input Parameters

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Top of Packer Test Interval (mah):	222.0
Bottom of Packer Test Interval (mah):	250.5
L: Length of Test Interval (mah)	28.5
Test Interval Midpoint (mah):	236
Stickup Height (mah):	1.48
Pressure Gauge Height (m above ground):	1.48
Depth to Water Table (mah):	1.80
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	66

* mah indicates "meters along hole"

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
126.7	5.4E-06	89.1	90.9	2.4E-09
			Geo Mean	**2.4.E-09**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-096
Design Test Interval: 270 to 300 m
Test #: 4

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: MRD

Collar El.:
Trend: 89
Plunge: 66 deg
Date: 13-Jun-09

Packer Setup Type: Single

Pressure Interval 65

Minutes	Pressure	Volume	Δ Volume
0	64	328.40	--
1	64	328.40	0.00
2			
3			
4			
5	no measureable flow		
6			
7			
8			
9			
10			
Stable Ave.	64		0.00

Pressure Interval 90

Minutes	Pressure	Volume	Δ Volume
0	90	329.89	--
1	90	329.89	0.00
2	-	329.89	0.00
3	90	329.89	0.00
4	90	329.94	0.05
5	90	329.95	0.01
6	90	329.99	0.04
7	95	330.01	0.02
8	90	330.05	0.04
9	90	330.10	0.05
10	95	330.11	0.01
Stable Ave.	91		0.02

Pressure Interval 90

Minutes	Pressure	Volume	Δ Volume
0	85	328.70	--
1	90	-	
2	90	-	
3	-	-	
4	90	328.82	0.03
5	-	-	
6	90	328.89	0.03
7	-	-	
8	-	-	
9	90	328.95	0.02
10	90	328.99	0.04
Stable Ave.	89		0.03

Pressure Interval 70

Minutes	Pressure	Volume	Δ Volume
0	70	330.15	--
1	-	330.15	0.00
2	70	330.19	0.04
3	-	330.19	0.00
4	70	330.22	0.03
5	-	330.22	0.00
6	72	330.29	0.07
7	-	330.29	0.00
8	72	330.32	0.03
9	-	330.32	0.00
10	72	330.35	0.03
Stable Ave.	71		0.02

Pressure Interval 130

Minutes	Pressure	Volume	Δ Volume
0	138	329.34	--
1	136	329.34	0.00
2	136	329.45	0.11
3	130	329.50	0.05
4	135	329.52	0.02
5	132	329.59	0.07
6	-	329.59	0.00
7	130	329.67	0.08
8	132	329.72	0.05
9	132	329.75	0.03
10	132	329.82	0.07
Stable Ave.	133		0.05

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	0.00	m
Top of Packer Interval:	270.05	m
Bottom of Packer Interval (or Bottom of Hole):	300.05	m
Packer Inflation Pressure:	757	psi
Rod Stickup Height:	1.8	m
Water Flushed (Vol./Time/Until Clean):	20 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	1.2	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 2:30 AM
End Flushing: 2:50 AM
Start Packer Testing:
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: 5 am - inflated packer to 760. N bottle vavle closed. 5:15 - prssure unchanged water at top of rods 1.8 mbgs. Trickle from casing throughout test. Flow from above packer? Packer inflation steady throughout test.

on each test fluctuated about 7 psi around average.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900

Hole #: **M-09-096**
Test #: **4**

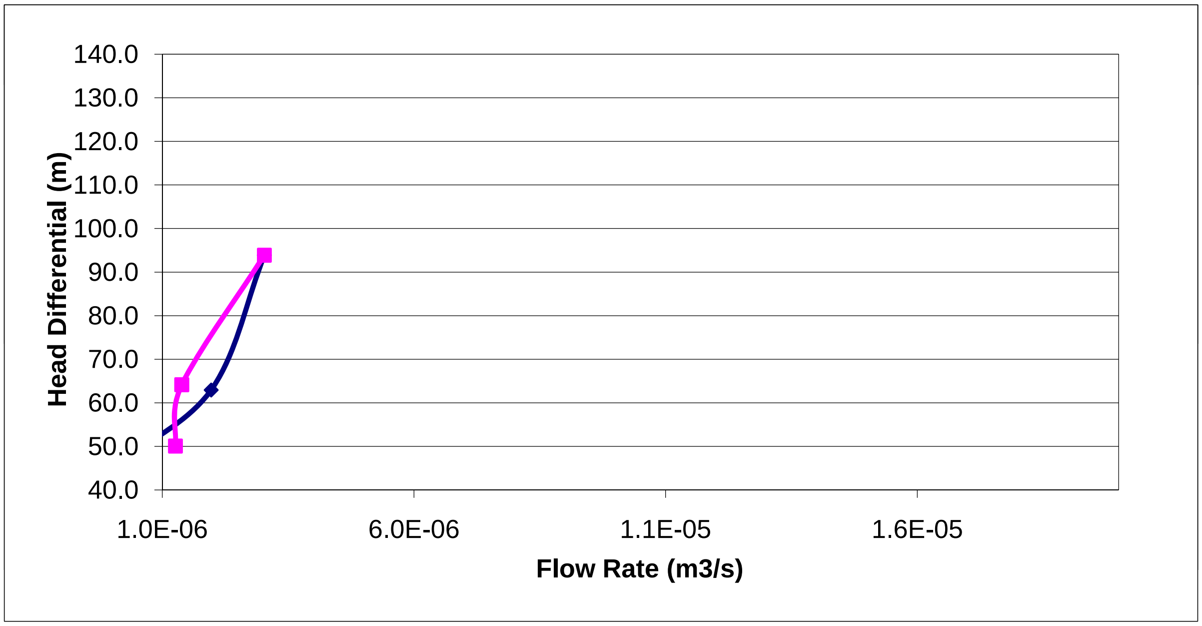
Calculation Input Parameters

Top of Packer Test Interval (mah):	270.1
Bottom of Packer Test Interval (mah):	300.1
L: Length of Test Interval (mah)	30.0
Test Interval Midpoint (mah):	285
Stickup Height (mah):	1.80
Pressure Gauge Height (m above ground):	1.80
Depth to Water Table (mah):	0.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	66

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L \sin(A)}{r}\right)}{2 \times \pi \times L \sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
64.0	0.0E+00	45.0	45.2	--
89.3	2.0E-06	62.8	62.9	1.2E-09
133.3	3.0E-06	93.7	93.9	1.2E-09
91.0	1.4E-06	64.0	64.1	8.3E-10
71.0	1.3E-06	49.9	50.1	9.6E-10
			Geo Mean	**1.0.E-09**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-097
Design Test Interval: 57 to 70.5 m
Test #: 2

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: M.Davies

Collar El.:
Trend: 54
Plunge: 59 deg
Date: 16-Jun-09 N/S

Packer Setup Type: Single

Pressure Interval 27.5

Minutes	Pressure	Volume	Δ Volume
0	28	635.00	--
1	27	643.90	8.90
2		652.40	8.50
3	28	660.90	8.50
4	28	669.40	8.50
5	28	677.70	8.30
6	28	685.80	8.10
7	28	694.30	8.50
8	28	702.60	8.30
9	28	710.90	8.30
10	28	719.20	8.30
Stable Ave.	28		8.42

Pressure Interval 41

Minutes	Pressure	Volume	Δ Volume
0	42	980.00	--
1	42	989.30	9.30
2	42	999.40	10.10
3	42	1009.30	9.90
4	42	1018.80	9.50
5	42	1028.40	9.60
6	42	1038.00	9.60
7			
8	41	1057.50	9.75
9	41	1067.00	9.50
10	41	1076.60	9.60
Stable Ave.	42		9.65

Pressure Interval 41

Minutes	Pressure	Volume	Δ Volume
0	42	735.00	--
1	44	745.60	10.60
2	45	755.00	9.40
3	46	764.90	9.90
4	46	774.90	10.00
5	46	784.70	9.80
6	45	794.50	9.80
7	46	804.40	9.90
8	46	814.20	9.80
9	46	824.10	9.90
10	46	833.80	9.70
Stable Ave.	45		9.88

Pressure Interval 27.5

Minutes	Pressure	Volume	Δ Volume
0	28	1088.00	--
1	25	1096.00	8.00
2	25	1104.10	8.10
3	25	1112.10	8.00
4	25	1120.40	8.30
5	25	1128.20	7.80
6	25	1136.70	8.50
7	25	1144.90	8.20
8	25	1153.00	8.10
9	25	1161.10	8.10
10	25	1169.60	8.50
Stable Ave.	25		8.16

Pressure Interval 55

Minutes	Pressure	Volume	Δ Volume
0	58	855.00	--
1	57	866.00	11.00
2	57	877.10	11.10
3	57	888.10	11.00
4	57	899.00	10.90
5	57	910.00	11.00
6	57	921.00	11.00
7	57	931.30	10.30
8	57	943.00	11.70
9	57	954.00	11.00
10	57	965.10	11.10
Stable Ave.	57		11.01

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	48.23	m
Top of Packer Interval:	57.00	m
Bottom of Packer Interval (or Bottom of Hole):	70.50	m
Packer Inflation Pressure:	344	psi
Rod Stickup Height:	2.0	m
Water Flushed (Vol./Time/Until Clean):	~ 30 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	1.4	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing:
End Flushing:
Start Packer Testing: 11:15 PM
End Packer Testing: 12:15 AM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: Packer pressure good throughout test. No leakage seen at casing. No grease on rods to this depth.

Hole #: **M-09-097**
Test #: **2**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

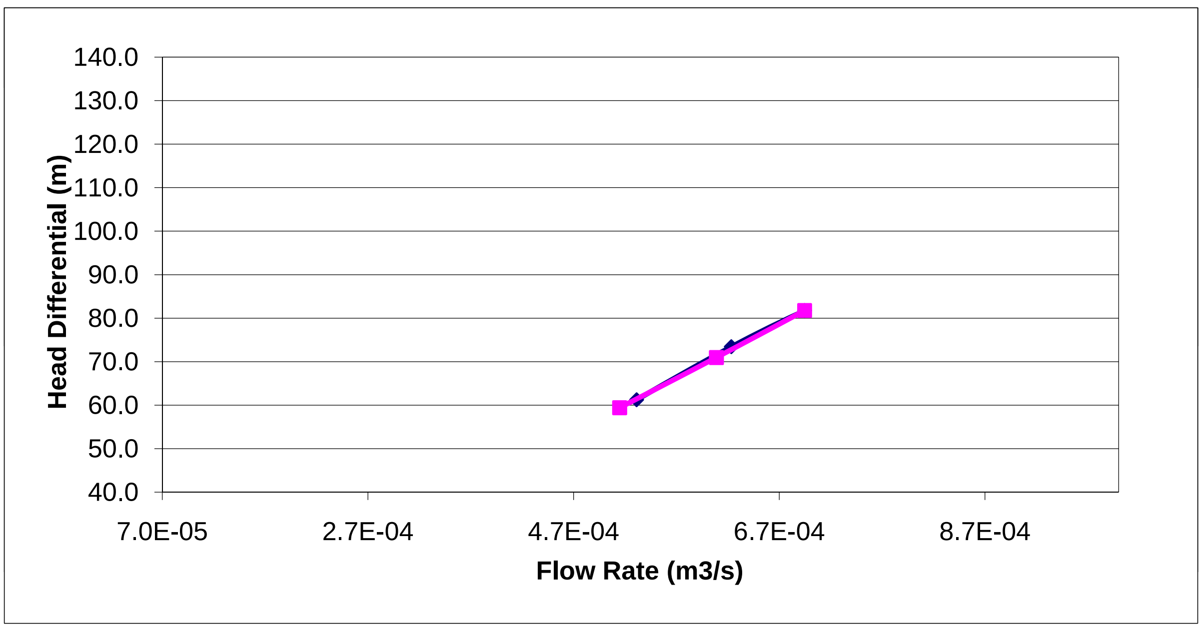
Calculation Input Parameters

Top of Packer Test Interval (mah):	57.0
Bottom of Packer Test Interval (mah):	70.5
L: Length of Test Interval (mah)	13.5
Test Interval Midpoint (mah):	64
Stickup Height (mah):	2.00
Pressure Gauge Height (m above ground):	2.00
Depth to Water Table (mah):	48.23
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	59

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
27.9	5.3E-04	19.6	61.2	6.8E-07
45.3	6.2E-04	31.8	73.5	6.7E-07
57.1	6.9E-04	40.1	81.8	6.7E-07
41.7	6.1E-04	29.3	70.9	6.8E-07
25.3	5.1E-04	17.8	59.4	6.8E-07
			Geo Mean	**6.8.E-07**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-097
Design Test Interval:
Test #: 3

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: M. Davies

Collar El.:
Trend: 54
Plunge: 59 deg
Date: 6/19-20/2009

Packer Setup Type: Single

Pressure Interval 22.5

Minutes	Pressure	Volume	Δ Volume
0	22	1815.00	--
1	22	1825.90	10.90
2	22	1836.40	10.50
3	22	1847.10	10.70
4	22	1857.60	10.50
5	22	1868.10	10.50
6	22	1878.70	10.60
7	22	1889.10	10.40
8	22	1899.60	10.50
9	22	1910.00	10.40
10	25	1920.40	10.40
Stable Ave.	22		10.54

Pressure Interval 33.8

Minutes	Pressure	Volume	Δ Volume
0	35	1945.00	--
1	35	1956.60	11.60
2	35	1968.00	11.40
3	36	1979.50	11.50
4	36	1991.00	11.50
5	36	2002.40	11.40
6	35	2013.70	11.30
7	36	2025.00	11.30
8	38	2036.40	11.40
9	38	2047.70	11.30
10	38	2059.00	11.30
Stable Ave.	36		11.40

Pressure Interval 45

Minutes	Pressure	Volume	Δ Volume
0	45	2080.00	--
1	45	2092.00	12.00
2	46	2103.90	11.90
3	45	2116.10	12.20
4	45	2127.70	11.60
5	46	2139.50	11.80
6	46	2151.60	12.10
7	48	2163.40	11.80
8	48	2175.60	12.20
9	46	2187.00	11.40
10	48	2198.80	11.80
Stable Ave.	46		11.88

Pressure Interval 33.8

Minutes	Pressure	Volume	Δ Volume
0	35	2215.00	--
1	35	2225.70	10.70
2	35	2236.50	10.80
3	35	2247.20	10.70
4	35	2257.90	10.70
5	35	2268.80	10.90
6	35	2279.50	10.70
7	35	2290.40	10.90
8	35	2301.10	10.70
9	35	2311.90	10.80
10	35	2322.70	10.80
Stable Ave.	35		10.77

Pressure Interval 22.5

Minutes	Pressure	Volume	Δ Volume
0	24	2340.00	--
1	24	2350.00	10.00
2	24	2359.90	9.90
3	24	2369.80	9.90
4	24	2379.50	9.70
5	25	2389.40	9.90
6	25	2398.90	9.50
7	24	2408.80	9.90
8	24	2418.50	9.70
9	25	2428.20	9.70
10	25	2438.10	9.90
Stable Ave.	24		9.81

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	56.35	m
Top of Packer Interval:	237.00	m
Bottom of Packer Interval (or Bottom of Hole):	253.50	m
Packer Inflation Pressure:	580	psi
Rod Stickup Height:	2.4	m
Water Flushed (Vol./Time/Until Clean):	~ 35-40 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	2.4	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing:
End Flushing:
Start Packer Testing: 12:45 AM
End Packer Testing: 1:50 AM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: no return to surface of water while drilling. Should be no grease in interval.
bottom ~ 100 m no grease used.

Hole #: **M-09-097**
Test #: **3**

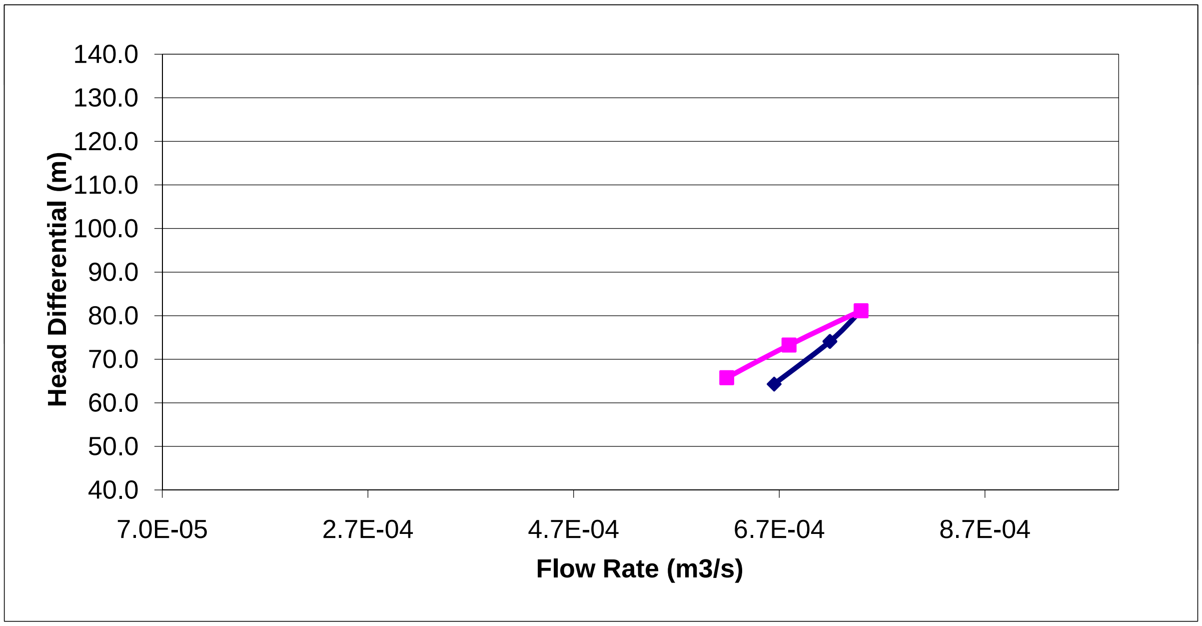
Calculation Input Parameters

Top of Packer Test Interval (mah):	237.0
Bottom of Packer Test Interval (mah):	253.5
L: Length of Test Interval (mah)	16.5
Test Interval Midpoint (mah):	245
Stickup Height (mah):	2.40
Pressure Gauge Height (m above ground):	2.40
Depth to Water Table (mah):	56.35
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	59

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
22.3	6.6E-04	15.7	64.3	6.9E-07
36.2	7.2E-04	25.4	74.1	6.5E-07
46.2	7.5E-04	32.5	81.1	6.2E-07
35.0	6.8E-04	24.6	73.3	6.2E-07
24.4	6.2E-04	17.1	65.8	6.3E-07
			Geo Mean	**6.4.E-07**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-097
Design Test Interval:
Test #: 4

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: EEL

Collar El.:
Trend: 54
Plunge: 59 deg
Date: 21-Jun-09

Packer Setup Type: Single

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0	64	2886.00	--
1	64	2886.60	0.60
2	64	2886.95	0.35
3	64	2887.40	0.45
4	64	2887.80	0.40
5	64	2888.20	0.40
6	64	2888.60	0.40
7	64	2889.00	0.40
8	64	2889.40	0.40
9	64	2889.80	0.40
10	63	2890.20	0.40
Stable Ave.	64		0.42

Pressure Interval 96

Minutes	Pressure	Volume	Δ Volume
0	98	2893.50	--
1	94	2894.00	0.50
2	99	2894.40	0.40
3	97	2894.85	0.45
4	94	2895.30	0.45
5	95	2895.70	0.40
6	95	2896.15	0.45
7	95	2896.60	0.45
8	94	2897.00	0.40
9	94	2897.40	0.40
10	96	2897.80	0.40
Stable Ave.	96		0.43

Pressure Interval 128

Minutes	Pressure	Volume	Δ Volume
0	124	2899.20	--
1	130	2899.70	0.50
2	124	2900.10	0.40
3	124	2900.60	0.50
4	126	2901.05	0.45
5	128	2901.50	0.45
6	130	2902.00	0.50
7	128	2902.50	0.50
8	130	2903.00	0.50
9	128	2903.40	0.40
10	130	2903.90	0.50
Stable Ave.	127		0.47

Pressure Interval 96

Minutes	Pressure	Volume	Δ Volume
0	92	2904.30	--
1	90	2904.70	0.40
2	90	2905.05	0.35
3	91	2905.40	0.35
4	92	2905.80	0.40
5	92	2906.20	0.40
6	93	2906.55	0.35
7	94	2906.90	0.35
8	91	2907.30	0.40
9	92	2907.65	0.35
10	93	2908.05	0.40
Stable Ave.	92		0.38

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0	66	2908.20	--
1	68	2908.50	0.30
2	66	2908.80	0.30
3	66	2909.10	0.30
4	66	2909.40	0.30
5	66	2909.70	0.30
6	66	2910.00	0.30
7	65	2910.35	0.35
8	65	2910.65	0.30
9	65	2910.95	0.30
10	67	2911.25	0.30
Stable Ave.	66		0.31

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup: 42.70 m
Top of Packer Interval: 325.50 m
Bottom of Packer Interval (or Bottom of Hole): 340.50 m
Packer Inflation Pressure: 785 psi
Rod Stickup Height: 2.4 m
Water Flushed (Vol./Time/Until Clean): until clean
Packer Pipe ID/ or Drill Rod ID (circle one): NQ
Borehole Outside Diameter: 0.076
Vertical height of gauge above ground: 1.5 m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 11:17 AM
End Flushing: 12:00 PM
Start Packer Testing: 3:30 PM
End Packer Testing: 4:30 PM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: Short interval to ensure a good seat for packers. Zone tested mainly comprised of fairly competent rock (unlike rock above at 325 m).

When filled rod· 100 m no grease used.

hole not getting any return during drilling

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900

Hole #: **M-09-097**
Test #: **4**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

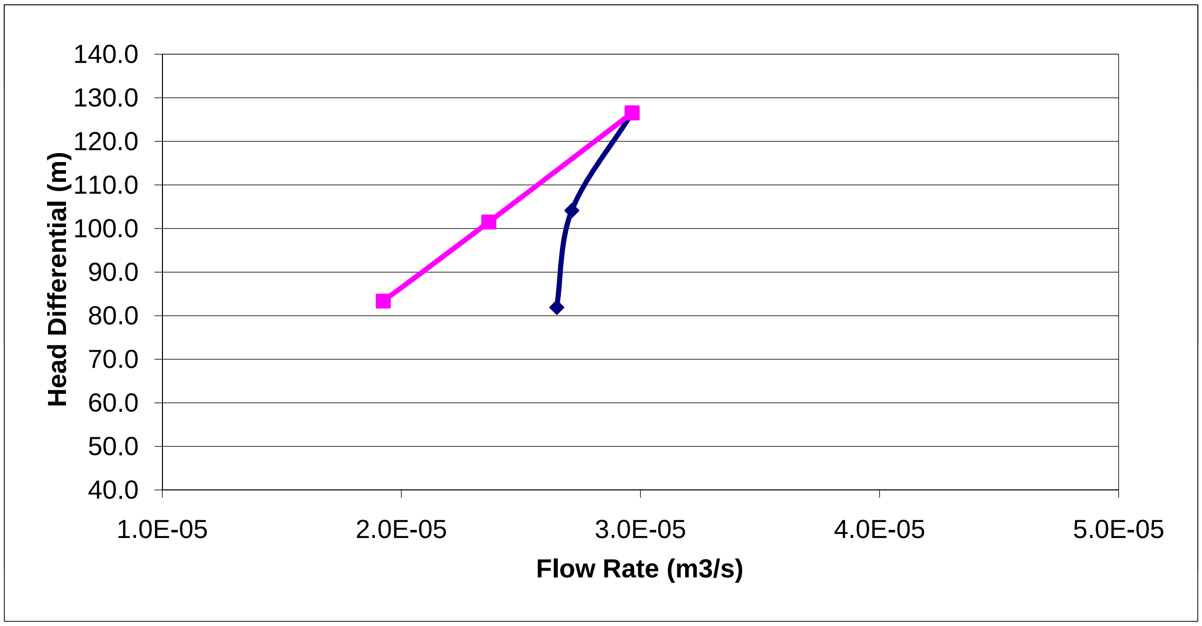
Calculation Input Parameters

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Top of Packer Test Interval (mah):	325.5
Bottom of Packer Test Interval (mah):	340.5
L: Length of Test Interval (mah)	15.0
Test Interval Midpoint (mah):	333
Stickup Height (mah):	2.40
Pressure Gauge Height (m above ground):	2.40
Depth to Water Table (mah):	42.70
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	59

* mah indicates "meters along hole"

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
63.9	2.6E-05	44.9	81.9	2.3E-08
95.5	2.7E-05	67.2	104.1	1.9E-08
127.5	3.0E-05	89.6	126.6	1.7E-08
91.8	2.4E-05	64.6	101.5	1.7E-08
66.0	1.9E-05	46.4	83.3	1.7E-08
			Geo Mean	**1.8.E-08**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-098
Design Test Interval: 21 to 39m
Test #: 1

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: MAB (Dean and Rudi)

Collar El.:
Trend: 346
Plunge: 62 deg
Date: 17-Jun-09

Packer Setup Type: Single

Pressure Interval 20

Minutes	Pressure	Volume	Δ Volume
0	20	2090.40	--
1	20	2090.55	0.15
2	20	2090.75	0.20
3	20	2090.95	0.20
4	20	2091.10	0.15
5	20	2091.30	0.20
6	20	2091.45	0.15
7	20	2091.65	0.20
8	20	2091.80	0.15
9	20	2092.00	0.20
10	20	2092.20	0.20
Stable Ave.	20		0.18

Pressure Interval 30

Minutes	Pressure	Volume	Δ Volume
0	30	2093.20	--
1	31	2093.50	0.30
2	30	2093.70	0.20
3	32	2093.95	0.25
4	31	2094.20	0.25
5	31	2094.45	0.25
6	31	2094.70	0.25
7	31	2095.00	0.30
8	31	2095.20	0.20
9	31	2095.50	0.30
10	31	2095.75	0.25
Stable Ave.	31		0.26

Pressure Interval 40

Minutes	Pressure	Volume	Δ Volume
0	40	2096.65	--
1	42	2097.20	0.55
2	40	2097.60	0.40
3	40	2098.05	0.45
4	40	2098.50	0.45
5	40	2099.00	0.50
6	40	2099.50	0.50
7	40	2100.00	0.50
8	40	2100.55	0.55
9	40	2101.05	0.50
10	40	2101.55	0.50
Stable Ave.	40		0.49

Pressure Interval 30

Minutes	Pressure	Volume	Δ Volume
0	30	2101.95	--
1	30	2102.40	0.45
2	30	2102.80	0.40
3	30	2103.20	0.40
4	30	2103.65	0.45
5	30	2104.10	0.45
6	30	2104.50	0.40
7	30	2104.95	0.45
8	30	2105.35	0.40
9	30	2105.80	0.45
10	30	2106.20	0.40
Stable Ave.	30		0.43

Pressure Interval 20

Minutes	Pressure	Volume	Δ Volume
0	20	2106.20	--
1	20	2106.40	0.20
2	20	2106.65	0.25
3	20	2106.90	0.25
4	20	2107.10	0.20
5	20	2107.40	0.30
6	20	2107.70	0.30
7	20	2107.95	0.25
8	20	2108.25	0.30
9	20	2108.50	0.25
10	20	2108.75	0.25
Stable Ave.	20		0.26

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	7.00	m
Top of Packer Interval:	21.40	m
Bottom of Packer Interval (or Bottom of Hole):	39.00	m
Packer Inflation Pressure:	300	psi
Rod Stickup Height:	3.0	m
Water Flushed (Vol./Time/Until Clean):	until clean	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	1.5	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing:
End Flushing:
Start Packer Testing:
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments:

Hole #: **M-09-098**
Test #: **1**

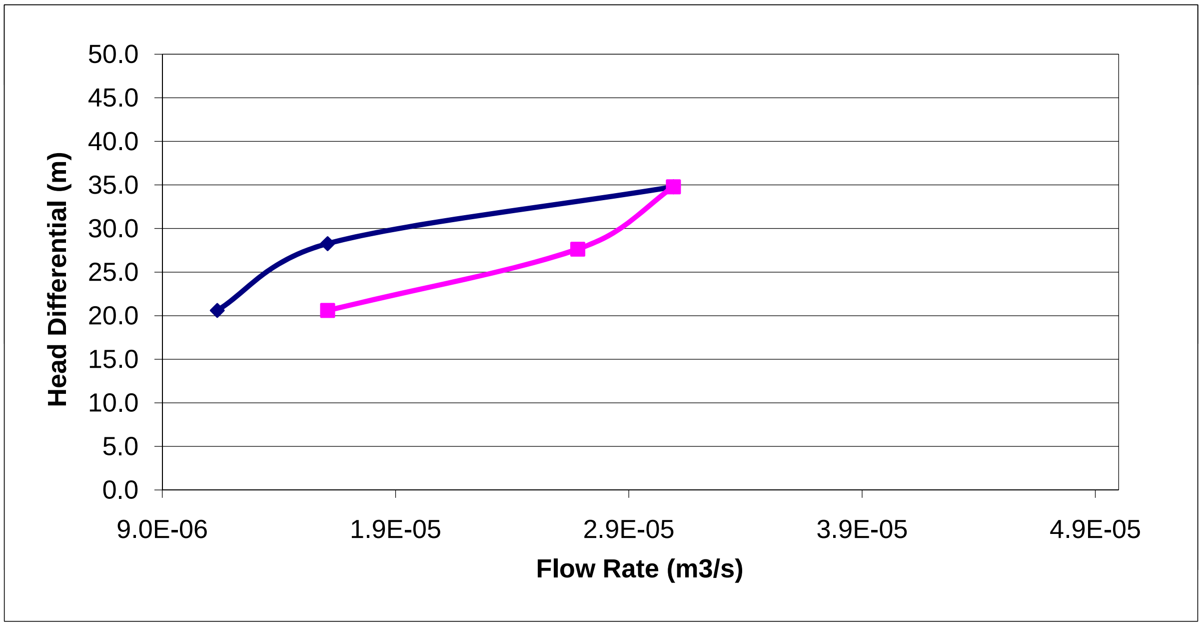
Calculation Input Parameters

Top of Packer Test Interval (mah):	21.4
Bottom of Packer Test Interval (mah):	39.0
L: Length of Test Interval (mah)	17.6
Test Interval Midpoint (mah):	30
Stickup Height (mah):	3.04
Pressure Gauge Height (m above ground):	3.04
Depth to Water Table (mah):	7.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	62

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
20.0	1.1E-05	14.1	20.6	3.4E-08
30.9	1.6E-05	21.7	28.3	3.5E-08
40.2	3.1E-05	28.3	34.8	5.5E-08
30.0	2.7E-05	21.1	27.6	6.0E-08
20.0	1.6E-05	14.1	20.6	4.8E-08
			Geo Mean	**4.5.E-08**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-098
Design Test Interval: 114 to 144.4 m
Test #: 2

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: JRW

Collar El.:
Trend: 346
Plunge: 62 deg
Date: 18-Jun-09

Packer Setup Type: Single

Pressure Interval 70

Minutes	Pressure	Volume	Δ Volume
0	68	2305.00	--
1	68	2312.20	7.20
2	62	2321.94	9.74
3	62	2326.80	4.86
4	64	2334.20	7.40
5	66	2341.80	7.60
6	64	2349.30	7.50
7	64	2356.70	7.40
8	66	2363.90	7.20
9	66	2371.30	7.40
10	64	2378.70	7.40
Stable Ave.	65		7.37

Pressure Interval 105

Minutes	Pressure	Volume	Δ Volume
0	100	2768.00	--
1	102	2776.00	8.00
2	105	2783.90	7.90
3	100	2791.90	8.00
4	105	2799.70	7.80
5	102	2807.40	7.70
6	102	2815.20	7.80
7	100	2823.00	7.80
8	95	2830.60	7.60
9	95	2838.70	8.10
10	100	2846.40	7.70
Stable Ave.	101		7.84

Pressure Interval 165

Minutes	Pressure	Volume	Δ Volume
0	100	2394.00	--
1	102	2403.10	9.10
2	102	2412.00	8.90
3	100	2420.80	8.80
4	98	2429.80	9.00
5	100	2438.90	9.10
6	100	2447.70	8.80
7	100	2456.90	9.20
8	105	2466.20	9.30
9	110	2475.10	8.90
10	112	2484.50	9.40
Stable Ave.	103		9.05

Pressure Interval 70

Minutes	Pressure	Volume	Δ Volume
0	68	2861.00	--
1	70	2868.10	7.10
2	68	2875.30	7.20
3	70	2882.30	7.00
4	70	2889.40	7.10
5	68	2896.40	7.00
6	70	2903.50	7.10
7	70	2910.40	6.90
8	72	2917.50	7.10
9	68	2924.50	7.00
10	70	2931.60	7.10
Stable Ave.	69		7.06

Pressure Interval 140

Minutes	Pressure	Volume	Δ Volume
0	130	2648.00	--
1	132	2657.00	9.00
2	138	2666.60	9.60
3	138	2675.80	9.20
4	138	2685.10	9.30
5	138	2694.40	9.30
6	136	2703.60	9.20
7	138	2712.70	9.10
8	142	2722.00	9.30
9	142	2731.10	9.10
10	140	2740.20	9.10
Stable Ave.	137		9.22

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	93.00	m
Top of Packer Interval:	114.40	m
Bottom of Packer Interval (or Bottom of Hole):	144.40	m
Packer Inflation Pressure:	438	psi
Rod Stickup Height:	2.1	m
Water Flushed (Vol./Time/Until Clean):	1/2 hour	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	1.5	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing:
End Flushing:
Start Packer Testing:
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments:

Hole #: **M-09-098**
Test #: **2**

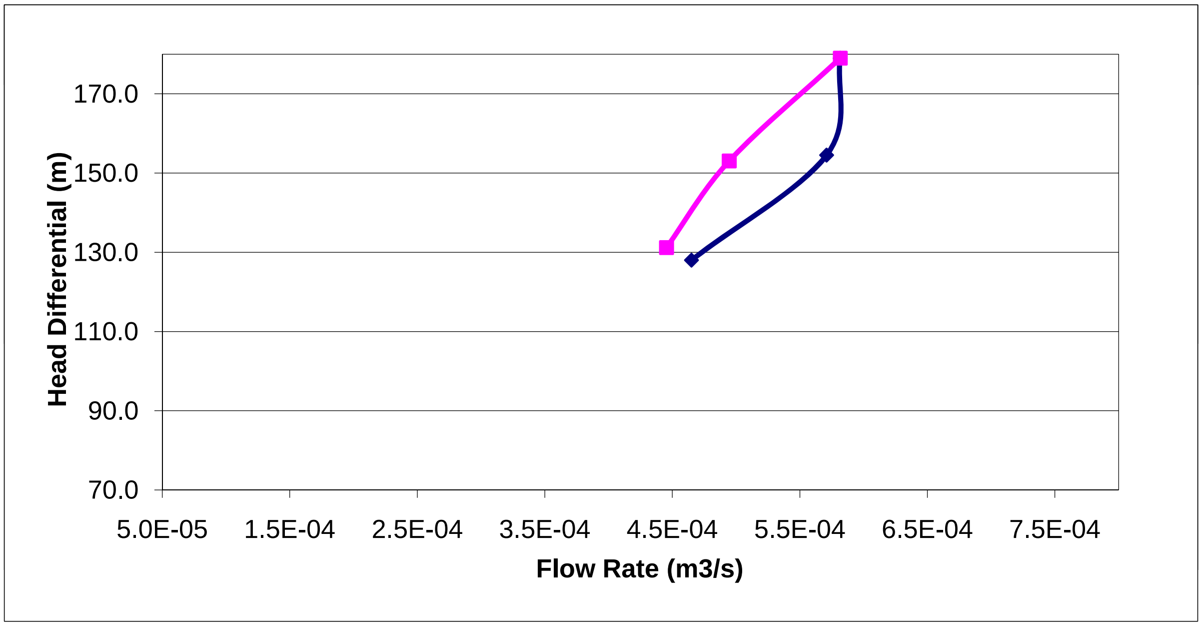
Calculation Input Parameters

Top of Packer Test Interval (mah):	114.4
Bottom of Packer Test Interval (mah):	144.4
L: Length of Test Interval (mah)	30.0
Test Interval Midpoint (mah):	129
Stickup Height (mah):	2.07
Pressure Gauge Height (m above ground):	2.07
Depth to Water Table (mah):	93.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	62

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
64.9	4.6E-04	45.6	128.0	1.4E-07
102.6	5.7E-04	72.2	154.5	1.5E-07
137.5	5.8E-04	96.6	179.0	1.3E-07
100.5	4.9E-04	70.7	153.1	1.3E-07
69.5	4.5E-04	48.8	131.2	1.3E-07
			Geo Mean	**1.4.E-07**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-098
Design Test Interval: 259.9 - 267.4
Test #: 3

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: MAB (Dean and Rudi)

Collar El.:
Trend: 346
Plunge: 62 deg
Date: 21-Jun-09

Packer Setup Type: Single

Pressure Interval 40

Minutes	Pressure	Volume	∆ Volume
0	40	3152.50	--
1	42	3155.20	2.70
2	42	3157.30	2.10
3	42	3159.40	2.10
4	42	3161.50	2.10
5	42	3163.70	2.20
6	42	3165.65	1.95
7	42	3167.70	2.05
8	42	3169.75	2.05
9	42	3171.80	2.05
10	42	3173.80	2.00
Stable Ave.	42		2.13

Pressure Interval 60

Minutes	Pressure	Volume	∆ Volume
0	60	3184.50	--
1	60	3186.70	2.20
2	60	3190.10	3.40
3	60	3191.80	1.70
4	60	3194.00	2.20
5	60	3196.10	2.10
6	60	3198.30	2.20
7	60	3200.60	2.30
8	60	3202.90	2.30
9	60	3205.10	2.20
10	60	3207.30	2.20
Stable Ave.	60		2.28

Pressure Interval 120

Minutes	Pressure	Volume	∆ Volume
0	120	3224.80	--
1	120	3227.50	2.70
2	120	3231.00	3.50
3	120	3234.30	3.30
4	120	3237.50	3.20
5	120	3240.60	3.10
6	120	3244.00	3.40
7	120	3247.10	3.10
8	120	3250.50	3.40
9	120	3253.40	2.90
10	120	3256.60	3.20
Stable Ave.	120		3.18

Pressure Interval 90

Minutes	Pressure	Volume	∆ Volume
0	90	3262.60	--
1	95	3265.80	3.20
2	90	3268.60	2.80
3	88	3271.00	2.40
4	88	3273.60	2.60
5	92	3275.60	2.00
6	95	3278.20	2.60
7	96	3280.60	2.40
8	96	3283.00	2.40
9	96	3285.50	2.50
10	96	3287.90	2.40
Stable Ave.	93		2.53

Pressure Interval 60

Minutes	Pressure	Volume	∆ Volume
0	60	3288.30	--
1	60	3290.40	2.10
2	60	3292.40	2.00
3	60	3294.40	2.00
4	60	3296.30	1.90
5	60	3298.20	1.90
6	60	3300.10	1.90
7	60	3302.10	2.00
8	60	3304.00	1.90
9	60	3306.00	2.00
10	60	3307.90	1.90
Stable Ave.	60		1.96

Pressure Interval

Minutes	Pressure	Volume	∆ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	150.00	m
Top of Packer Interval:	259.90	m
Bottom of Packer Interval (or Bottom of Hole):	267.40	m
Packer Inflation Pressure:	390	psi
Rod Stickup Height:	2.25	m
Water Flushed (Vol./Time/Until Clean):	30 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	1.5	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing:
End Flushing:
Start Packer Testing: 11:00 PM
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	∆ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900

Hole #: M-09-098
Test #: 3

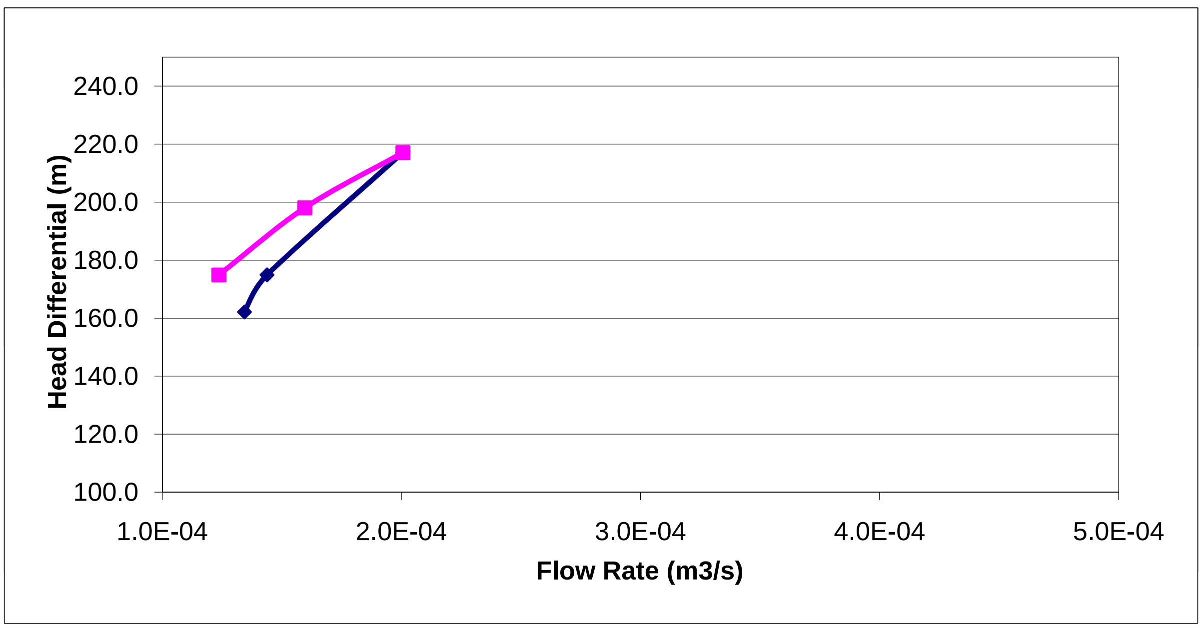
Calculation Input Parameters

Top of Packer Test Interval (mah):	259.9
Bottom of Packer Test Interval (mah):	267.4
L: Length of Test Interval (mah)	7.5
Test Interval Midpoint (mah):	264
Stickup Height (mah):	2.25
Pressure Gauge Height (m above ground):	2.25
Depth to Water Table (mah):	150.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	62

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L \sin(A)}{r}\right)}{2 \times \pi \times L \sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
41.8	1.3E-04	29.4	162.1	1.0E-07
60.0	1.4E-04	42.2	174.9	1.0E-07
120.0	2.0E-04	84.4	217.1	1.1E-07
92.9	1.6E-04	65.3	198.0	1.0E-07
60.0	1.2E-04	42.2	174.9	8.8E-08
			Geo Mean	**1.0.E-07**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-098
Design Test Interval: 345.5 - 366.4
Test #: 4

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: JRW

Collar El.:
Trend: 346
Plunge: 62 deg
Date: 22-Jun-09

Packer Setup Type: Single

Pressure Interval 65

Minutes	Pressure	Volume	Δ Volume
0	68	3438.00	--
1	68	3439.70	1.70
2	68	3441.30	1.60
3	70	3442.80	1.50
4	70	3444.30	1.50
5	72	3445.70	1.40
6	72	3447.20	1.50
7	72	3448.50	1.30
8	72	3449.80	1.30
9	72	3451.00	1.20
10	72	3452.10	1.10
Stable Ave.	71		1.41

Pressure Interval 98

Minutes	Pressure	Volume	Δ Volume
0	100	3455.50	--
1	98	3456.90	1.40
2	100	3458.80	1.90
3	100	3459.60	0.80
4	100	3460.90	1.30
5	100	3462.20	1.30
6	100	3463.50	1.30
7	98	3464.60	1.10
8	102	3465.80	1.20
9	98	3467.00	1.20
10	100	3468.20	1.20
Stable Ave.	100		1.27

Pressure Interval 130

Minutes	Pressure	Volume	Δ Volume
0	130	3471.50	--
1	132	3472.80	1.30
2	136	3474.00	1.20
3	132	3475.20	1.20
4	132	3476.40	1.20
5	138	3477.50	1.10
6	142	3478.60	1.10
7	138	3479.60	1.00
8	136	3480.70	1.10
9	142	3481.80	1.10
10	134	3482.30	0.50
Stable Ave.	136		1.08

Pressure Interval 98

Minutes	Pressure	Volume	Δ Volume
0	100	3487.20	--
1	100	3487.90	0.70
2	100	3488.60	0.70
3	100	3489.20	0.60
4	104	3489.80	0.60
5	104	3490.40	0.60
6	106	3491.10	0.70
7	106	3491.70	0.60
8	100	3492.30	0.60
9	100	3492.90	0.60
10	104	3493.50	0.60
Stable Ave.	102		0.63

Pressure Interval 65

Minutes	Pressure	Volume	Δ Volume
0	70	3494.20	--
1	72	3494.60	0.40
2	72	3495.10	0.50
3	68	3495.60	0.50
4	70	3496.00	0.40
5	68	3496.50	0.50
6	68	3496.90	0.40
7	76	3497.30	0.40
8	72	3497.70	0.40
9	70	3498.20	0.50
10	74	3498.60	0.40
Stable Ave.	71		0.44

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	80.00	m
Top of Packer Interval:	345.40	m
Bottom of Packer Interval (or Bottom of Hole):	366.40	m
Packer Inflation Pressure:	850	psi
Rod Stickup Height:	2.07	m
Water Flushed (Vol./Time/Until Clean):	45 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	2.1	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 12:15 PM
End Flushing: 1:00 PM
Start Packer Testing:
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments:

May not be seated in optimal location. Test completed on bit change. Water pressure gauge leaked oil in pelican case a bit.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900

Hole #: **M-09-098**
Test #: **4**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

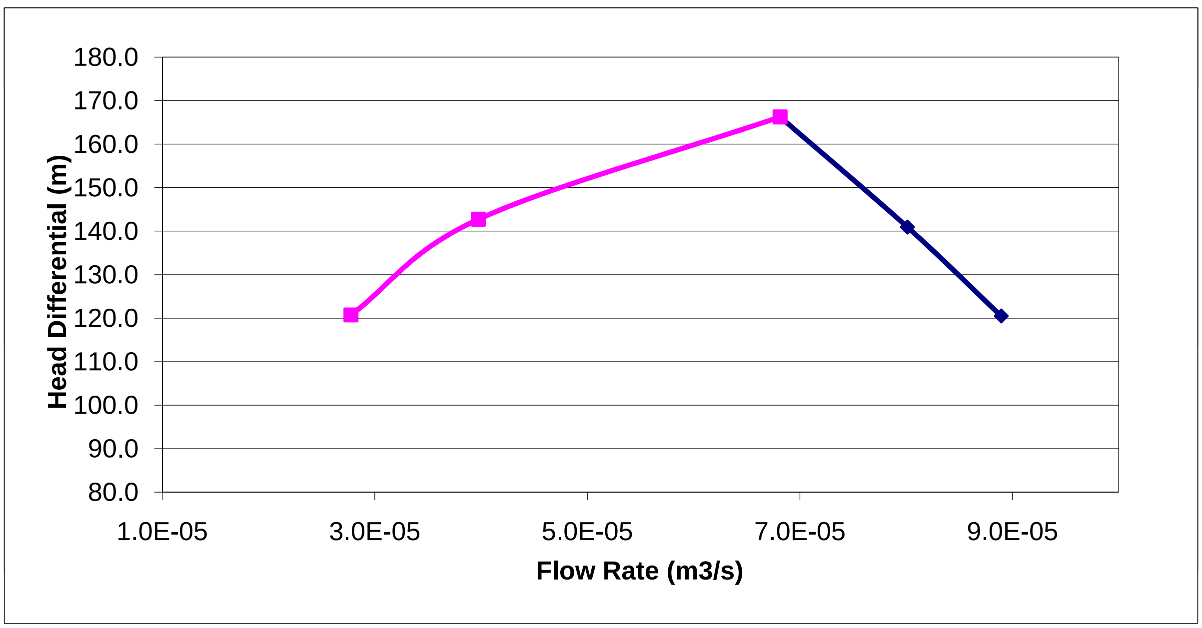
Calculation Input Parameters

Top of Packer Test Interval (mah):	345.4
Bottom of Packer Test Interval (mah):	366.4
L: Length of Test Interval (mah)	21.0
Test Interval Midpoint (mah):	356
Stickup Height (mah):	2.07
Pressure Gauge Height (m above ground):	2.07
Depth to Water Table (mah):	80.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	62

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
70.5	8.9E-05	49.6	120.5	3.9E-08
99.6	8.0E-05	70.1	140.9	3.0E-08
135.6	6.8E-05	95.4	166.2	2.2E-08
102.2	4.0E-05	71.8	142.7	1.5E-08
70.9	2.8E-05	49.9	120.7	1.2E-08
			Geo Mean	**2.2.E-08**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-099
Design Test Interval: 28.5 m
Test #: 1

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: EEL

Collar El.:
Trend: 39
Plunge: 74 deg
Date: 27-Jun-09

Packer Setup Type: Single

Pressure Interval 55

Minutes	Pressure	Volume	Δ Volume
0	56	2953.80	--
1	56	2956.00	2.20
2	56	2958.00	2.00
3	56	2960.00	2.00
4	57	2962.00	2.00
5	57	2964.00	2.00
6	57	2966.20	2.20
7	58	2968.30	2.10
8	59	2970.40	2.10
9	58	2972.50	2.10
10	58	2974.50	2.00
Stable Ave.	57		2.07

Pressure Interval 82

Minutes	Pressure	Volume	Δ Volume
0	86	3059.50	--
1	84	3063.20	3.70
2	83	3067.00	3.80
3	86	3070.40	3.40
4	87	3074.00	3.60
5	79	3077.40	3.40
6	79	3080.80	3.40
7	80	3084.20	3.40
8	80	3087.60	3.40
9	80	3090.80	3.20
10	81	3094.20	3.40
Stable Ave.	82		3.47

Pressure Interval 82

Minutes	Pressure	Volume	Δ Volume
0	78	2979.70	--
1	79	2982.40	2.70
2	79	2985.00	2.60
3	78	2987.60	2.60
4	78	2990.30	2.70
5	78	2993.00	2.70
6	79	2995.70	2.70
7	78	2998.40	2.70
8	80	3001.10	2.70
9	80	3003.70	2.60
10	78	3006.50	2.80
Stable Ave.	79		2.68

Pressure Interval 55

Minutes	Pressure	Volume	Δ Volume
0	55	3099.60	--
1	55	3102.40	2.80
2	55	3105.20	2.80
3	56	3107.80	2.60
4	55	3110.60	2.80
5	56	3113.30	2.70
6	56	3116.00	2.70
7	56	3118.70	2.70
8	56	3121.40	2.70
9	57	3124.10	2.70
10	57	3126.70	2.60
Stable Ave.	56		2.71

Pressure Interval 110

Minutes	Pressure	Volume	Δ Volume
0	110	3011.30	--
1	111	3015.30	4.00
2	109	3019.40	4.10
3	109	3023.50	4.10
4	110	3027.50	4.00
5	105	3031.60	4.10
6	108	3035.80	4.20
7	107	3039.80	4.00
8	107	3044.00	4.20
9	106	3048.20	4.20
10	108	3052.40	4.20
Stable Ave.	108		4.11

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup: 17.00 m
Top of Packer Interval: 60.00 m
Bottom of Packer Interval (or Bottom of Hole): 88.50 m
Packer Inflation Pressure: 422.6 psi
Rod Stickup Height: 3.1 m
Water Flushed (Vol./Time/Until Clean): 30 min
Packer Pipe ID/ or Drill Rod ID (circle one): NQ3
Borehole Outside Diameter: 0.076
Vertical height of gauge above ground: 3.0 m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 10:00 AM
End Flushing: 10:30 AM
Start Packer Testing: 11:15 AM
End Packer Testing: 12:20 PM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: Unable to see return. No grease used on rods.

Hole #: **M-09-099**
Test #: **1**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

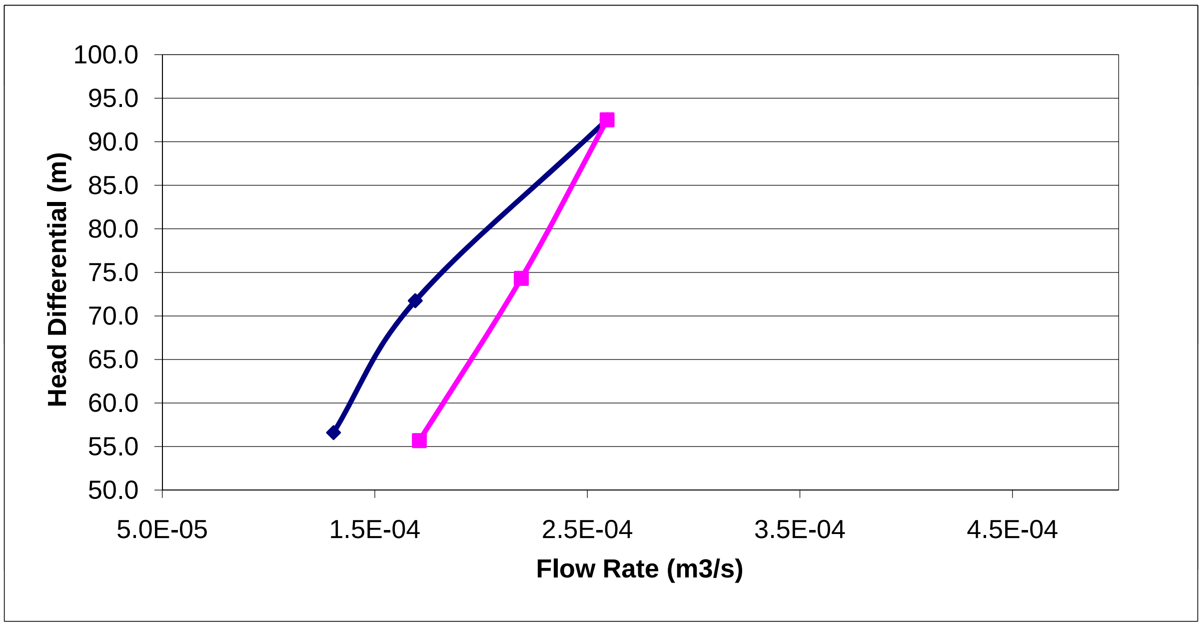
Calculation Input Parameters

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Top of Packer Test Interval (mah):	60.0
Bottom of Packer Test Interval (mah):	88.5
L: Length of Test Interval (mah)	28.5
Test Interval Midpoint (mah):	74
Stickup Height (mah):	3.06
Pressure Gauge Height (m above ground):	3.06
Depth to Water Table (mah):	17.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	74

* mah indicates "meters along hole"

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
57.1	1.3E-04	40.1	56.6	8.8E-08
78.6	1.7E-04	55.3	71.8	9.0E-08
108.2	2.6E-04	76.1	92.5	1.1E-07
82.3	2.2E-04	57.8	74.3	1.1E-07
55.8	1.7E-04	39.2	55.7	1.2E-07
			Geo Mean	**1.0.E-07**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-099
Design Test Interval:
Test #: 2

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: EEL

Collar El.:
Trend: 10 deg
Plunge: 74 deg
Date: 28-Jun-09

Packer Setup Type: Single

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0	64	7.30	--
1	64	7.35	0.05
2	64	7.40	0.05
3	64	7.50	0.10
4	63	7.60	0.10
5	62	7.70	0.10
6	64	7.75	0.05
7	64	7.85	0.10
8	64	7.90	0.05
9	65	8.00	0.10
10	62	8.05	0.05
Stable Ave.	64		0.08

Pressure Interval 96

Minutes	Pressure	Volume	Δ Volume
0	97	8.60	--
1	97	8.65	0.05
2	94	8.70	0.05
3	95	8.80	0.10
4	94	8.90	0.10
5	99	9.00	0.10
6			
7			
8			
9			
10			
Stable Ave.	96		0.08

Pressure Interval 128

Minutes	Pressure	Volume	Δ Volume
0	130	9.30	--
1	135	9.40	0.10
2	132	9.50	0.10
3	134	9.60	0.10
4	134	9.70	0.10
5	135	9.80	0.10
6			
7			
8			
9			
10			
Stable Ave.	133		0.10

Pressure Interval 96

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00
Stable Ave.			

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00
Stable Ave.			

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup: 25.40 m
Top of Packer Interval: 132.00 m
Bottom of Packer Interval (or Bottom of Hole): 160.50 m
Packer Inflation Pressure: 592 psi
Rod Stickup Height: 3.1 m
Water Flushed (Vol./Time/Until Clean): 30 min
Packer Pipe ID/ or Drill Rod ID (circle one): NQ3
Borehole Outside Diameter: 0.076
Vertical height of gauge above ground: 3.0 m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 8:40 AM
End Flushing: 9:10 AM
Start Packer Testing: 10:00 AM
End Packer Testing: 11:15 AM

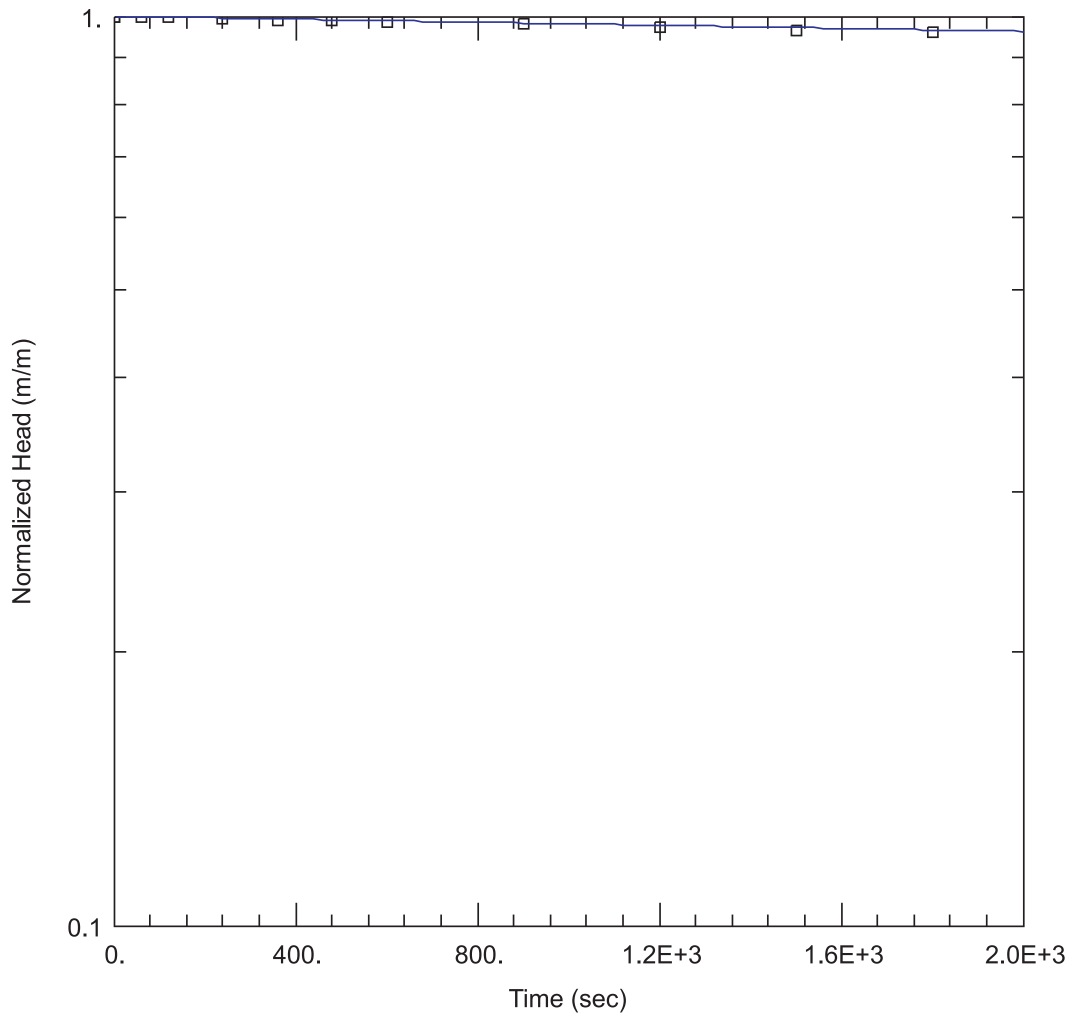
IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0	0.36	-
1	0.40	0.04
2	0.43	0.03
4	0.50	0.04
6	0.58	0.04
8	0.65	0.04
10	0.72	0.04
15	0.88	0.03
20	1.04	0.03
25	1.20	0.03
30	1.36	0.03
40		
50		
60		

Additional Comments: Test interval in good rock. Unable to see return (if any) because of cobbles surrounding top of hole (not safe to go under pad and dig around).

Hose leaking slightly (3 drips/sec) before flow meter on release hose. Falling head test from 3.35m above ground surface (vertically).

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900



Obs. Wells
□ M-09-099

Solution
Hvorslev

Parameters
K = 3.4E-9 m/sec

N:\BGC\Projects\0638 Seabridge\004 KSM Pit Hydrogeo PFS\Packer Tests\Analyzed Tests\M-09-99\Packer2_M0999.cdr

SCALE: NOT TO SCALE	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PRE-FEASIBILITY STUDY PIT DEPRESSURIZATION ANALYSES
DATE: NOV 2009	CHECKED: RT		TITLE: M09-099 Packer #2 132 to 160.5 m along hole FH results
DRAWN: RT	APPROVED: APPROVE		
		CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 — FIG. No.: Packer Test Appendix — REV.: 0

Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-099
Design Test Interval:
Test #: 3

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: EEL/JV

Collar El.:
Trend: 39
Plunge: 74 deg
Date: 30-Jun-09

Packer Setup Type: Single

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0	61	2.80	--
1	63	3.10	0.30
2	64	3.30	0.20
3	63	3.50	0.20
4	64	3.75	0.25
5	64	3.95	0.20
6	64	4.20	0.25
7	66	4.40	0.20
8	66	4.65	0.25
9	65	4.90	0.25
10	66	5.10	0.20
Stable Ave.	64		0.23

Pressure Interval 96

Minutes	Pressure	Volume	Δ Volume
0	99	5.80	--
1	92	6.00	0.20
2	98	6.25	0.25
3	92	6.50	0.25
4	92	6.70	0.20
5	93	7.00	0.30
6	96	7.20	0.20
7	94	7.50	0.30
8	94	7.70	0.20
9	96	7.95	0.25
10	96	8.20	0.25
Stable Ave.	95		0.24

Pressure Interval 128

Minutes	Pressure	Volume	Δ Volume
0	128	9.10	--
1	130	9.40	0.30
2	129	9.70	0.30
3	132	10.00	0.30
4	131	10.25	0.25
5	130	10.55	0.30
6	131	10.80	0.25
7	131	11.10	0.30
8	132	11.35	0.25
9	132	11.60	0.25
10	131	11.90	0.30
Stable Ave.	131		0.28

Pressure Interval 96

Minutes	Pressure	Volume	Δ Volume
0	98	1.90	--
1	96	2.10	0.20
2	96	2.25	0.15
3	98	2.50	0.25
4	98	2.70	0.20
5	98	2.90	0.20
6	96	3.10	0.20
7	98	3.30	0.20
8	98	3.50	0.20
9	98	3.75	0.25
10	96	3.90	0.15
Stable Ave.	97		0.20

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0	62	3.80	--
1	62	4.00	0.20
2	62	4.10	0.10
3	60	4.20	0.10
4	61	4.40	0.20
5	60	4.55	0.15
6	61	4.65	0.10
7	61	4.80	0.15
8	61	5.00	0.20
9	61	5.10	0.10
10	60	5.20	0.10
Stable Ave.	61		0.14

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	255.00	m
Top of Packer Interval:	294.00	m
Bottom of Packer Interval (or Bottom of Hole):	322.50	m
Packer Inflation Pressure:	850.2	psi
Rod Stickup Height:	3.1	m
Water Flushed (Vol./Time/Until Clean):	30 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ3	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	3.0	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing:
End Flushing:
Start Packer Testing: 7:40am
End Packer Testing: 8:47am

IF NO MEASUREABLE FLOW IN CH TEST --->
FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900

Hole #: **M-09-099**
Test #: **3**

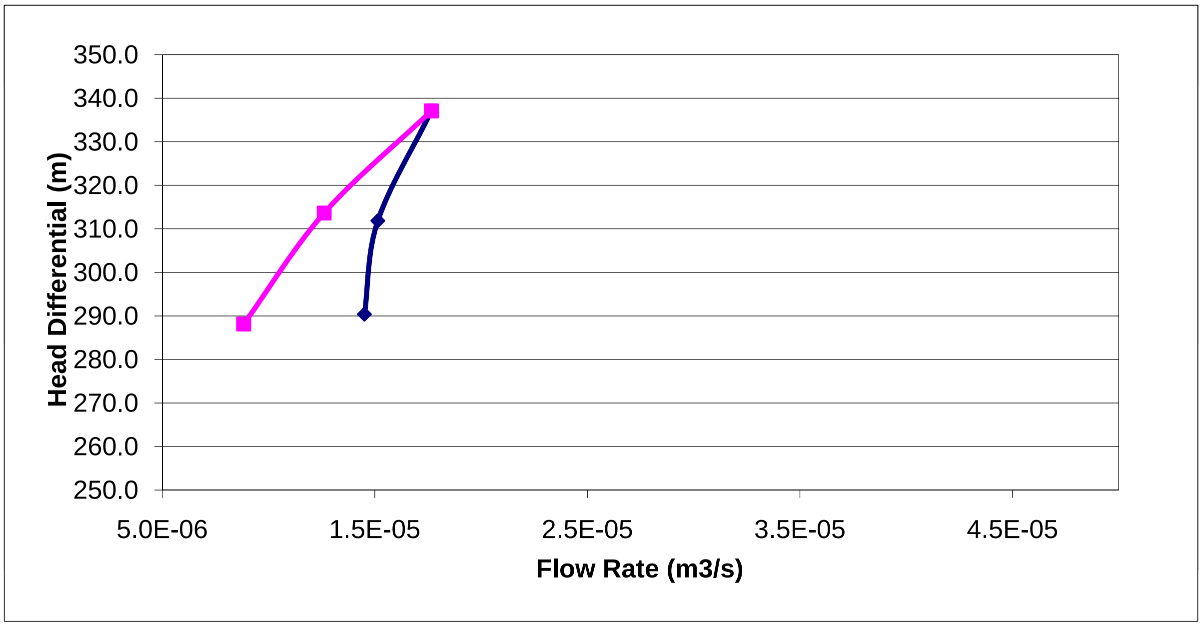
Calculation Input Parameters

Top of Packer Test Interval (mah):	294.0
Bottom of Packer Test Interval (mah):	322.5
L: Length of Test Interval (mah)	28.5
Test Interval Midpoint (mah):	308
Stickup Height (mah):	3.06
Pressure Gauge Height (m above ground):	3.06
Depth to Water Table (mah):	255.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	74

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2\times\pi\times L\sin(A)\times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
64.2	1.5E-05	45.1	290.4	1.9E-09
94.7	1.5E-05	66.6	311.8	1.9E-09
130.6	1.8E-05	91.9	337.1	2.0E-09
97.3	1.3E-05	68.4	313.6	1.5E-09
61.0	8.8E-06	42.9	288.1	1.2E-09
			Geo Mean	**1.7.E-09**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-100
Design Test Interval:
Test #: 1

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: MRD JD CJ

Collar El.:
Trend: 252
Plunge: 73 deg
Date: 29-Jun-09

Packer Setup Type: Single

Pressure Interval 25 ±5

Minutes	Pressure	Volume	Δ Volume
0	25	3660.00	--
1	25	3668.50	8.50
2	25	3678.00	9.50
3	25	3686.50	8.50
4	25	3685.00	
5	25	3694.50	9.50
6	25	3705.20	10.70
7	25	3713.00	7.80
8	25	3722.50	9.50
9	25	3731.30	8.80
10	25	3740.70	9.40
Stable Ave.	25		9.13

Pressure Interval 37.5 ±10

Minutes	Pressure	Volume	Δ Volume
0	37.5	3900.00	--
1	37.5	3911.20	11.20
2	37.5	3921.70	10.50
3	37.5	3934.00	12.30
4	37.5	3945.50	11.50
5	37.5	3957.70	12.20
6	37.5	3968.30	10.60
7	37.5	3979.70	11.40
8	37.5	3991.00	11.30
9	37.5	4002.50	11.50
10	38	4014.00	11.50
Stable Ave.	38		11.40

Pressure Interval 50 ±10

Minutes	Pressure	Volume	Δ Volume
0	50	4050.00	--
1	50	4061.10	11.10
2	50	4071.80	10.70
3	50	4082.70	10.90
4	50	4093.70	11.00
5	50	4104.50	10.80
6	50	4115.50	11.00
7	50	4126.30	10.80
8	50	4137.70	11.40
9	50	4148.70	11.00
10	50	4159.70	11.00
Stable Ave.	50		10.97

Pressure Interval 37.5 ±10

Minutes	Pressure	Volume	Δ Volume
0	37.5	4170.00	--
1	37.5	4180.50	10.50
2	37.5	4189.20	8.70
3	37.5	4198.80	9.60
4	37.5	4208.40	9.60
5	37.5	4217.70	9.30
6	37.5	4227.50	9.80
7	37.5	4236.80	9.30
8	37.5	4246.50	9.70
9	37.5	4256.10	9.60
10	37.5	4265.70	9.60
Stable Ave.	38		9.57

Pressure Interval 25 ±5

Minutes	Pressure	Volume	Δ Volume
0	25	4290.00	--
1	25	4296.80	6.80
2	25	4306.70	9.90
3	25	4310.70	4.00
4	25	4317.60	6.90
5	25	4324.50	6.90
6	25	4331.40	6.90
7	25	4338.30	6.90
8	25	4345.20	6.90
9	25	4352.20	7.00
10	25	4359.20	7.00
Stable Ave.	25		6.92

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	0.94	m
Top of Packer Interval:	43.50	m
Bottom of Packer Interval (or Bottom of Hole):	67.40	m
Packer Inflation Pressure:	392	psi
Rod Stickup Height:	2.5	m
Water Flushed (Vol./Time/Until Clean):	~15 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	3.0	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 4:15 PM
End Flushing: 4:30 PM
Start Packer Testing:
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments:

Hole #: **M-09-100**
Test #: **1**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

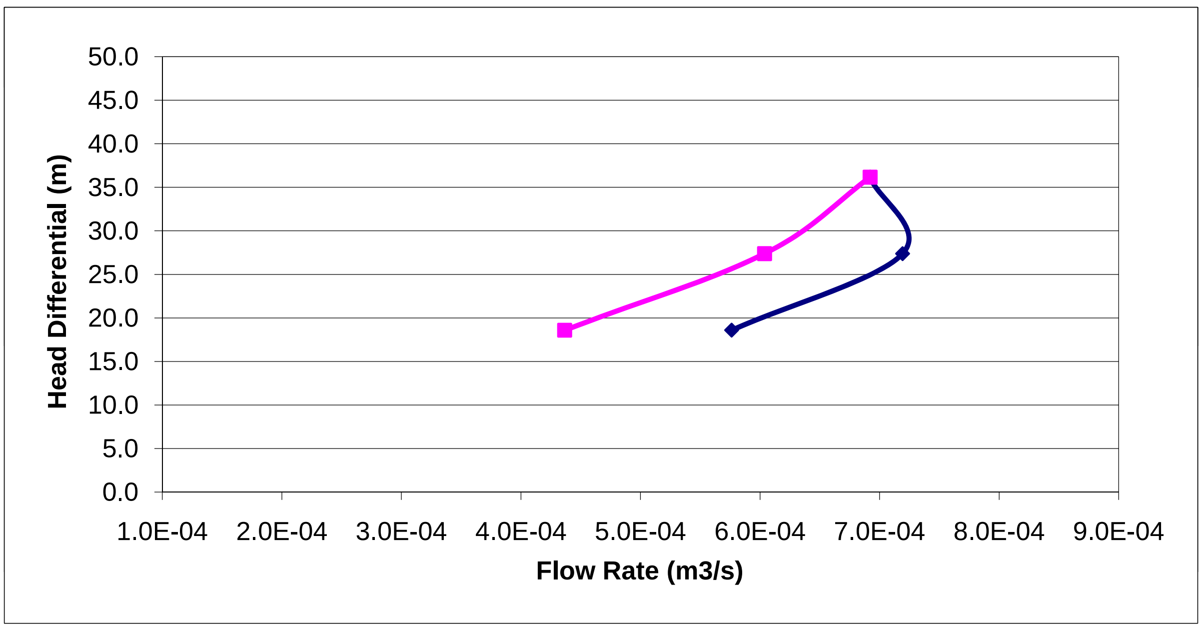
Calculation Input Parameters

Top of Packer Test Interval (mah):	43.5
Bottom of Packer Test Interval (mah):	67.4
L: Length of Test Interval (mah)	23.9
Test Interval Midpoint (mah):	55
Stickup Height (mah):	2.50
Pressure Gauge Height (m above ground):	2.50
Depth to Water Table (mah):	0.94
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	73

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
25.0	5.8E-04	17.6	18.6	1.4E-06
37.5	7.2E-04	26.4	27.4	1.2E-06
50.0	6.9E-04	35.2	36.2	8.5E-07
37.5	6.0E-04	26.4	27.4	9.8E-07
25.0	4.4E-04	17.6	18.6	1.0E-06
			Geo Mean	**1.1.E-06**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-100
Design Test Interval: 85.28 to 175.5 m
Test #: 3

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel:

Collar El.:
Trend: 252
Plunge: 73 deg
Date: 1-Jul-09

Packer Setup Type: Single

Pressure Interval 50 ±5

Minutes	Pressure	Volume	Δ Volume
0	50	4360.00	--
1	50	4375.50	15.50
2	50	4390.00	14.50
3	50	4400.50	10.50
4	50	4417.70	17.20
5	50	4431.60	13.90
6	50	4445.20	13.60
7	50	4458.80	13.60
8	50	4471.80	13.00
9	50	4485.30	13.50
10	50	4502.50	17.20
Stable Ave.	50		14.25

Pressure Interval 75 ±15

Minutes	Pressure	Volume	Δ Volume
0	75	4900.00	--
1	75	4917.20	17.20
2	75	4934.00	16.80
3	75	4950.20	16.20
4	75	4967.40	17.20
5	75	4984.00	16.60
6	75	4999.60	15.60
7	75	5015.80	16.20
8	75	5031.40	15.60
9	75	5047.60	16.20
10	75	5063.10	15.50
Stable Ave.	75		16.31

Pressure Interval 75 ±15

Minutes	Pressure	Volume	Δ Volume
0	75	4540.00	--
1	75	4556.50	16.50
2	75	4572.80	16.30
3	75	4588.80	16.00
4	75	4605.20	16.40
5	75	4621.10	15.90
6	75	4637.50	16.40
7	75	4654.30	16.80
8	75	4670.10	15.80
9	75	4686.50	16.40
10	75	4702.60	16.10
Stable Ave.	75		16.26

Pressure Interval 50 ±5

Minutes	Pressure	Volume	Δ Volume
0	50	5090.00	--
1	50	5101.80	11.80
2	50	5113.70	11.90
3	50	5125.70	12.00
4	50	5137.40	11.70
5	50	5149.00	11.60
6	50	5160.80	11.80
7	50	5172.70	11.90
8	50	5185.00	12.30
9	50	5197.10	12.10
10	50	5208.30	11.20
Stable Ave.	50		11.83

Pressure Interval 100 ±10

Minutes	Pressure	Volume	Δ Volume
0	100	4730.00	--
1	100	4748.80	18.80
2	100	4768.00	19.20
3	100	4786.70	18.70
4	100	4805.50	18.80
5	100	4824.60	19.10
6	100	4843.40	18.80
7	100	4861.80	18.40
8	100	4880.70	18.90
9	100	4900.00	19.30
10	100	4917.30	17.30
Stable Ave.	100		18.73

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	0.00	m
Top of Packer Interval:	85.28	m
Bottom of Packer Interval (or Bottom of Hole):	175.50	m
Packer Inflation Pressure:	532.5	psi
Rod Stickup Height:	2.5	m
Water Flushed (Vol./Time/Until Clean):	30 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	3.0	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing:
End Flushing:
Start Packer Testing: 10:00 AM
End Packer Testing: 11:00 AM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: Artesian pressure 10 psi, flow rate 2.3 gallons/min initial. 6.6 gallons/min after test.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Vancouver, BC Phone: (604) 684 5900

Hole #: M-09-100
Test #: 3

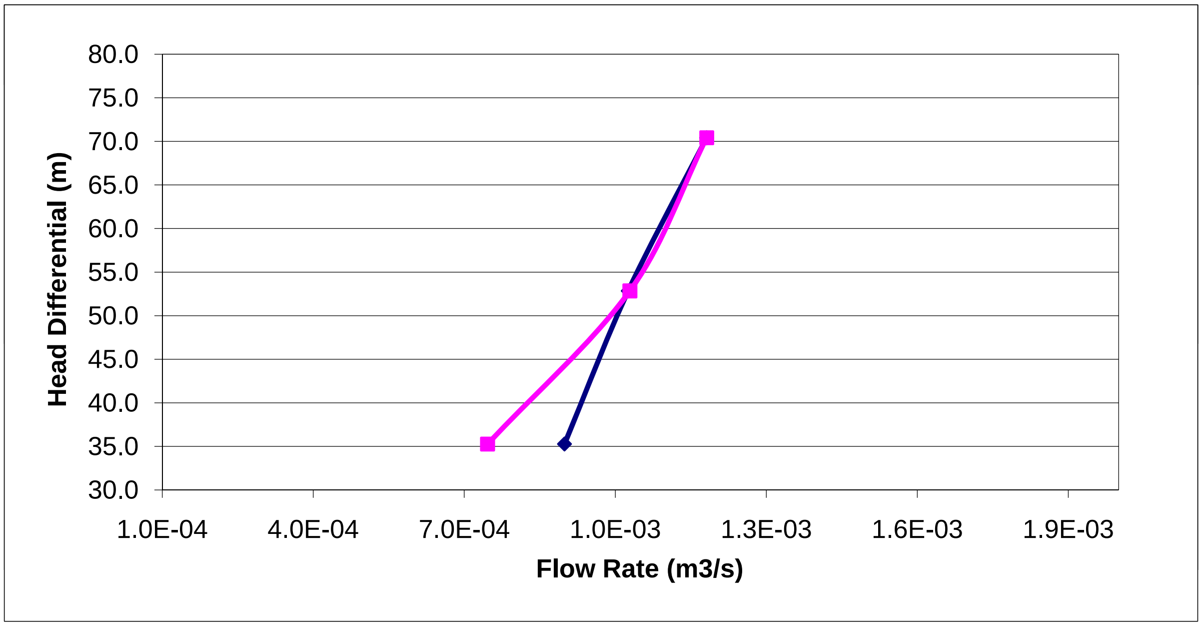
Calculation Input Parameters

Top of Packer Test Interval (mah):	85.3
Bottom of Packer Test Interval (mah):	175.5
L: Length of Test Interval (mah)	90.2
Test Interval Midpoint (mah):	130
Stickup Height (mah):	2.48
Pressure Gauge Height (m above ground):	2.48
Depth to Water Table (mah):	0.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	73

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
50.0	9.0E-04	35.2	35.3	3.6E-07
75.0	1.0E-03	52.7	52.8	2.8E-07
100.0	1.2E-03	70.3	70.4	2.4E-07
75.0	1.0E-03	52.7	52.8	2.8E-07
50.0	7.5E-04	35.2	35.3	3.0E-07
			Geo Mean	**2.9.E-07**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-100
Design Test Interval: 214.5 to 234.0m
Test #: 4

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: J. Danielson

Collar El.:
Trend: 252
Plunge: 73 deg
Date: 2-Jul-09

Packer Setup Type: Single

Pressure Interval 175 ±5

Minutes	Pressure	Volume	Δ Volume
0	150	5203.00	--
1	150	5203.70	0.70
2	150	5204.40	0.70
3	150	5204.80	0.40
4	150	5205.20	0.40
5	150	5205.60	0.40
6	150	5206.10	0.50
7	150	5206.50	0.40
8	150	5207.00	0.50
9	150	5207.30	0.30
10	150	5207.70	0.40

Stable Ave. 150 0.47

Pressure Interval 263 ±15

Minutes	Pressure	Volume	Δ Volume
0	220	5218.00	--
1	220	5218.10	0.10
2	200	5218.10	0.00
3	215	5218.20	0.10
4			
5			
6			
7			
8			
9			
10			

Stable Ave. 214 0.07

Pressure Interval 350 ±10

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00

Stable Ave.

Pressure Interval 263 ±15

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00

Stable Ave.

Pressure Interval 175 ±5

Minutes	Pressure	Volume	Δ Volume
0			--
1			0.00
2			0.00
3			0.00
4			0.00
5			0.00
6			0.00
7			0.00
8			0.00
9			0.00
10			0.00

Stable Ave.

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup: 0.00 m
Top of Packer Interval: 214.50 m
Bottom of Packer Interval (or Bottom of Hole): 234.00 m
Packer Inflation Pressure: 950 psi
Rod Stickup Height: 2.5 m
Water Flushed (Vol./Time/Until Clean): 15min
Packer Pipe ID/ or Drill Rod ID (circle one): NQ
Borehole Outside Diameter: 0.076
Vertical height of gauge above ground: 2.5 m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

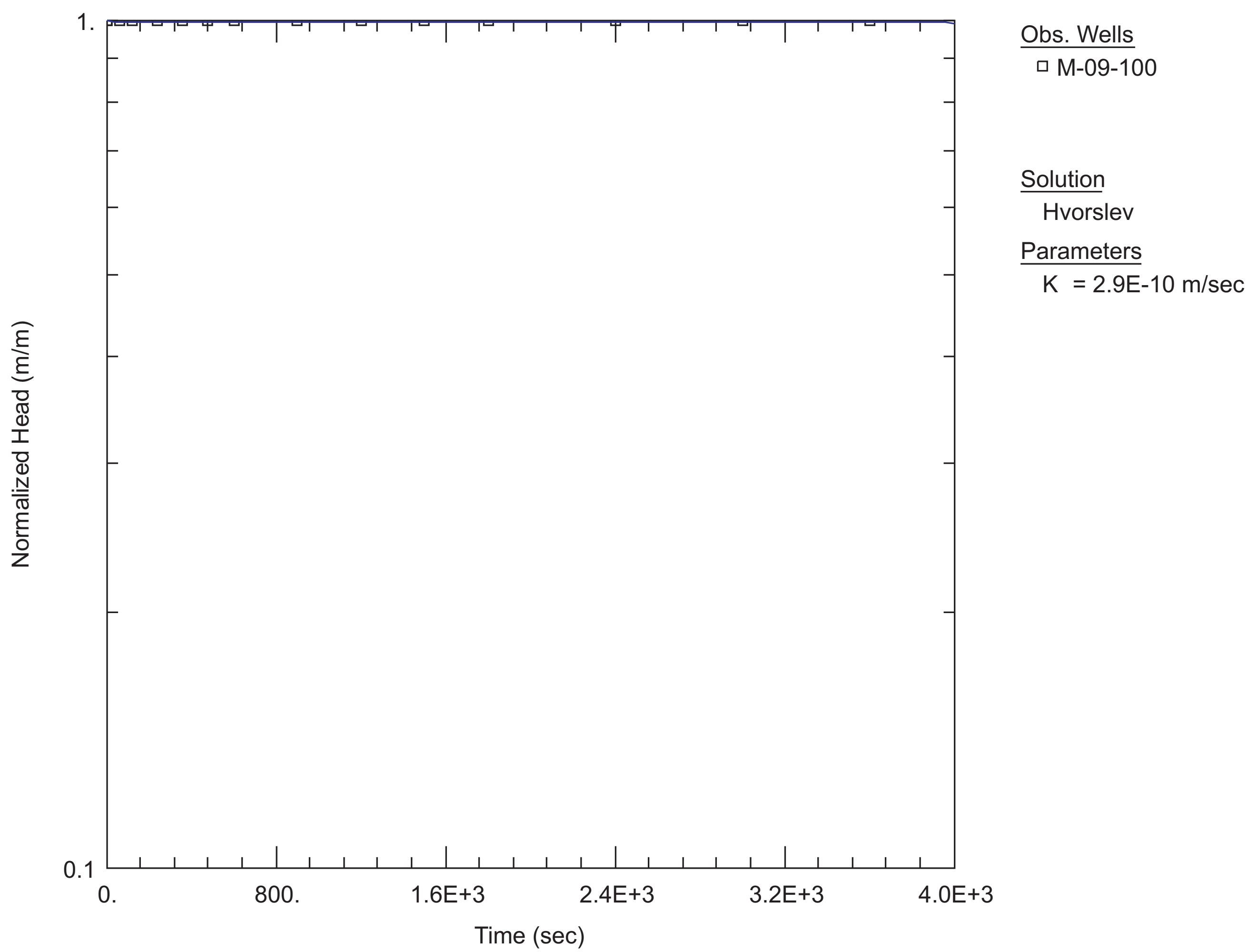
Time

Start Flushing:
End Flushing:
Start Packer Testing:
End Packer Testing:

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0	0.1	-
1	0.1	
2	0.102	
4	0.11	
6	0.111	0.0005
8	0.111	0
10	0.112	0.0005
15	0.114	0.0004
20	0.117	0.0006
25	0.119	0.0004
30	0.12	0.0002
40	0.125	0.0005
50	0.13	0.0005
60	0.136	0.0006

Additional Comments: Volume change during first interval (175psi) was likely due to leakage (it was visible) through stuffing. Fixed leak in stuffing for second interval (263psi) and flow decreased to almost 0 GAL/min. Switched to falling head test.



SCALE: NOT TO SCALE	DESIGNED: RT
DATE: NOV 2009	CHECKED: RT
DRAWN: RT	APPROVED: APPROVE

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PRE-FEASIBILITY STUDY
PIT DEPRESSURIZATION ANALYSES

TITLE: M09-100 Packer #4
214.5 to 2340.0 m along hole FH results

PROJECT No.:	FIG. No.:	REV.:
0638-004	Packer Test Appendix	0

N:\BGC\Projects\0638 Seabridge\004 KSM Pit Hydrogeo PFS\Packer Tests\Analyzed Tests\M-09-100\Packer4_M09100FH.cdr

Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-101
Design Test Interval: 267.4 to 289.9 m
Test #:

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: JD/ CJ

Collar El.:
Trend: 141
Plunge: 65 deg
Date: 13-Jul-09

Packer Setup Type: Single

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0	65	10.98	--
1	70	11.02	0.04
2	60	11.05	0.04
3	72	11.09	0.04
4	70	11.13	0.04
5	68	11.17	0.03
6	68	11.20	0.03
7	66	11.24	0.03
8	66	11.27	0.03
9	60	11.30	0.03
10	67	11.33	0.03
Stable Ave.	67		0.04

Pressure Interval 96

Minutes	Pressure	Volume	Δ Volume
0	100	11.50	--
1	94	11.55	0.04
2	94	11.58	0.04
3	94	11.63	0.04
4	94	11.67	0.04
5	94	11.70	0.04
6	94	11.74	0.04
7	94	11.78	0.04
8	94	11.82	0.04
9	96	11.86	0.04
10	96	11.90	0.04
Stable Ave.	95		0.04

Pressure Interval 128

Minutes	Pressure	Volume	Δ Volume
0	128	12.40	--
1	128	12.44	0.04
2	128	12.48	0.04
3	128	12.51	0.03
4	128	12.54	0.03
5	128	12.60	0.06
6	100	12.67	0.07
7	128	12.70	0.03
8	128	12.74	0.04
9	128	12.77	0.03
10	128	12.80	0.03
Stable Ave.	125		0.04

Pressure Interval 96

Minutes	Pressure	Volume	Δ Volume
0	96	12.90	--
1	96	12.93	0.03
2	96	12.97	0.03
3	96	13.00	0.03
4	96	13.03	0.03
5	96	13.06	0.03
6	96	13.09	0.03
7	96	13.13	0.03
8	96	13.16	0.03
9	96	13.19	0.03
10	96	13.22	0.03
Stable Ave.	96		0.03

Pressure Interval 64

Minutes	Pressure	Volume	Δ Volume
0	64	13.30	--
1	64	13.33	0.03
2	64	13.35	0.03
3	64	13.38	0.02
4	64	13.40	0.02
5	64	13.42	0.02
6	64	13.45	0.03
7	64	13.48	0.02
8	64	13.50	0.03
9	64	13.53	0.03
10	64	13.55	0.02
Stable Ave.	64		0.03

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	43.60	m
Top of Packer Interval:	267.40	m
Bottom of Packer Interval (or Bottom of Hole):	289.90	m
Packer Inflation Pressure:	807.7	psi
Rod Stickup Height:	3.1	m
Water Flushed (Vol./Time/Until Clean):	30 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	3.0	m

Measurment Units

Volume: m3
Pressure: psi
Length: m

Time

Start Flushing: 8:40 AM
End Flushing: 9:10 AM
Start Packer Testing: 10:00 AM
End Packer Testing: 11:15 AM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: using gear borrowed from Rescan. M3 for this test only.

Hole #: **M-09-101**
Test #: **0**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

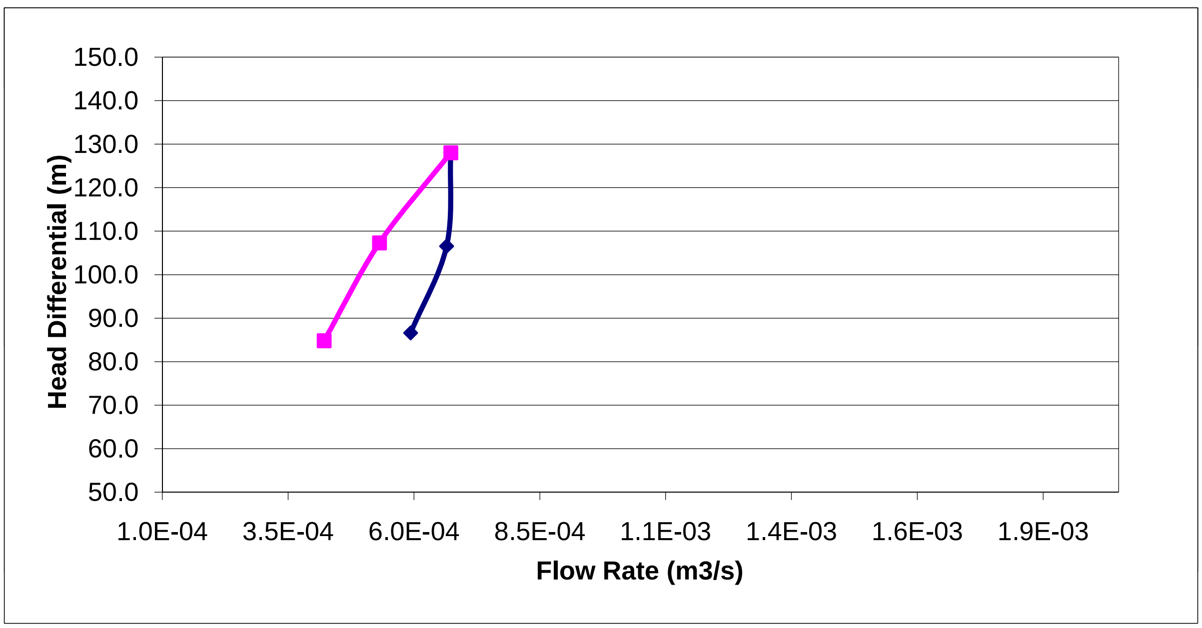
Calculation Input Parameters

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Top of Packer Test Interval (mah):	267.4
Bottom of Packer Test Interval (mah):	289.9
L: Length of Test Interval (mah)	22.5
Test Interval Midpoint (mah):	279
Stickup Height (mah):	3.06
Pressure Gauge Height (m above ground):	3.06
Depth to Water Table (mah):	43.60
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	65

* mah indicates "meters along hole"

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
66.5	5.9E-04	46.8	86.6	3.4E-07
94.9	6.6E-04	66.7	106.5	3.1E-07
125.5	6.7E-04	88.2	128.0	2.6E-07
96.0	5.3E-04	67.5	107.3	2.4E-07
64.0	4.2E-04	45.0	84.8	2.4E-07
			Geo Mean	**2.8.E-07**



Constant Head (CH) and Falling/Rising Head (F/RH) Packer Test - Field Form

Hole # M-09-102a
Design Test Interval:
Test #: 2

Client: Seabridge
Project: KSM
Project #: 0638-003
Personel: JRW

Collar El.:
Trend: 205
Plunge: 79 deg
Date: 15-Jul-09

Packer Setup Type: Single

Pressure Interval 65

Minutes	Pressure	Volume	Δ Volume
0	70	4156.00	--
1	80	4162.30	6.30
2	70	4168.30	6.00
3	72	4174.20	5.90
4	80	4180.20	6.00
5	80	4186.00	5.80
6	78	4191.60	5.60
7	82	4197.50	5.90
8	80	4203.20	5.70
9	86	4209.00	5.80
10	86	4214.70	5.70
Stable Ave.	79		5.87

Pressure Interval 100

Minutes	Pressure	Volume	Δ Volume
0	98	4392.50	--
1	98	4398.90	6.40
2	100	4405.20	6.30
3	100	4411.50	6.30
4	106	4417.90	6.40
5	102	4424.20	6.30
6	104	4430.50	6.30
7	102	4436.80	6.30
8	102	4443.10	6.30
9	100	4449.40	6.30
10	102	4455.70	6.30
Stable Ave.	101		6.32

Pressure Interval 100

Minutes	Pressure	Volume	Δ Volume
0	100	4226.00	--
1	102	4232.30	6.30
2	102	4238.40	6.10
3	102	4244.60	6.20
4	104	4250.80	6.20
5	102	4257.10	6.30
6	102	4263.20	6.10
7	100	4269.50	6.30
8	104	4275.60	6.10
9	100	4281.80	6.20
10	102	4288.20	6.40
Stable Ave.	102		6.22

Pressure Interval 65

Minutes	Pressure	Volume	Δ Volume
0	66	4460.00	--
1	66	4465.60	5.60
2	68	4471.30	5.70
3	68	4476.90	5.60
4	68	4482.50	5.60
5	70	4488.20	5.70
6	70	4493.60	5.40
7	70	4499.30	5.70
8	72	4504.80	5.50
9	72	4510.40	5.60
10	70	4515.90	5.50
Stable Ave.	69		5.59

Pressure Interval 130

Minutes	Pressure	Volume	Δ Volume
0	130	4301.50	--
1	126	4308.90	7.40
2	126	4316.40	7.50
3	128	4323.60	7.20
4	128	4331.10	7.50
5	130	4338.60	7.50
6	132	4345.80	7.20
7	132	4353.30	7.50
8	132	4360.80	7.50
9	132	4367.40	6.60
10	130	4374.90	7.50
Stable Ave.	130		7.34

Pressure Interval

Minutes	Pressure	Volume	Δ Volume
0			-
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Measurements

Depth to Water from Top of Stickup:	170.00	m
Top of Packer Interval:	303.00	m
Bottom of Packer Interval (or Bottom of Hole):	315.00	m
Packer Inflation Pressure:	1237	psi
Rod Stickup Height:	2.7	m
Water Flushed (Vol./Time/Until Clean):	30 min	
Packer Pipe ID/ or Drill Rod ID (circle one):	NQ	
Borehole Outside Diameter:	0.076	
Vertical height of gauge above ground:	2.7	m

Measurment Units

Volume: GAL
Pressure: psi
Length: m

Time

Start Flushing: 8:40 AM
End Flushing: 9:10 AM
Start Packer Testing: 10:00 AM
End Packer Testing: 11:15 AM

IF NO MEASUREABLE FLOW IN CH TEST ---> FALLING HEAD TEST or RISING HEAD TEST

Time (Min)	Depth to H2O	Δ Depth/Min
0		-
1		
2		
4		
6		
8		
10		
15		
20		
25		
30		
40		
50		
60		

Additional Comments: Rods were greased during night shift. Tried to pressure up 4 times. Once the line blew. New line was spliced. Regulator would not go over 900 psi.
Also, tank was swiched because it only had 650 psi. Later received different regulator and was able to achieve desired pressure.

Hole #: **M-09-102a**
Test #: **2**

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

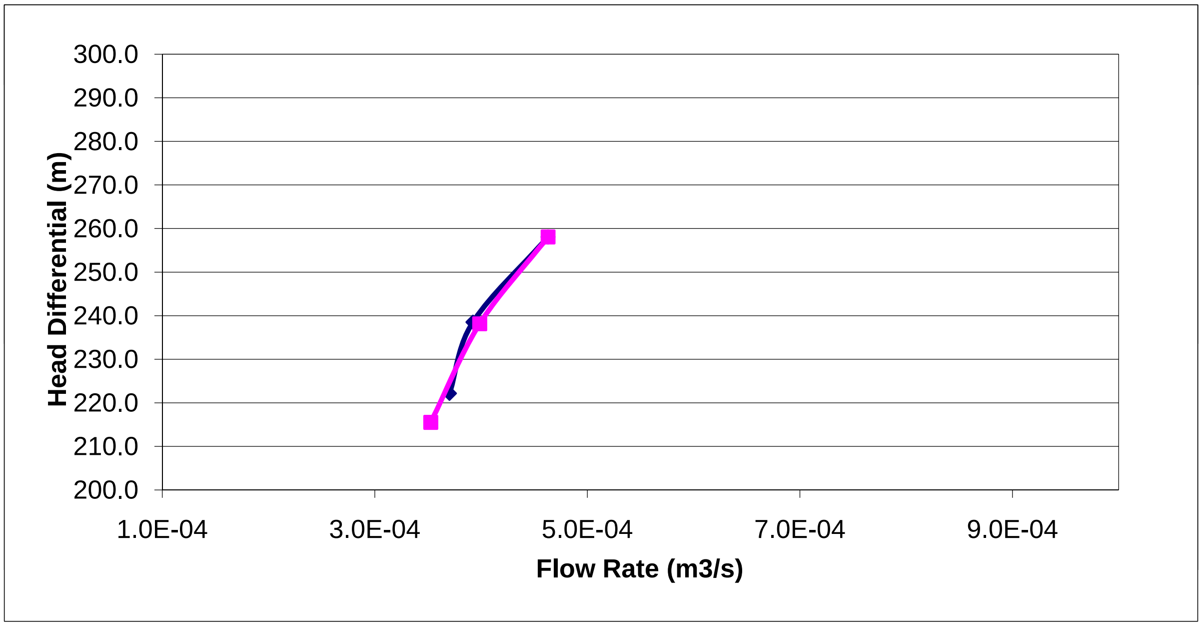
Calculation Input Parameters

Top of Packer Test Interval (mah):	303.0
Bottom of Packer Test Interval (mah):	315.0
L: Length of Test Interval (mah)	12.0
Test Interval Midpoint (mah):	309
Stickup Height (mah):	2.65
Pressure Gauge Height (m above ground):	2.65
Depth to Water Table (mah):	170.00
Borehole Diameter (mm):	75.7
r: Borehole Radius (m):	0.03785
A: Angle From Horizontal (deg):	79

* mah indicates "meters along hole"

$$K = \frac{Q \times \ln\left(\frac{L\sin(A)}{r}\right)}{2 \times \pi \times L\sin(A) \times dH}$$

Pressure (psi)	Q: Flowrate (m^3/s):	Pressure (m of water)	dH: Head Differential (m)	K: Hydraulic Conductivity (m/s)
78.5	3.7E-04	55.2	222.2	1.3E-07
101.8	3.9E-04	71.6	238.5	1.3E-07
129.6	4.6E-04	91.1	258.1	1.4E-07
101.3	4.0E-04	71.2	238.1	1.3E-07
69.1	3.5E-04	48.6	215.5	1.3E-07
			Geo Mean	**1.3.E-07**

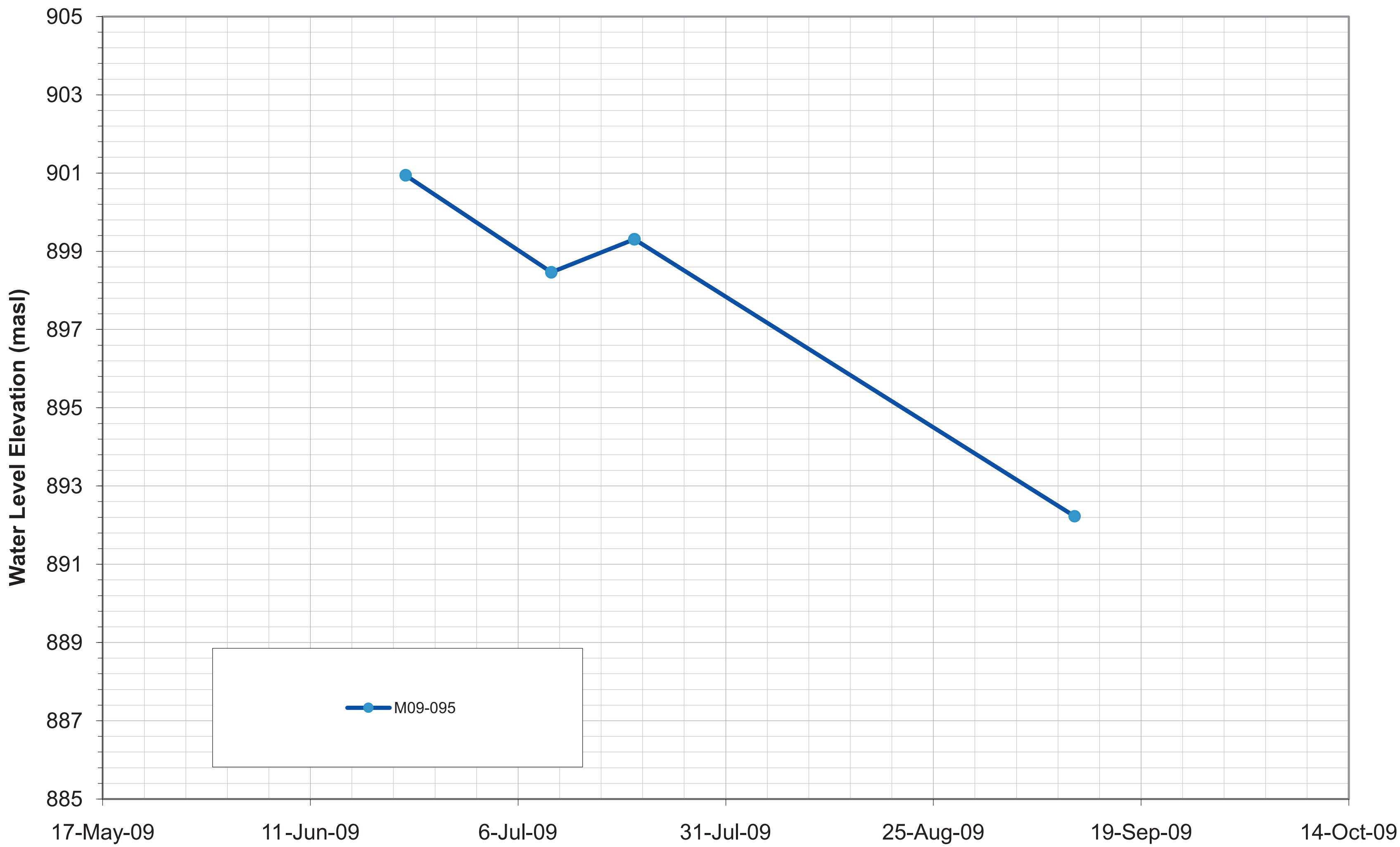


APPENDIX B

M09 WATER LEVEL DATA SUMMARY

Table B1. M09 Borehole VW Piezometer Data

VWP ID	VW Tip UTM Easting (m)	VW Tip UTM Northing (m)	VWP Tip Ground Elev. (masl)	Borehole Collar UTM Easting (m)	Borehole Collar UTM Northing (m)	Borehole Collar Elevation (masl)	Plunge	Trend	RST VWP Serial Number	VWP Installation Depth (meters along borehole)	VWP Elevation (m)	Date	B Reading	Pressure Head (m)	Groundwater Elevation (masl)	Notes
M09-095	423218	6265214	986.4	423198	6265329	970	73	159	VW11268	400.0	587.5	22-Jun-09	7455.0	313.47	900.95	
M09-095	423218	6265214	986.4	423198	6265329	970	73	159	VW11268	400.0	587.5	10-Jul-09	7465.5	310.99	898.46	
M09-095	423218	6265214	986.4	423198	6265329	970	73	159	VW11268	400.0	587.5	20-Jul-09	7461.9	311.83	899.31	
M09-095	423218	6265214	986.4	423198	6265329	970	73	159	VW11268	400.0	587.5	11-Sep-09	7492.0	304.75	892.23	
M09-096S	423602	6265470	909.9	423582	6265470	911	66	89	VW11259	48.4	866.8	22-Jun-09	7393.4	43.32	910.11	
M09-096S	423602	6265470	909.9	423582	6265470	911	66	89	VW11259	48.4	866.8	10-Jul-09	7393.9	43.42	910.20	
M09-096S	423602	6265470	909.9	423582	6265470	911	66	89	VW11259	48.4	866.8	20-Jul-09	7398.0	43.30	910.08	
M09-096S	423602	6265470	909.9	423582	6265470	911	66	89	VW11259	48.4	866.8	11-Sep-09	7405.0	43.09	909.88	
M09-096D	423684	6265472	903.1	423582	6265470	911	66	89	VW11263	250.0	682.6	22-Jun-09	7706.6	224.61	907.22	
M09-096D	423684	6265472	903.1	423582	6265470	911	66	89	VW11263	250.0	682.6	10-Jul-09	7703.2	225.30	907.92	
M09-096D	423684	6265472	903.1	423582	6265470	911	66	89	VW11263	250.0	682.6	20-Jul-09	7707.5	224.56	907.17	
M09-096D	423684	6265472	903.1	423582	6265470	911	66	89	VW11263	250.0	682.6	11-Sep-09	7724.4	221.55	904.16	
M09-097S	423184	6266421	1352.1	423144	6266392	1334	59	54	VW11260	95.6	1252.1	25-Jun-09	8418.3	26.45	1278.54	
M09-097S	423184	6266421	1352.1	423144	6266392	1334	59	54	VW11260	95.6	1252.1	10-Jul-09	8448.8	23.67	1275.76	
M09-097S	423184	6266421	1352.1	423144	6266392	1334	59	54	VW11260	95.6	1252.1	20-Jul-09	8462.1	22.93	1275.02	
M09-097S	423184	6266421	1352.1	423144	6266392	1334	59	54	VW11260	95.6	1252.1	30-Jul-09	8550.9	18.02	1270.11	
M09-097S	423184	6266421	1352.1	423144	6266392	1334	59	54	VW11260	95.6	1252.1	10-Aug-09	8605.9	14.97	1267.06	
M09-097S	423184	6266421	1352.1	423144	6266392	1334	59	54	VW11260	95.6	1252.1	24-Aug-09	8688.5	10.40	1262.49	
M09-097S	423184	6266421	1352.1	423144	6266392	1334	59	54	VW11260	95.6	1252.1	1-Sep-09	8718.3	8.75	1260.84	
M09-097S	423184	6266421	1352.1	423144	6266392	1334	59	54	VW11260	95.6	1252.1	11-Sep-09	8752.2	6.87	1258.96	
M09-097D	423267	6266482	1358.8	423144	6266392	1334	59	54	VW11265	296.0	1080.3	25-Jun-09	7315.9	226.08	1306.35	
M09-097D	423267	6266482	1358.8	423144	6266392	1334	59	54	VW11265	296.0	1080.3	10-Jul-09	7430.5	204.66	1284.94	
M09-097D	423267	6266482	1358.8	423144	6266392	1334	59	54	VW11265	296.0	1080.3	20-Jul-09	7432.8	204.25	1284.53	
M09-097D	423267	6266482	1358.8	423144	6266392	1334	59	54	VW11265	296.0	1080.3	30-Jul-09	7463.7	198.74	1279.02	
M09-097D	423267	6266482	1358.8	423144	6266392	1334	59	54	VW11265	296.0	1080.3	9-Aug-09	7483.3	195.24	1275.52	
M09-097D	423267	6266482	1358.8	423144	6266392	1334	59	54	VW11265	296.0	1080.3	24-Aug-09	7510.9	190.31	1270.59	
M09-097D	423267	6266482	1358.8	423144	6266392	1334	59	54	VW11265	296.0	1080.3	31-Aug-09	7520.3	188.64	1268.92	
M09-097D	423267	6266482	1358.8	423144	6266392	1334	59	54	VW11265	296.0	1080.3	10-Sep-09	7531.4	186.66	1266.93	
M09-098	422877	6266115	1233.4	422888	6266069	1201	62	346	VW11261	101.0	1111.8	27-Jun-09	8845.2	3.85	1115.67	
M09-098	422877	6266115	1233.4	422888	6266069	1201	62	346	VW11261	101.0	1111.8	10-Jul-09	8850.0	3.17	1114.99	
M09-098	422877	6266115	1233.4	422888	6266069	1201	62	346	VW11261	101.0	1111.8	20-Jul-09	8851.0	3.04	1114.86	
M09-098	422877	6266115	1233.4	422888	6266069	1201	62	346	VW11261	101.0	1111.8	11-Sep-09	8854.2	2.63	1114.45	
M09-099	422970	6265791	958.5	422900	6265705	892	74	39	VW11268	402.0	505.6	10-Jul-09	7772.8	239.45	745.02	
M09-099	422970	6265791	958.5	422900	6265705	892	74	39	VW11268	402.0	505.6	20-Jul-09	7884.4	213.20	718.77	
M09-099	422970	6265791	958.5	422900	6265705	892	74	39	VW11268	402.0	505.6	11-Sep-09	7710.4	254.03	759.60	
M09-100S	422341	6265243	795.0	422354	6265247	793	73	252	VW11258	48.3	746.8	10-Jul-09	7360.1	46.93	793.74	
M09-100S	422341	6265243	795.0	422354	6265247	793	73	252	VW11258	48.3	746.8	20-Jul-09	7352.2	47.16	793.97	
M09-100S	422341	6265243	795.0	422354	6265247	793	73	252	VW11258	48.3	746.8	15-Sep-09	7360.1	46.93	793.74	
M09-100D	422285	6265225	809.4	422354	6265247	793	73	252	VW11264	248.3	555.5	10-Jul-09	7539.6	222.04	777.59	
M09-100D	422285	6265225	809.4	422354	6265247	793	73	252	VW11264	248.3	555.5	20-Jul-09	7778.8	179.23	734.78	
M09-100D	422285	6265225	809.4	422354	6265247	793	73	252	VW11264	248.3	555.5	31-Jul-09	7888.9	159.54	715.09	
M09-100D	422285	6265225	809.4	422354	6265247	793	73	252	VW11264	248.3	555.5	8-Aug-09	7931.2	151.96	707.51	
M09-100D	422285	6265225	809.4	422354	6265247	793	73	252	VW11264	248.3	555.5	18-Aug-09	7966.3	145.69	701.24	
M09-100D	422285	6265225	809.4	422354	6265247	793	73	252	VW11264	248.3	555.5	24-Aug-09	7983.8	142.57	698.11	
M09-100D	422285	6265225	809.4	422354	6265247	793	73	252	VW11264	248.3	555.5	1-Sep-09	7999.7	139.71	695.25	
M09-100D	422285	6265225	809.4	422354	6265247	793	73	252	VW11264	248.3	555.5	11-Sep-09	8020.0	136.09	691.64	
M09-101	423471	6264732	1270.0	423418	6264798	1252	65	141	VW11262	200.2	1070.6	16-Jul-09	6450.7	136.48	1207.04	
M09-101	423471	6264732	1270.0	423418	6264798	1252	65	141	VW11262	200.2	1070.6	20-Jul-09	6493.8	131.27	1201.82	
M09-101	423471	6264732	1270.0	423418	6264798	1252	65	141	VW11262	200.2	1070.6	11-Sep-09	6863.3	84.83	1155.38	
M09-102a	422359	6264604	1281.6	422387	6264664	1247	79	205	VW11266	349.0	904.4	18-Jul-09	7828.9	178.70	1083.11	
M09-102a	422359	6264604	1281.6	422387	6264664	1247	79	205	VW11266	349.0	904.4	20-Jul-09	7826.0	179.23	1083.64	
M09-102a	422359	6264604	1281.6	422387	6264664	1247	79	205	VW11266	349.0	904.4	11-Sep-09	7803.0	183.03	1087.44	



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: CT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

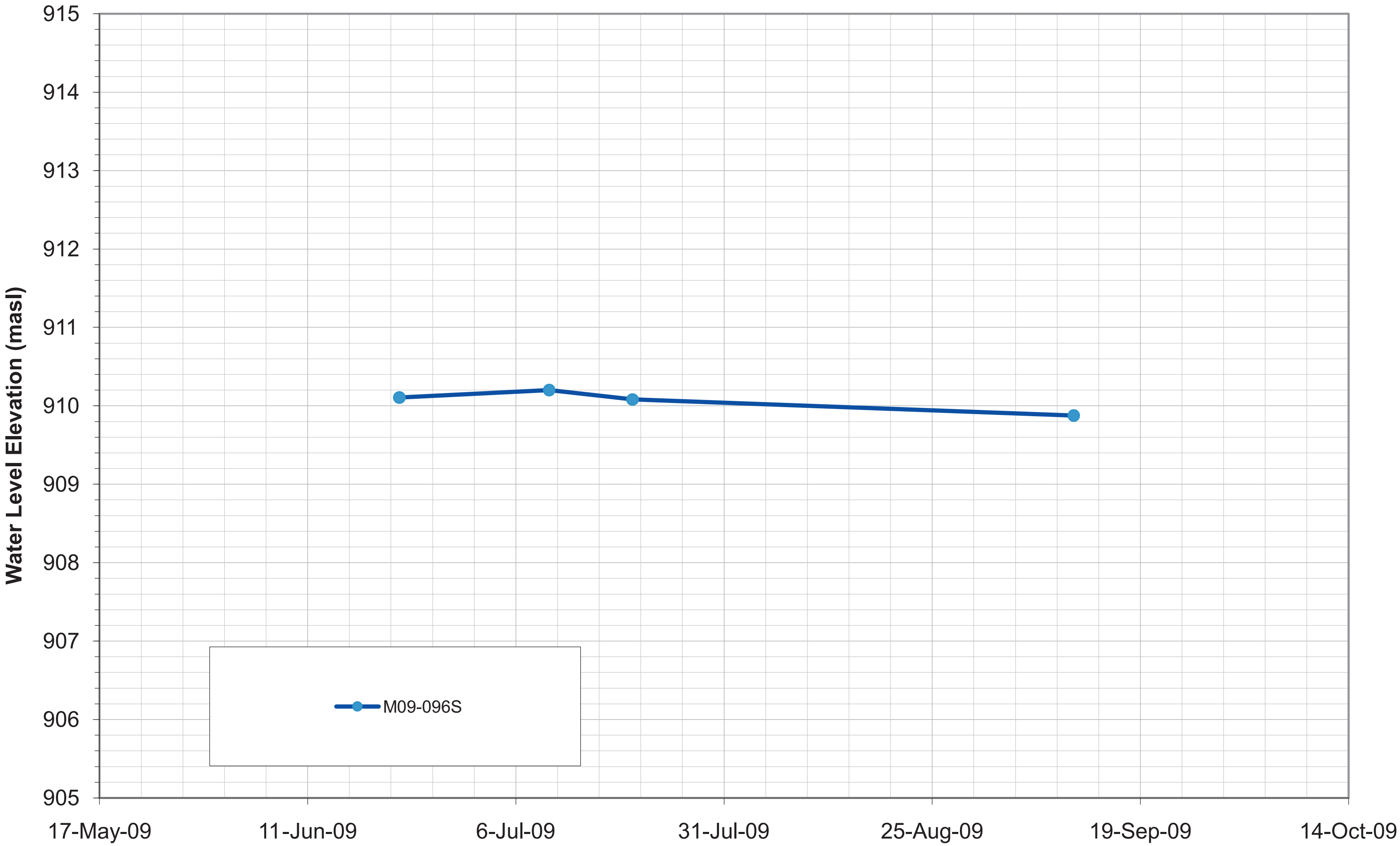
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
M09-095 VW Piezometer Total Head Elevation Data

PROJECT No.:	DWG No.:	REV.:
0638-004	B1	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr

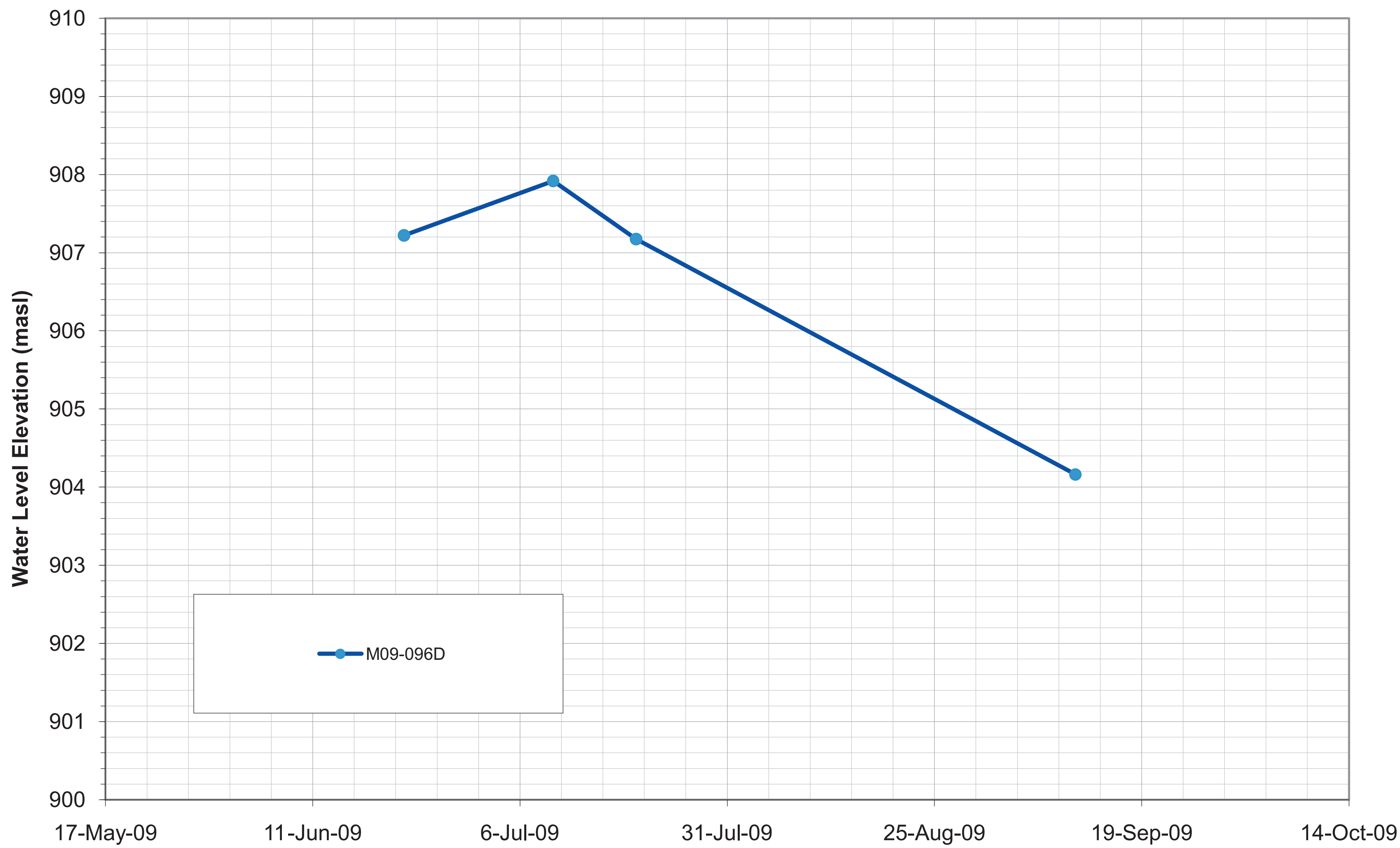


SCALE: NTS	DESIGNED: RT	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES	
DATE: APRIL 2010	CHECKED: RT	TITLE: M09-096S VW Piezometer Total Head Elevation Data	
DRAWN: RT	APPROVED: CT		

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

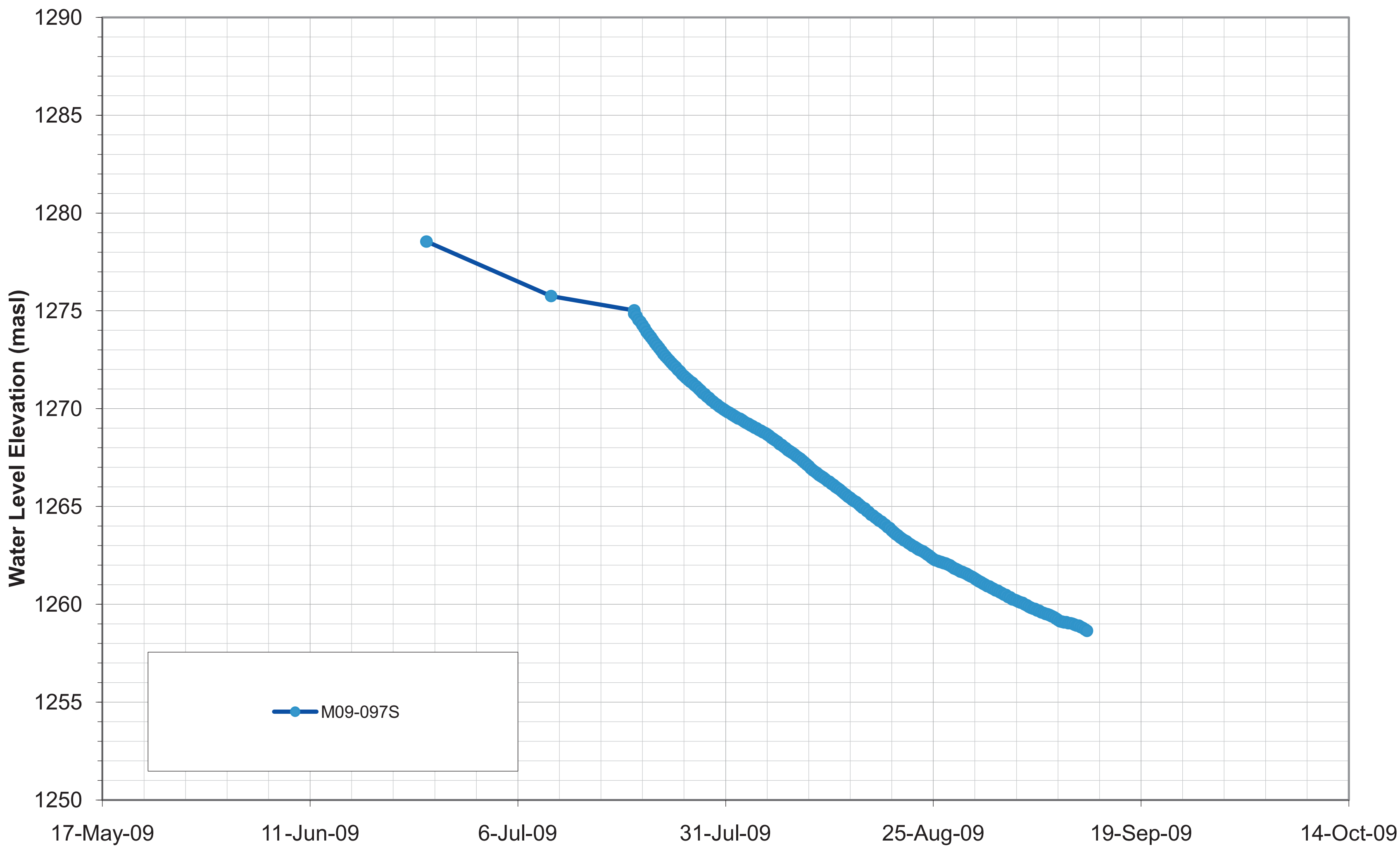
CLIENT: SEABRIDGE GOLD INC.		
PROJECT No.: 0638-004	DWG No.: B2	REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



SCALE: NTS	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT		TITLE: M09-096D VW Piezometer Total Head Elevation Data
DRAWN: RT	APPROVED: CT	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 / DWG No.: B3 / REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: CT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

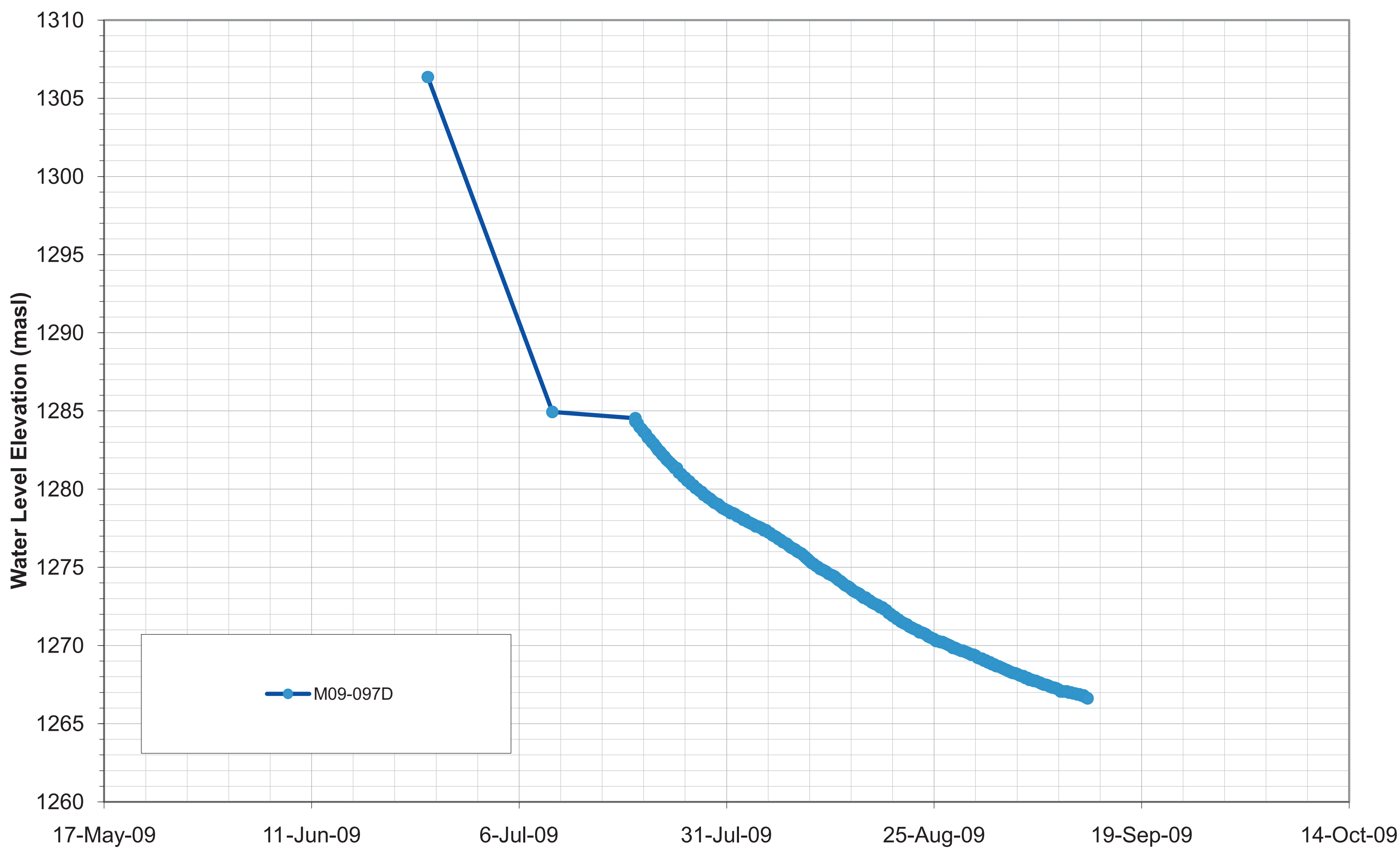
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
M09-097S VW Piezometer Total Head Elevation Data

PROJECT No.:	DWG No.:	REV.:
0638-004	B4	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



SCALE:	NTS	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	RT	APPROVED:	CT

BGC

BGC ENGINEERING INC.

AN APPLIED EARTH SCIENCES COMPANY

CLIENT:

SEABRIDGE GOLD INC.

PROJECT:

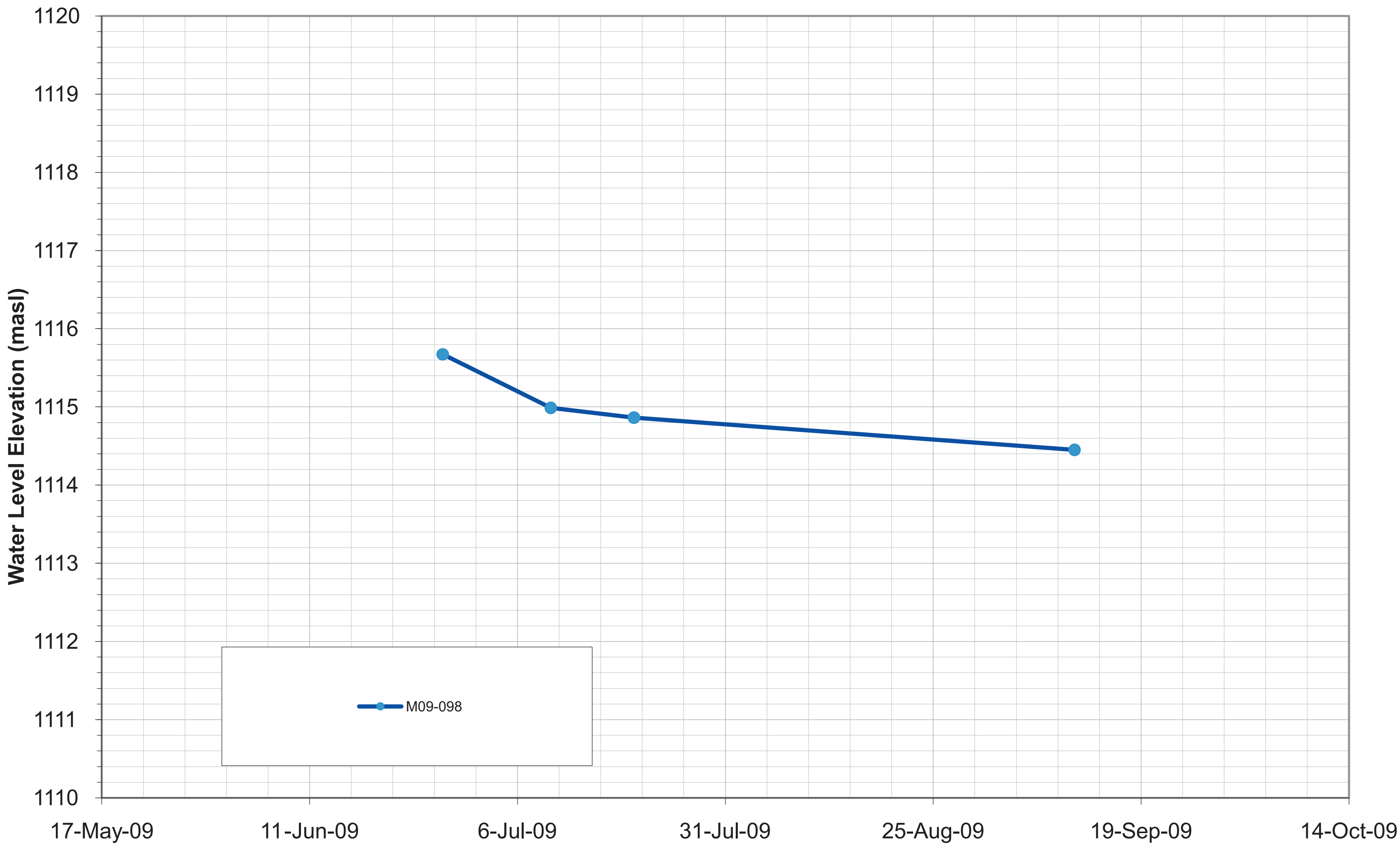
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:

M09-097D VW Piezometer Total Head Elevation Data

PROJECT No.:	DWG No.:	REV.:
0638-004	B5	0

NK:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: CT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

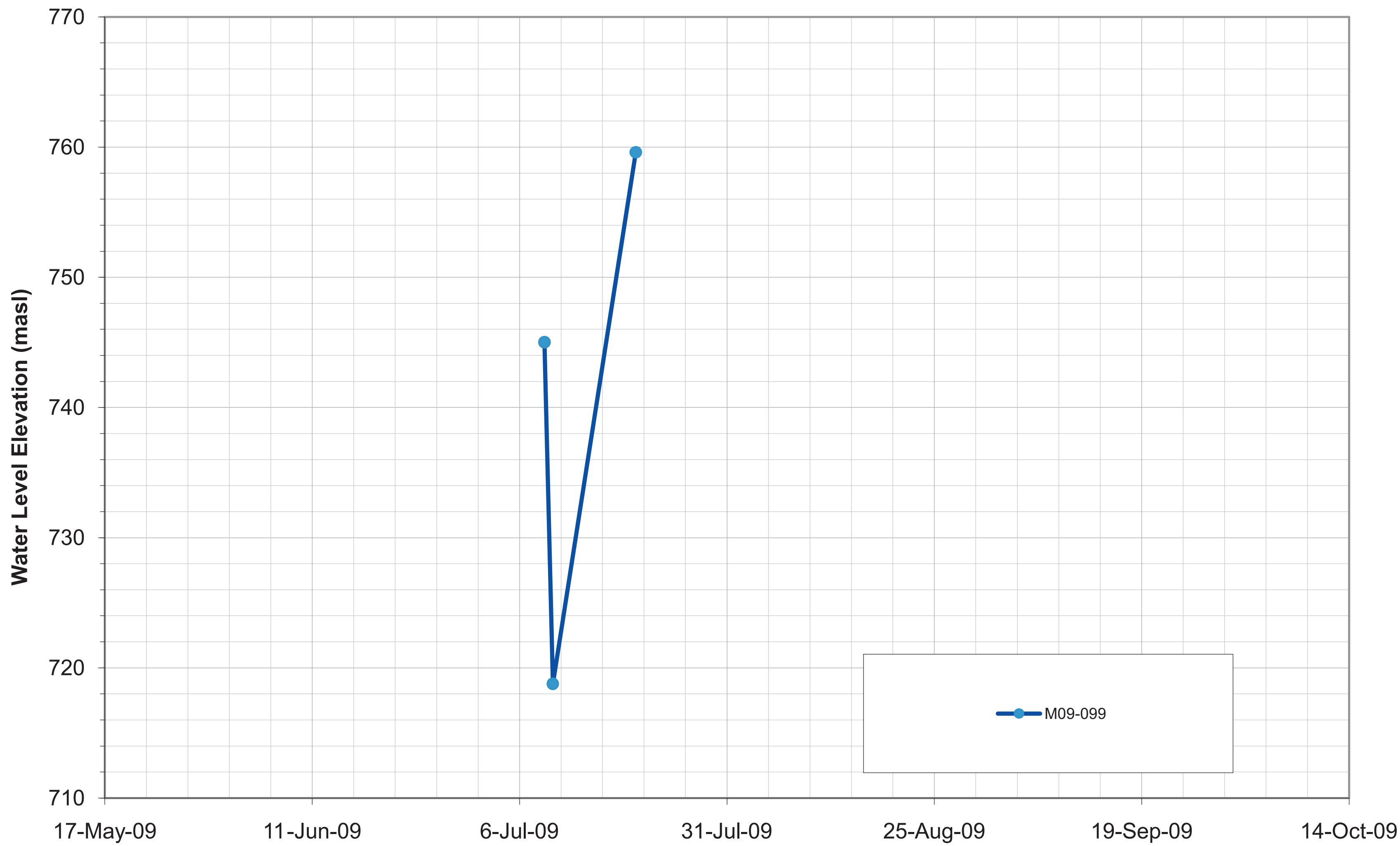
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: M09-098 VW Piezometer Total Head Elevation Data

PROJECT No.:	DWG No.:	REV.:
0638-004	B6	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: CT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

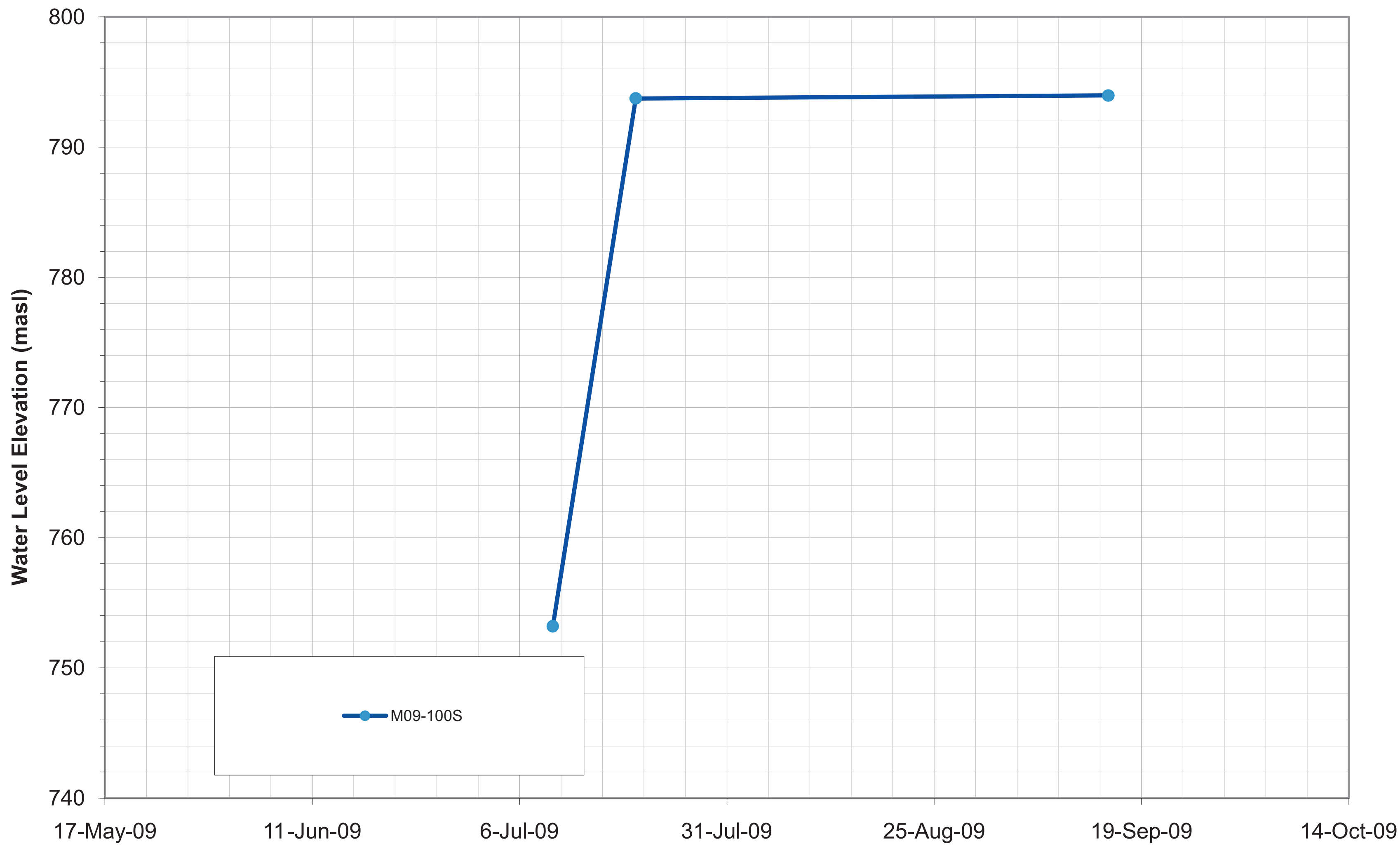
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: M09-099 VW Piezometer Total Head Elevation Data

PROJECT No.:	DWG No.:	REV.:
0638-004	B7	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: CT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

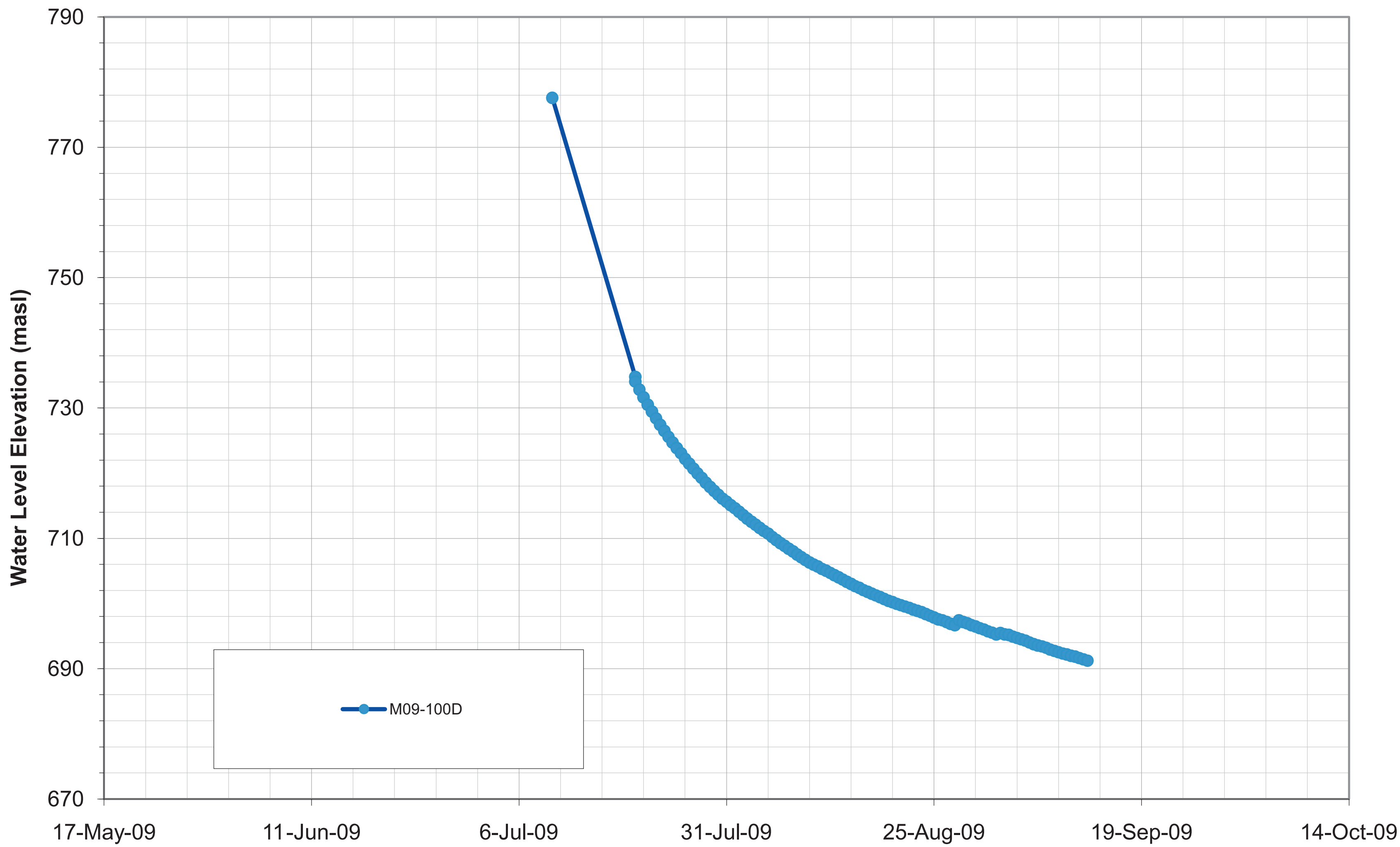
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: M09-100S VW Piezometer Total Head Elevation Data

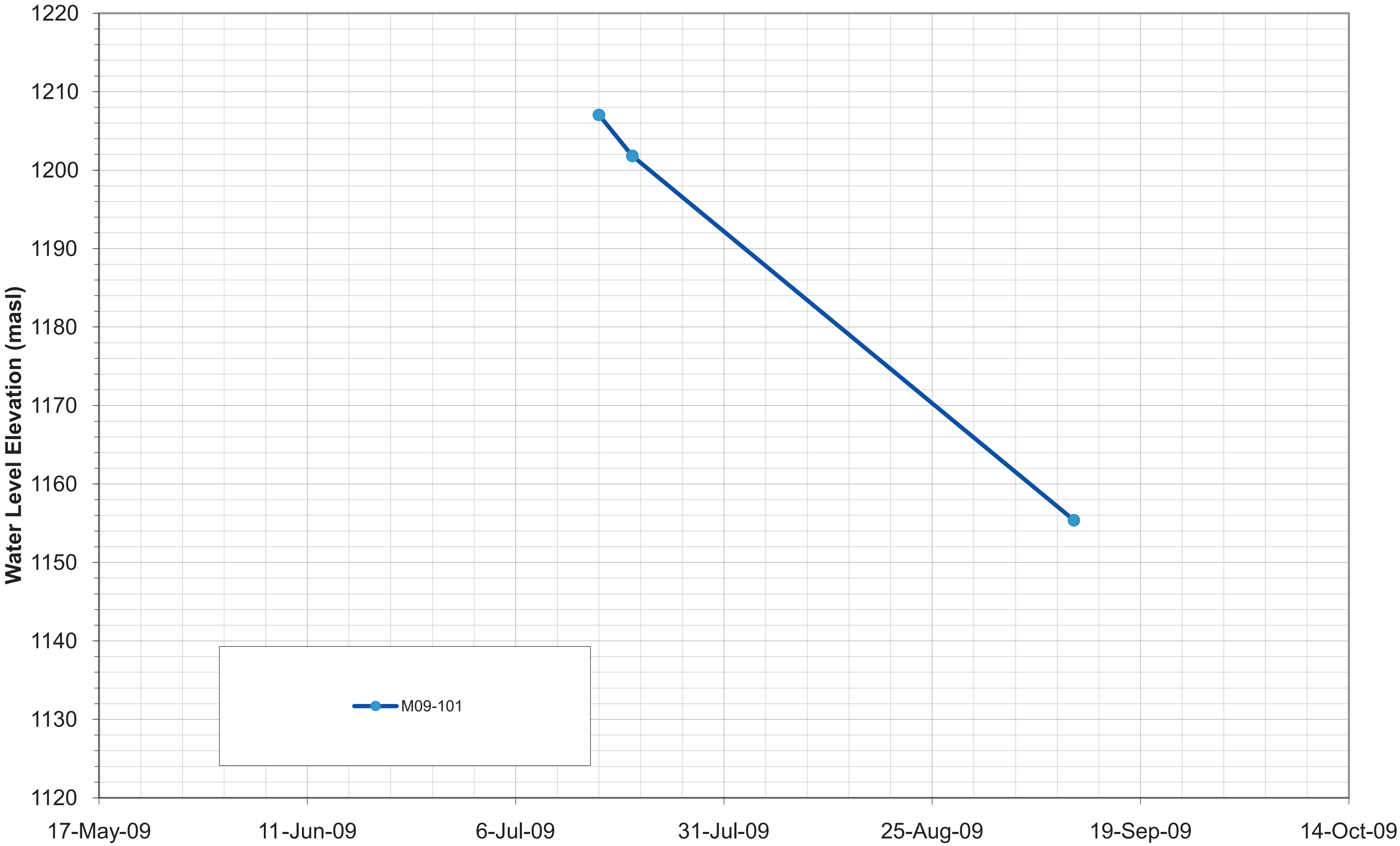
PROJECT No.:	DWG No.:	REV.:
0638-004	B8	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



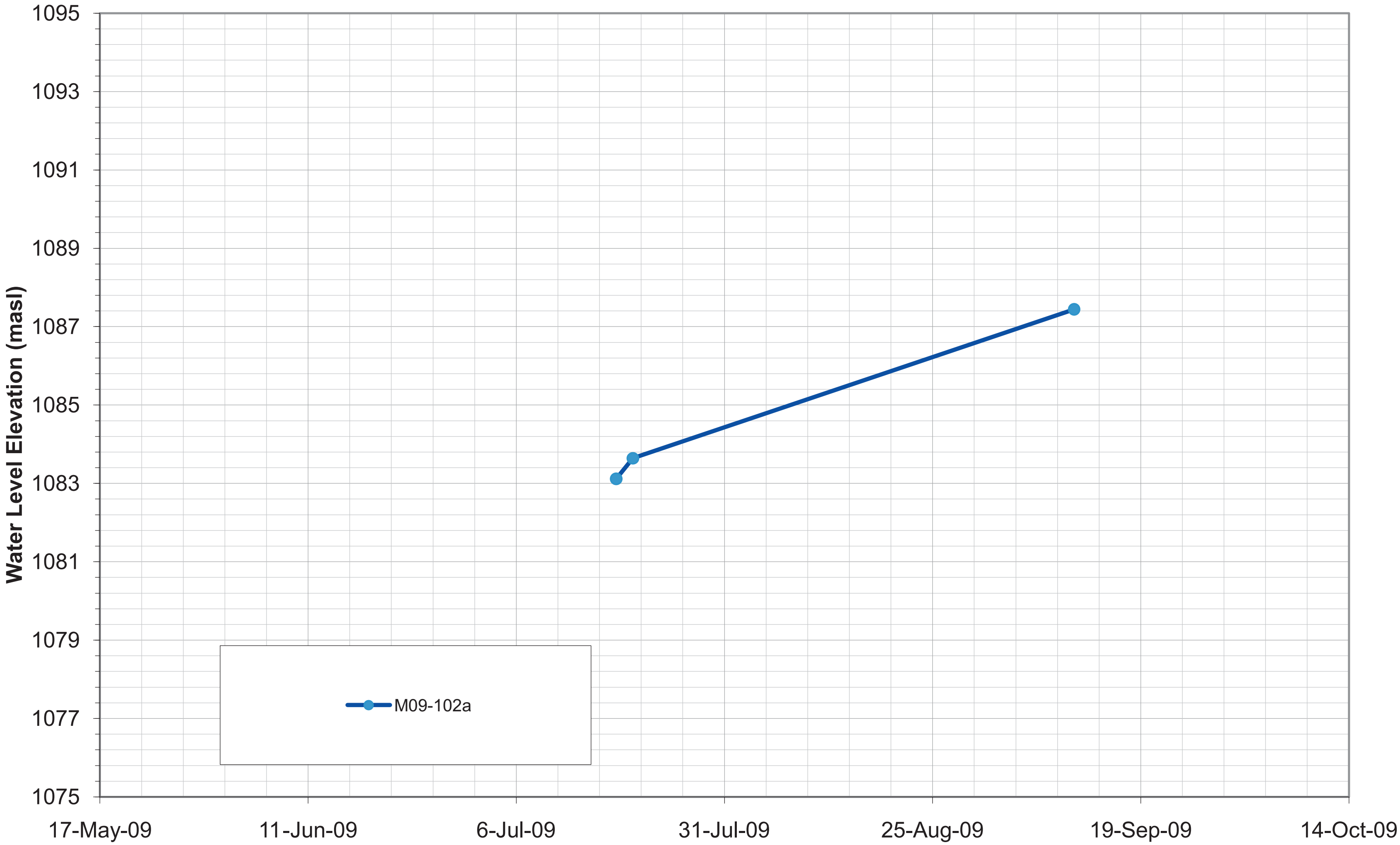
SCALE: NTS	DESIGNED: RT		PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	TITLE: M09-100D VW Piezometer Total Head Elevation Data
DRAWN: RT	APPROVED: CT	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 / DWG No.: B9 / REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



SCALE: NTS	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT		TITLE: M09-101 VW Piezometer Total Head Elevation Data
DRAWN: RT	APPROVED: CT	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 · DWG No.: B10 · REV.: 0

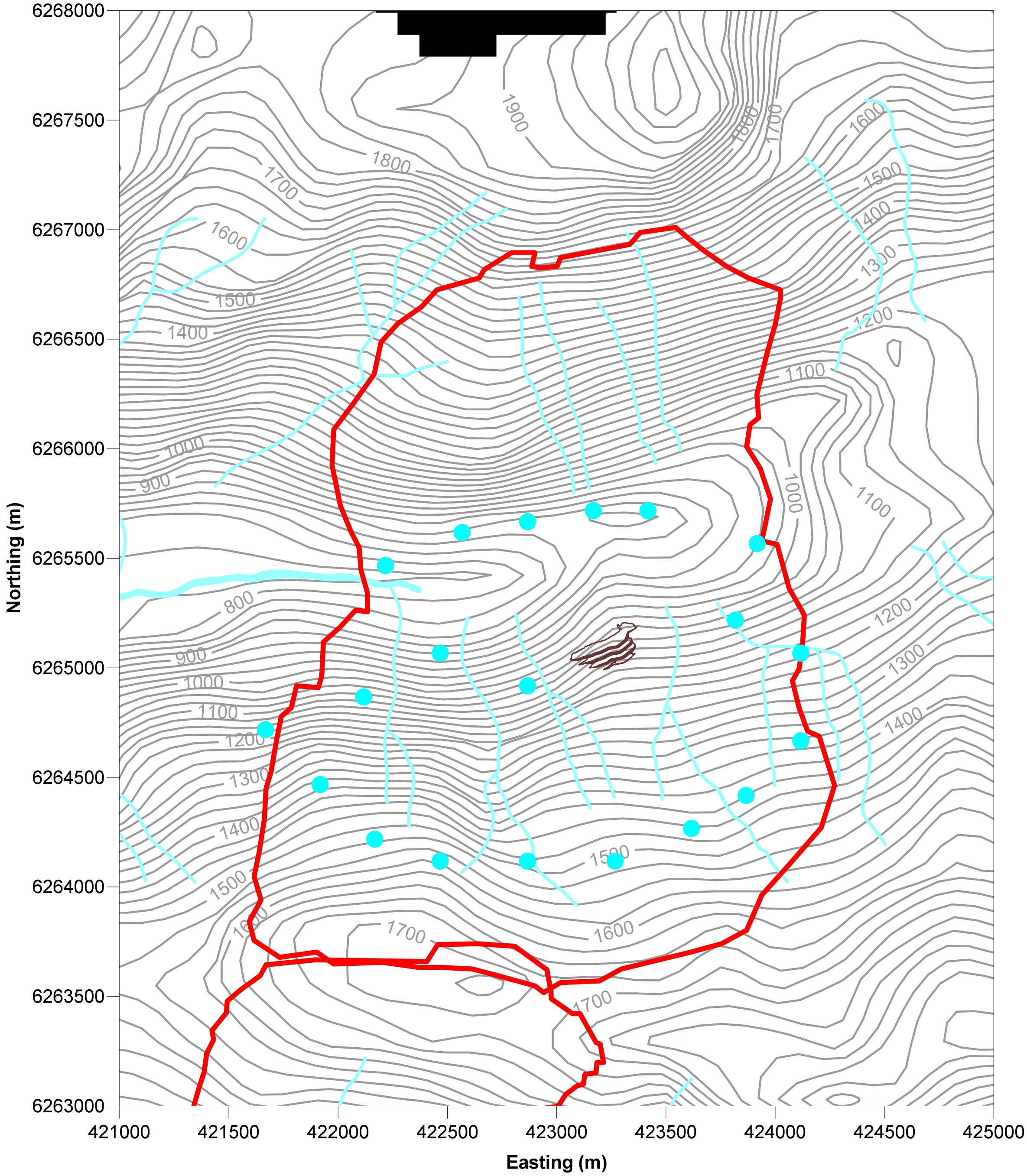
K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr



SCALE: NTS	DESIGNED: RT		PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	TITLE: M09102a VW Piezometer Total Head Elevation Data
DRAWN: RT	APPROVED: CT	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 / DWG No.: B11 / REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Water Levels\Water LevelPlots_ksm_pfs.cdr

APPENDIX C
DEPRESSURIZATION WELL LAYOUTS



OPEN PIT OUTLINES	HYDROLOGY	INACTIVE CELLS			
OPEN PITS	TOPOGRAPHIC CONTOURS (masl)	GROUP 1 WELLS			
GROUP 2 WELLS	GROUP 3 WELLS	GROUP 4 WELLS			
GROUP 5 WELLS	GROUP 6 WELLS	GROUP 7 WELLS			

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

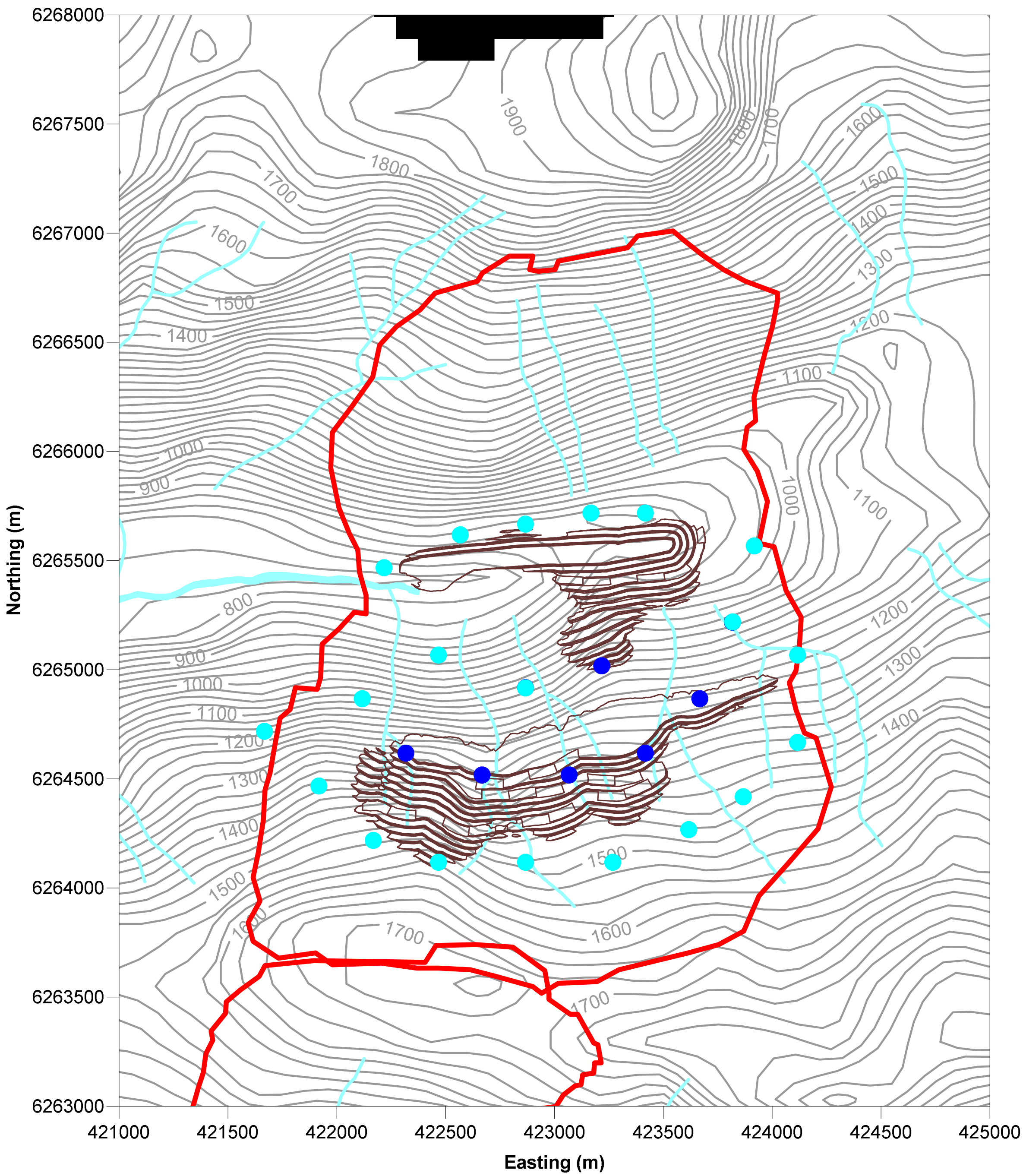
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT PRE-PRODUCTION WELL LAYOUT

CLIENT	PROJECT No:	FIG No:	REV.
SEABRIDGE GOLD INC.	0638-004	C1	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Pre-development Well Layout.srf



OPEN PIT OUTLINES		OPEN PITS		GROUP 2 WELLS	GROUP 5 WELLS
HYDROLOGY		TOPOGRAPHIC CONTOURS (masl)		GROUP 3 WELLS	GROUP 6 WELLS
INACTIVE CELLS		GROUP 1 WELLS		GROUP 4 WELLS	GROUP 7 WELLS

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

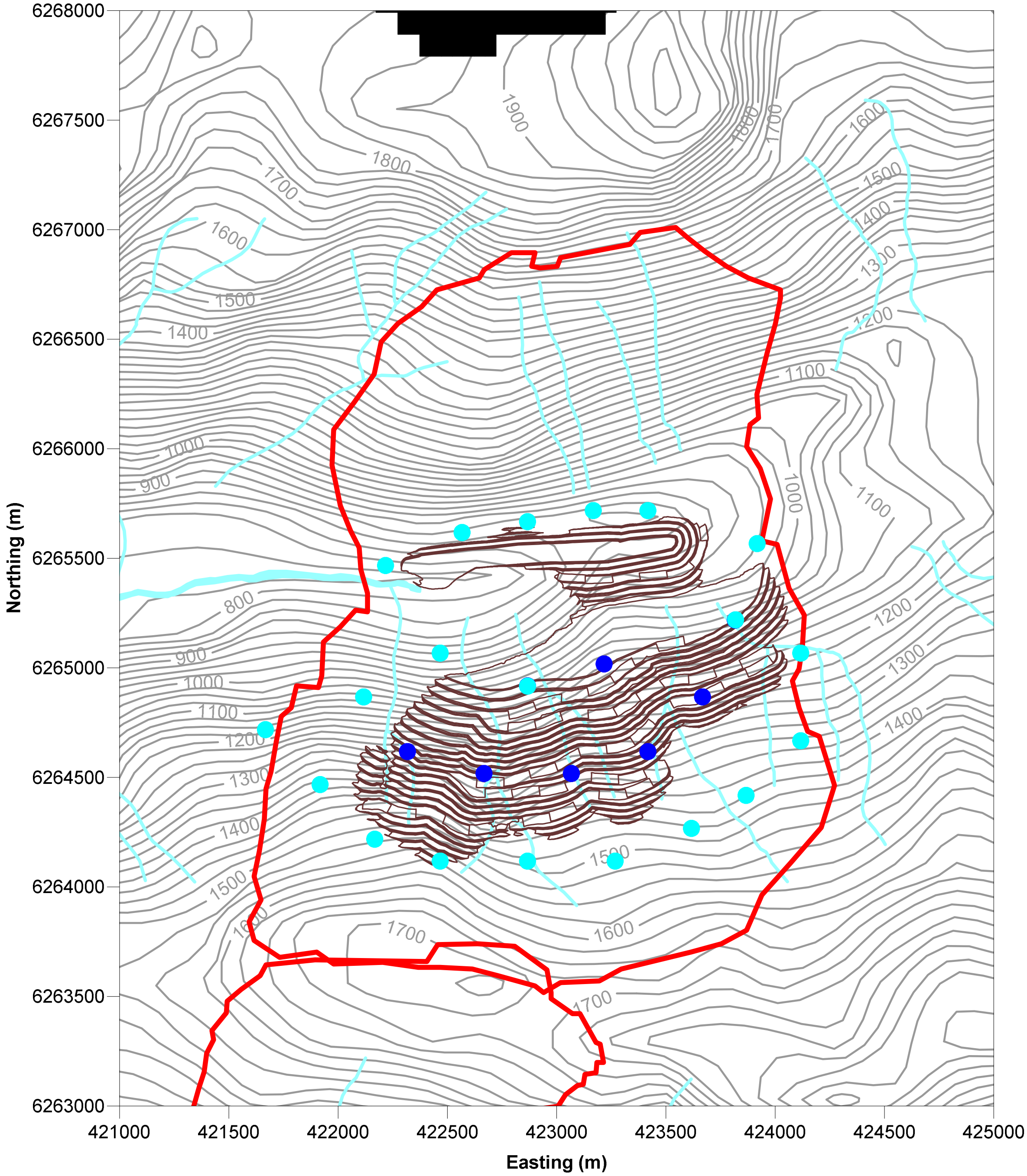
PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT YEAR 1 WELL LAYOUT

CLIENT: SEABRIDGE GOLD INC.

PROJECT No:	FIG No:	REV.
0638-004	C2	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Year 1 Well Layout.srf



OPEN PIT OUTLINES	OPEN PITS	GROUP 2 WELLS	GROUP 5 WELLS
HYDROLOGY	TOPOGRAPHIC CONTOURS (masl)	GROUP 3 WELLS	GROUP 6 WELLS
INACTIVE CELLS	GROUP 1 WELLS	GROUP 4 WELLS	GROUP 7 WELLS

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

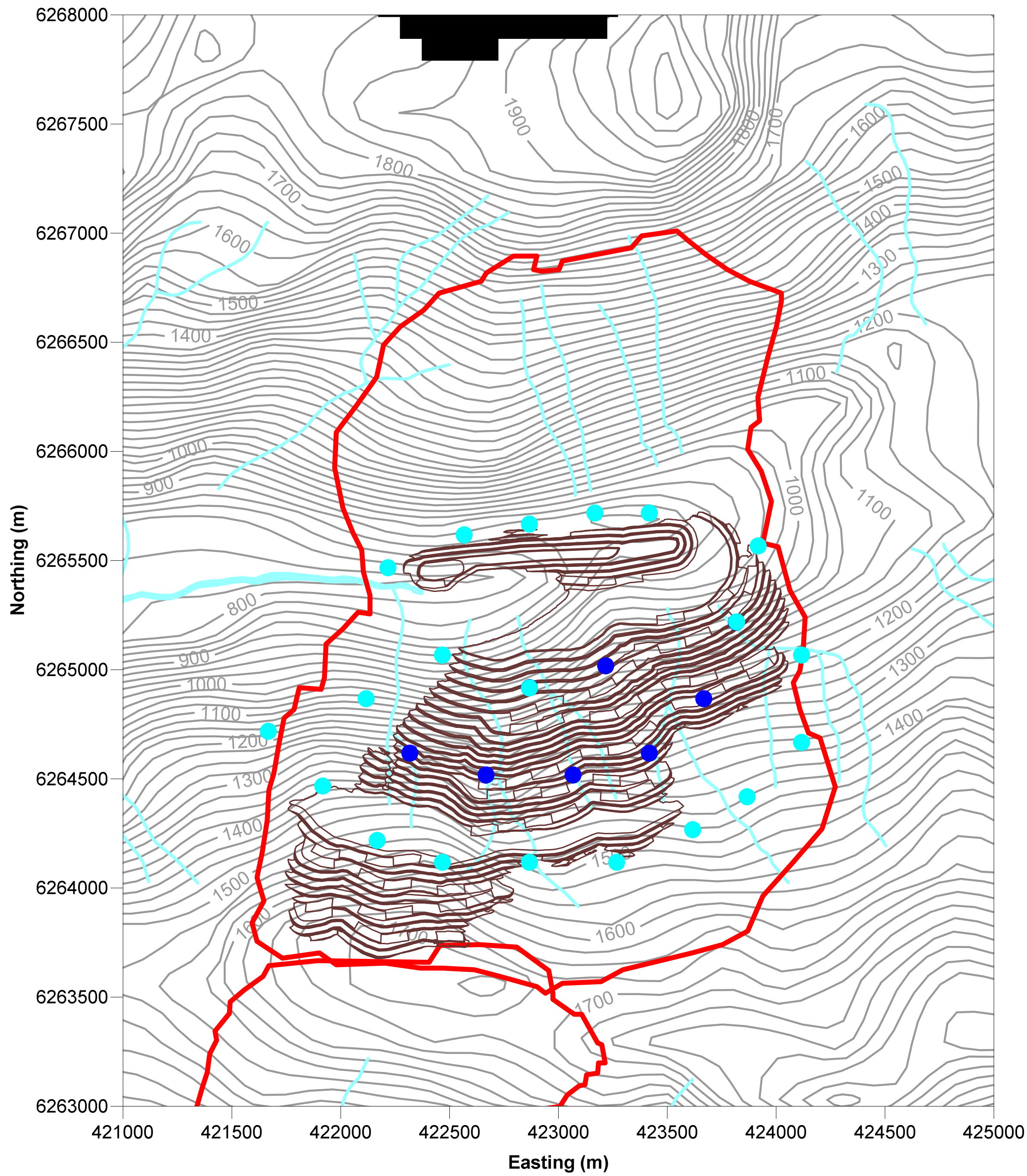
PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT YEAR 2 WELL LAYOUT

CLIENT: SEABRIDGE GOLD INC.

PROJECT No:	FIG No:	REV.
0638-004	C3	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Year 2 Well Layout.srf



OPEN PIT OUTLINES	OPEN PITS	GROUP 2 WELLS	GROUP 5 WELLS
HYDROLOGY	TOPOGRAPHIC CONTOURS (masl)	GROUP 3 WELLS	GROUP 6 WELLS
INACTIVE CELLS	GROUP 1 WELLS	GROUP 4 WELLS	GROUP 7 WELLS

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

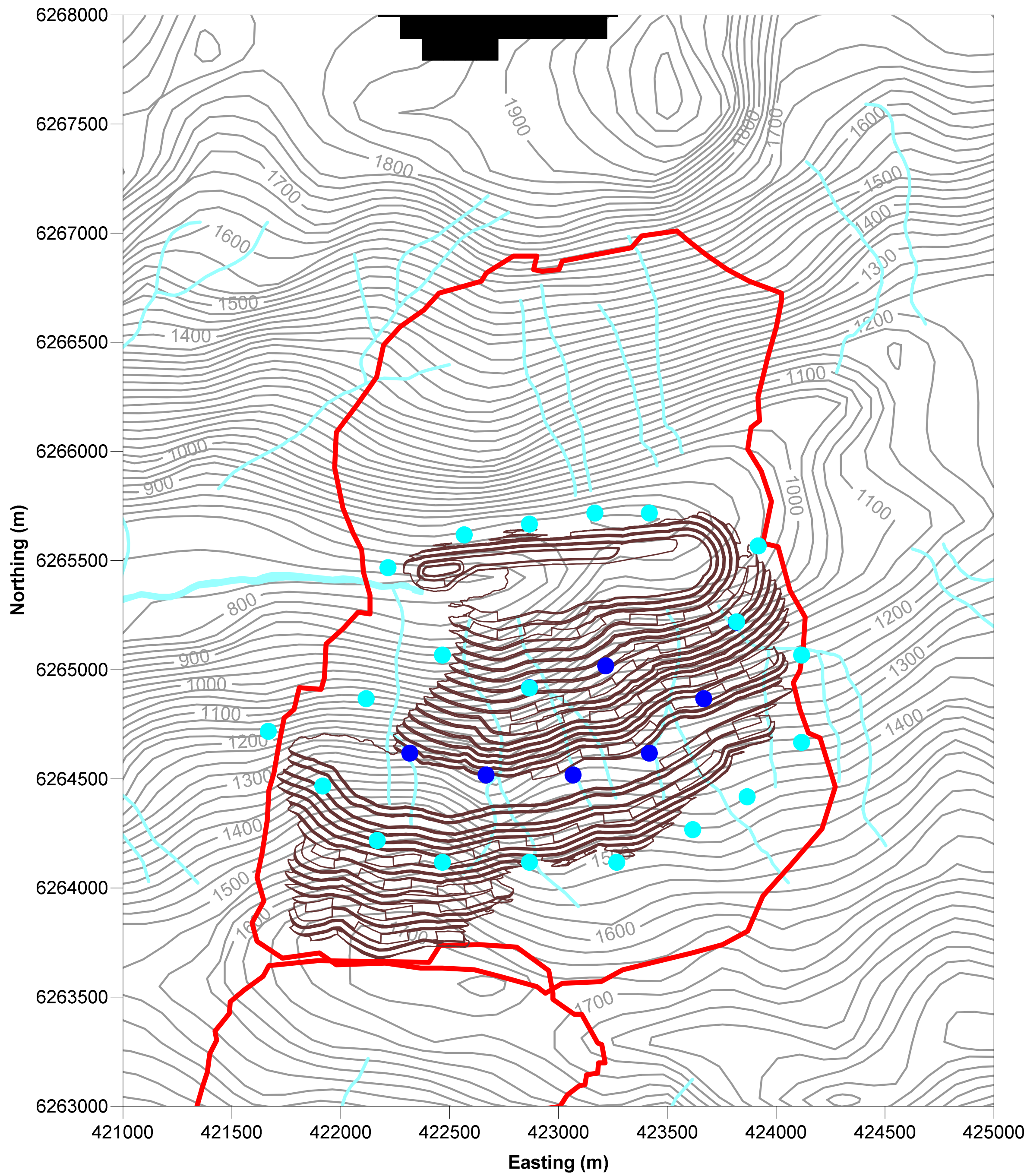
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT YEAR 3 WELL LAYOUT

CLIENT: SEABRIDGE GOLD INC.	PROJECT No: 0638-004	FIG No: C4	REV. 0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Year 3 Well Layout.srf



OPEN PIT OUTLINES
HYDROLOGY
INACTIVE CELLS
OPEN PITS
TOPOGRAPHIC CONTOURS (masl)
GROUP 1 WELLS
GROUP 2 WELLS
GROUP 3 WELLS
GROUP 4 WELLS
GROUP 5 WELLS
GROUP 6 WELLS
GROUP 7 WELLS

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

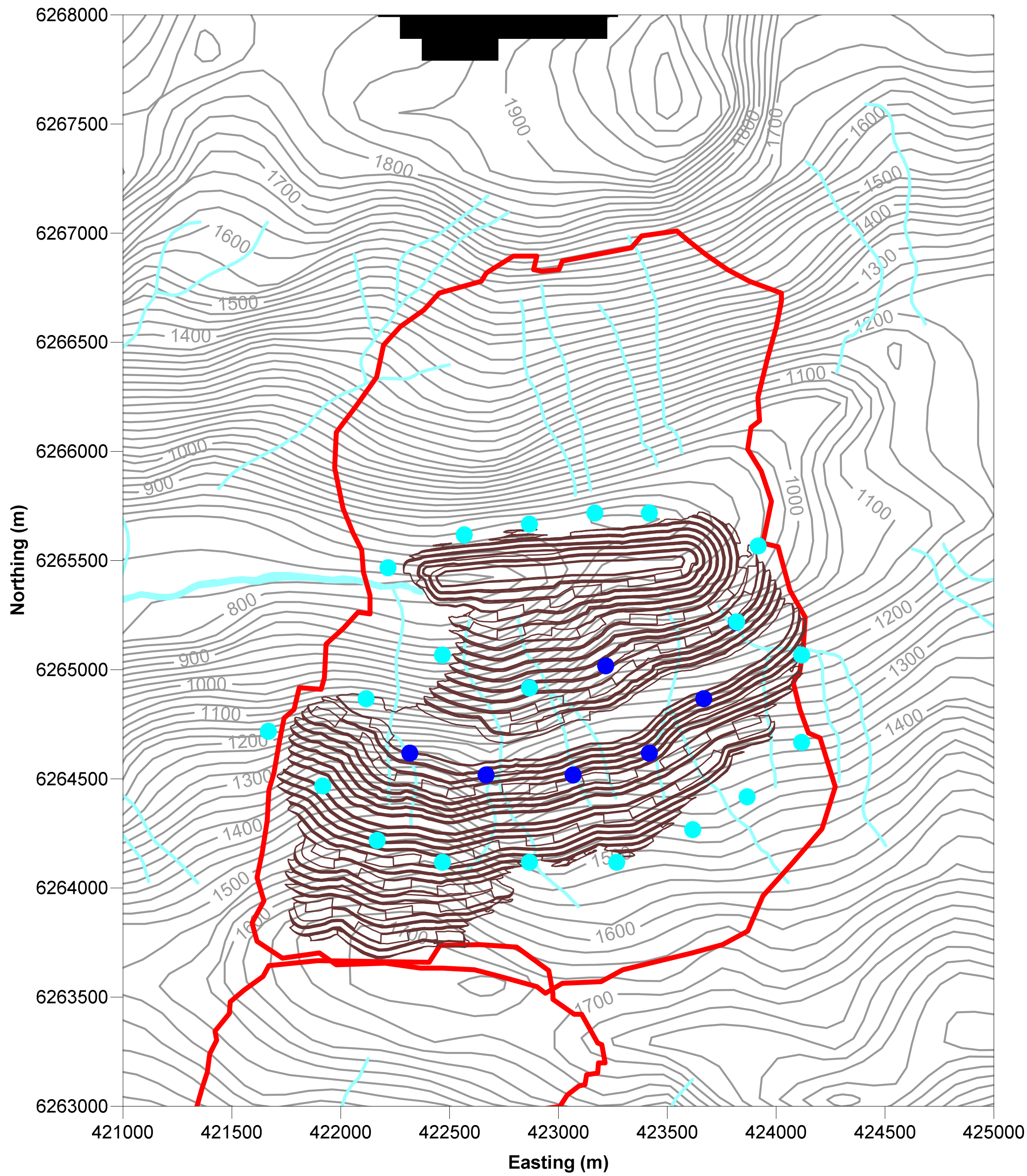
PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT YEAR 4 WELL LAYOUT

CLIENT: SEABRIDGE GOLD INC.

PROJECT No:	FIG No:	REV.
0638-004	C5	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Year 4 Well Layout.srf



OPEN PIT OUTLINES	OPEN PITS	GROUP 2 WELLS	GROUP 5 WELLS
HYDROLOGY	TOPOGRAPHIC CONTOURS (masl)	GROUP 3 WELLS	GROUP 6 WELLS
INACTIVE CELLS	GROUP 1 WELLS	GROUP 4 WELLS	GROUP 7 WELLS

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

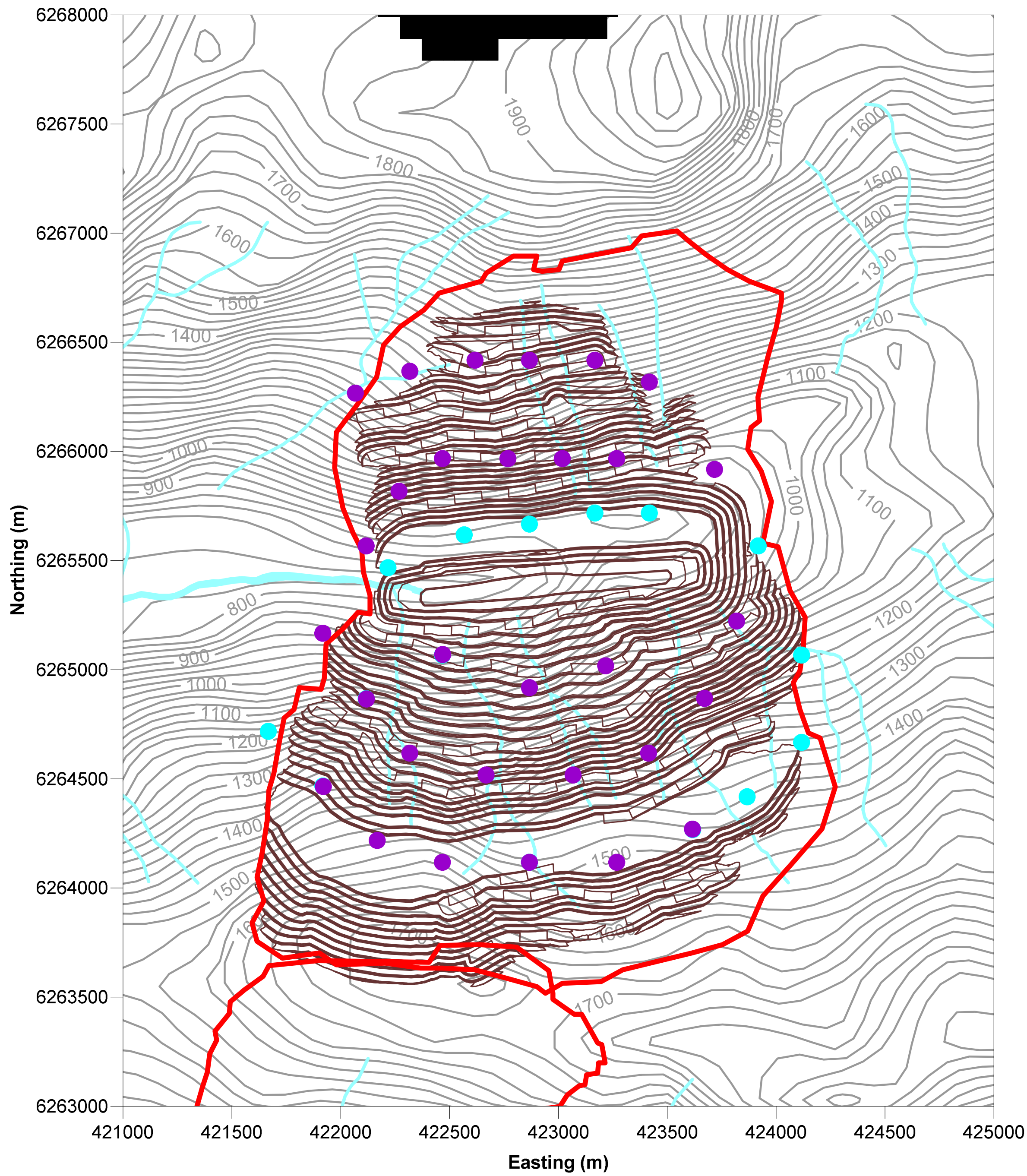
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT YEAR 5 WELL LAYOUT

CLIENT: SEABRIDGE GOLD INC.	PROJECT No: 0638-004	FIG No: C6	REV. 0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Year 5 Well Layout.srf



OPEN PIT OUTLINES	(red line)	OPEN PITS	(brown line)	GROUP 2 WELLS (blue)	GROUP 5 WELLS (pink)
HYDROLOGY	(cyan)	TOPOGRAPHIC CONTOURS (masl)	(grey line)	GROUP 3 WELLS (dark green)	GROUP 6 WELLS (green)
INACTIVE CELLS	(black)	GROUP 1 WELLS	(cyan dot)	GROUP 4 WELLS (purple)	GROUP 7 WELLS (orange)

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

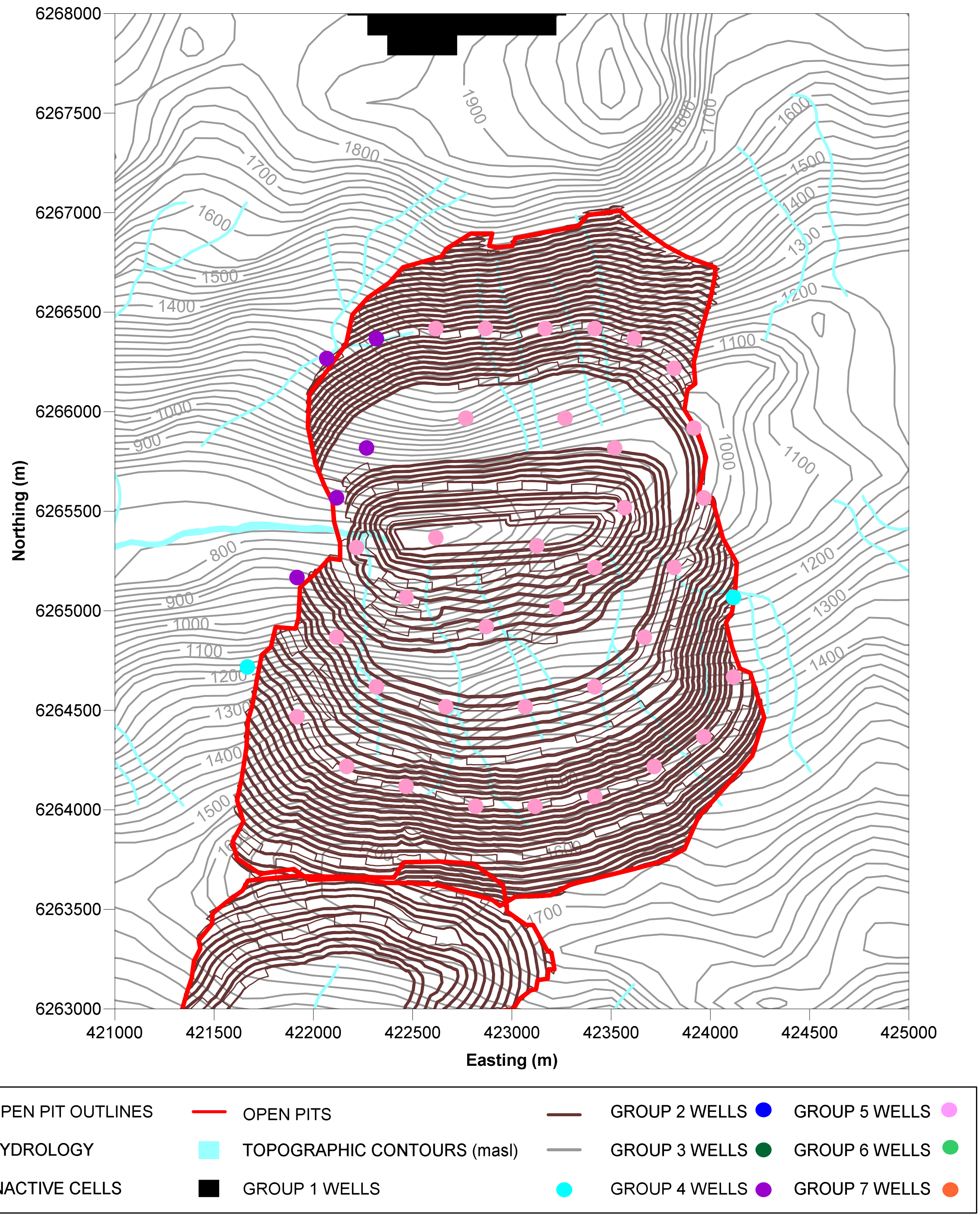
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT YEAR 10 WELL LAYOUT

CLIENT	PROJECT No:	FIG No:	REV.
SEABRIDGE GOLD INC.	0638-004	C7	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Year 10 Well Layout.srf



K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Year 20 Well Layout.srf

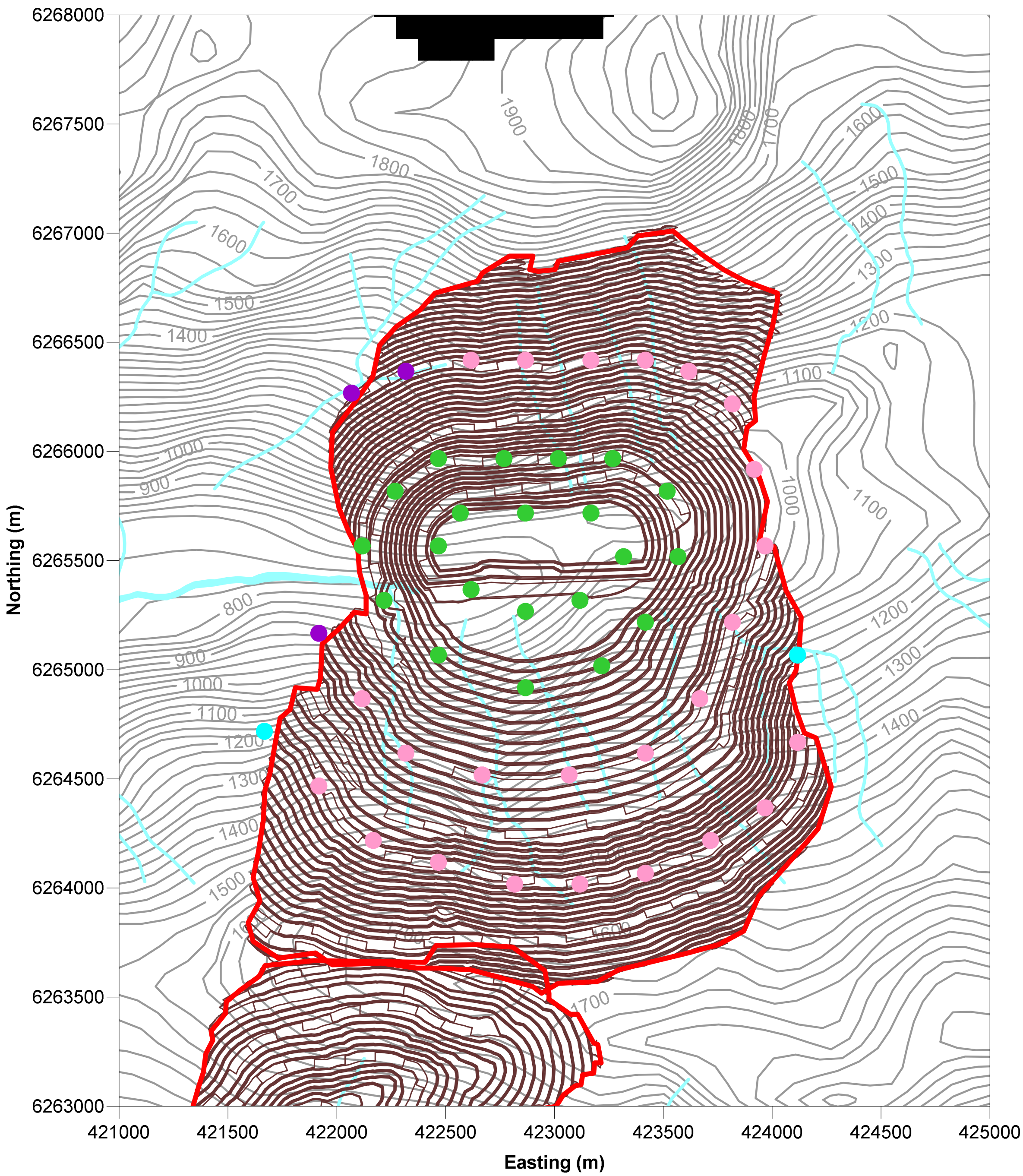
SCALE: AS SHOWN	DESIGNED: RT
DATE: APR 2010	CHECKED: RT
DRAWN: DKR	APPROVED: TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT YEAR 20 WELL LAYOUT

CLIENT	PROJECT No:	FIG No:	REV.
SEABRIDGE GOLD INC.	0638-004	C8	0



OPEN PIT OUTLINES		OPEN PITS		GROUP 2 WELLS	GROUP 5 WELLS
HYDROLOGY		TOPOGRAPHIC CONTOURS (masl)		GROUP 3 WELLS	GROUP 6 WELLS
INACTIVE CELLS		GROUP 1 WELLS		GROUP 4 WELLS	GROUP 7 WELLS

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

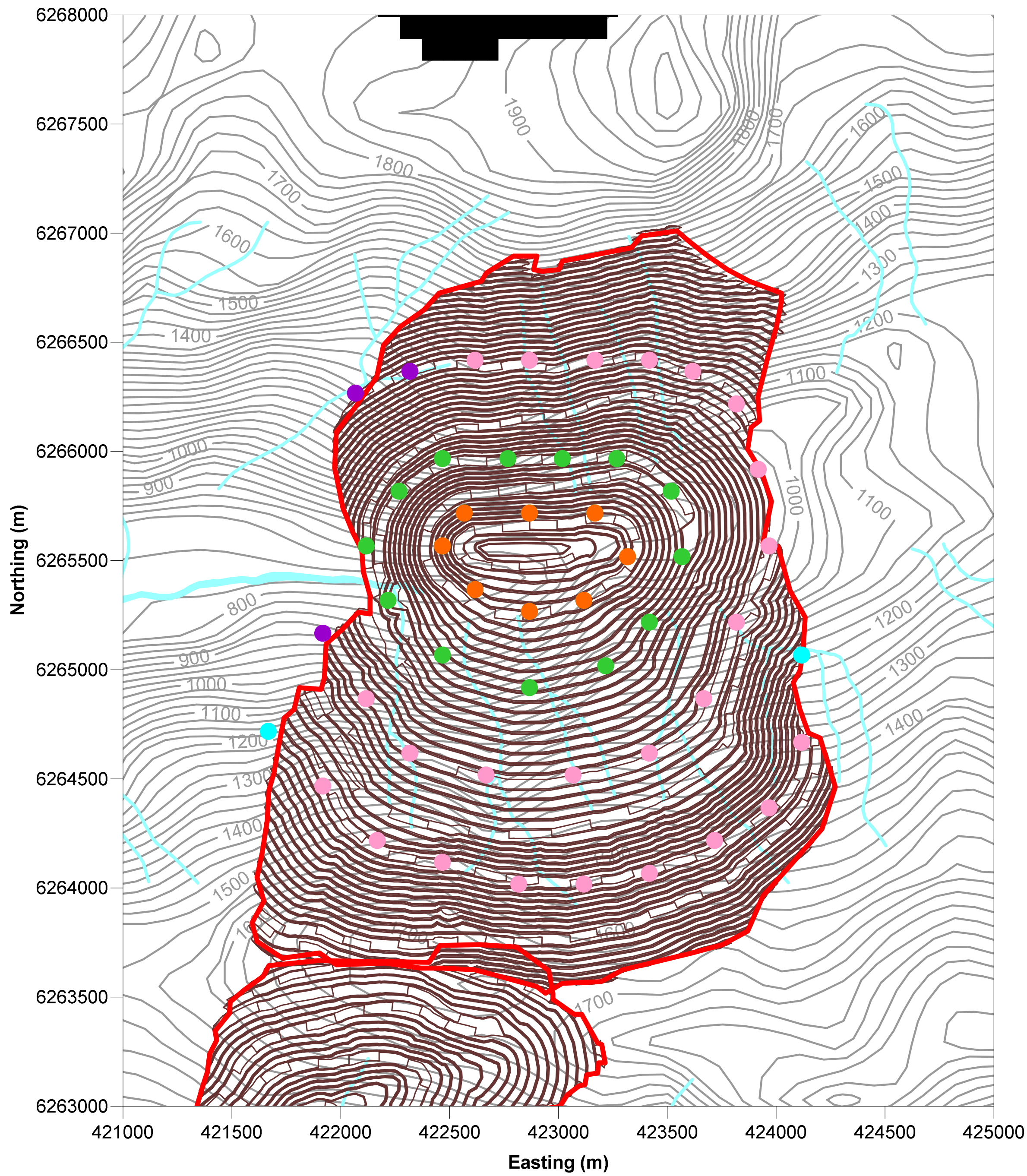
PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT YEAR 30 WELL LAYOUT

CLIENT: SEABRIDGE GOLD INC.

PROJECT No:	FIG No:	REV.
0638-004	C9	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Year 30 Well Layout.srf



OPEN PIT OUTLINES		OPEN PITS		GROUP 2 WELLS	GROUP 5 WELLS
HYDROLOGY		TOPOGRAPHIC CONTOURS (masl)		GROUP 3 WELLS	GROUP 6 WELLS
INACTIVE CELLS		GROUP 1 WELLS		GROUP 4 WELLS	GROUP 7 WELLS

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	TC

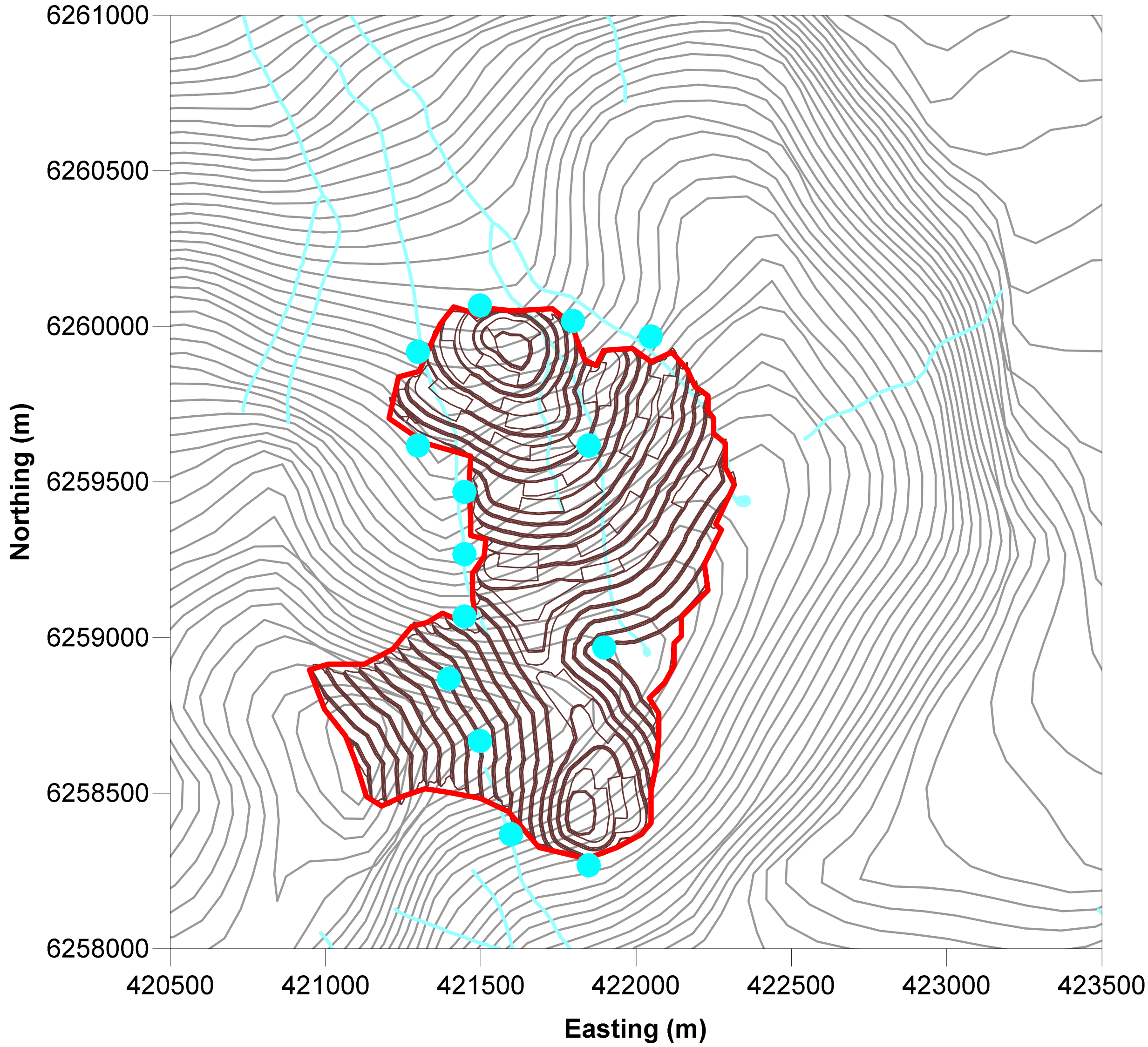
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: MITCHELL PIT LIFE OF MINE WELL LAYOUT

CLIENT	PROJECT No:	FIG No:	REV.
SEABRIDGE GOLD INC.	0638-004	C10	0

K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Mitchell Pit LOM Well Layout.srf



OPEN PIT OUTLINES	(red line)	OPEN PITS	(dark brown line)
HYDROLOGY	(light cyan square)	TOPOGRAPHIC CONTOURS (masl)	(grey line)
INACTIVE CELLS	(black square)	GROUP 1 WELLS	(cyan dot)

SCALE:	AS SHOWN	DESIGNED:	RT
DATE:	APR 2010	CHECKED:	RT
DRAWN:	DKR	APPROVED:	RT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

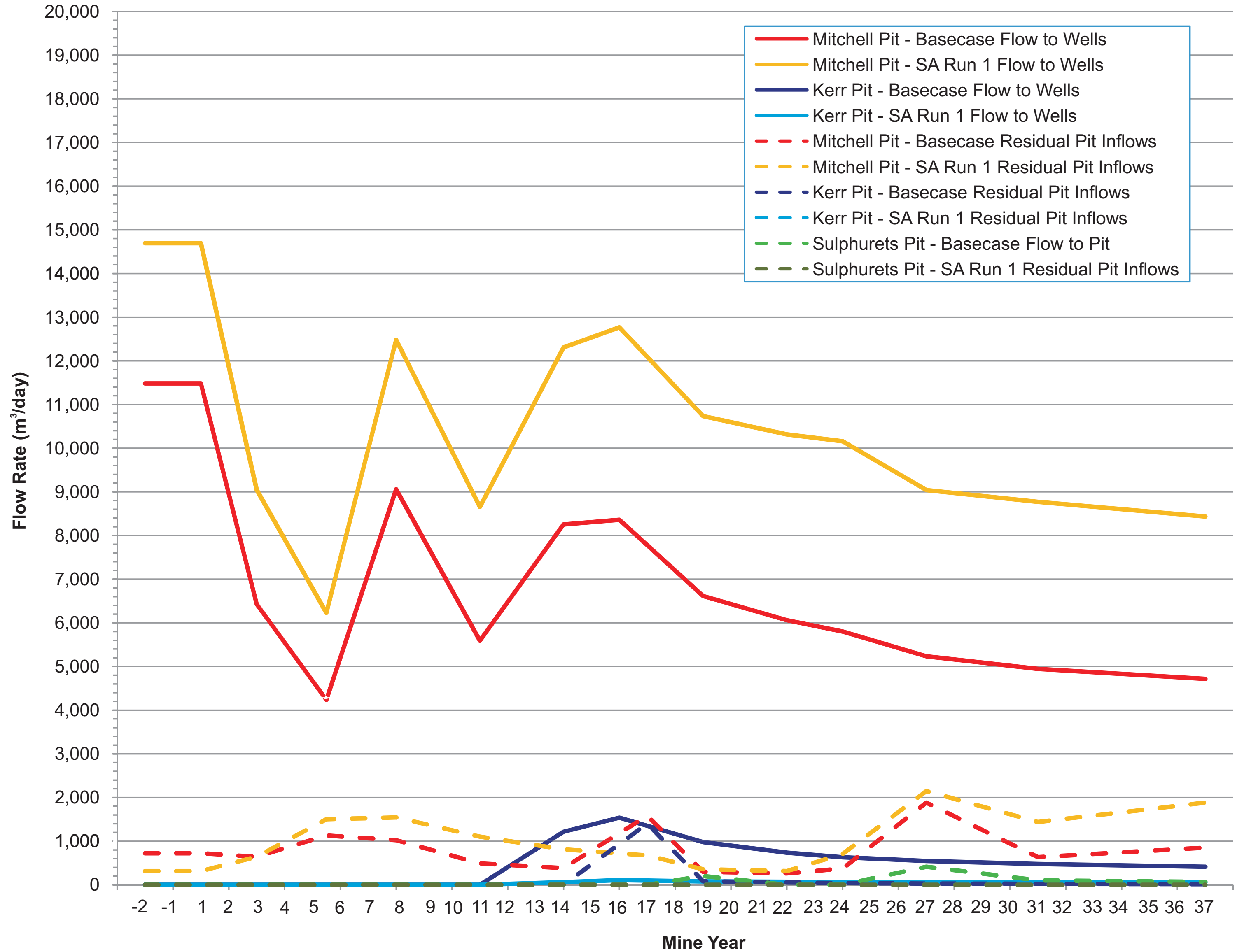
PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: KERR PIT LIFE OF MINE WELL LAYOUT

CLIENT	PROJECT No:	FIG No:	REV.
SEABRIDGE GOLD INC.	0638-004	C11	0

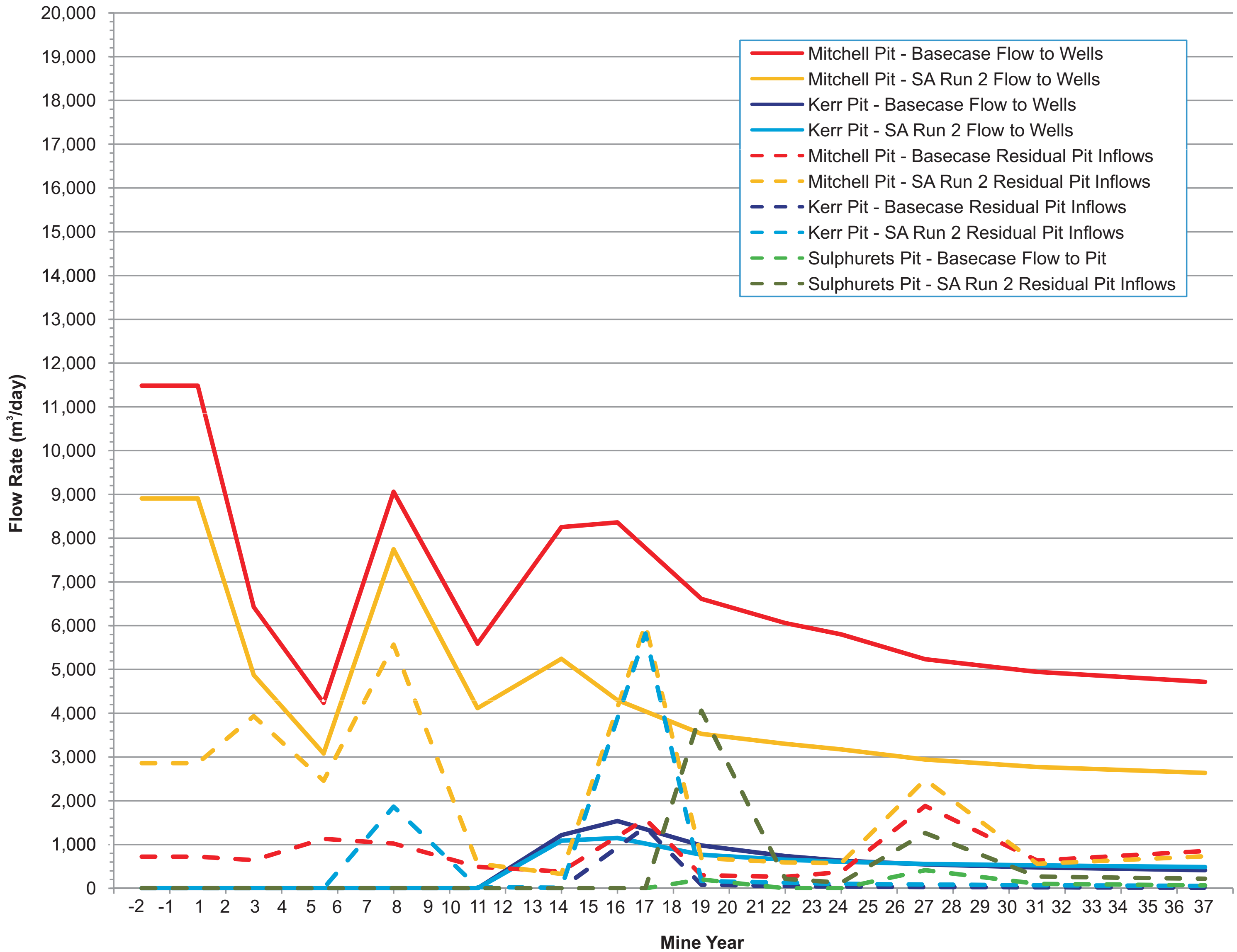
K:/Projects/0638 004 Seabridge/004 KSM Pit Hydrogeo PFS/Report/Appendices/Appendix D/Kerr Pit LOM Well Layout.srf

APPENDIX D
SENSITIVITY ANALYSIS RESULTS



SCALE: NTS	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT		TITLE: SENSITIVITY ANALYSES RESULTS - RUN 1
DRAWN: RT	APPROVED: TC	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 / DWG No.: D1 / REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

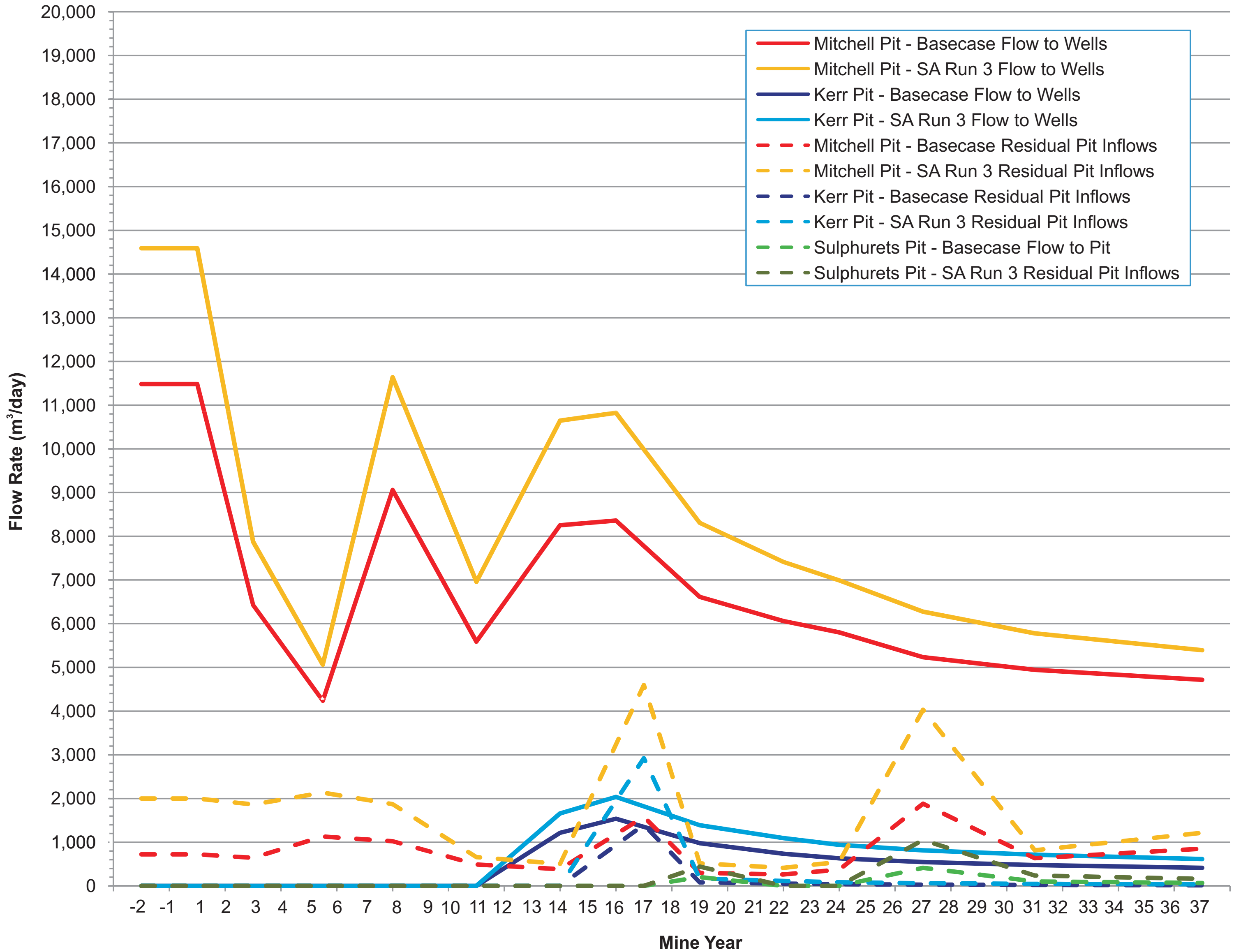
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: SENSITIVITY ANALYSES RESULTS - RUN 2

PROJECT No.:	DWG No.:	REV.:
0638-004	D2	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE:	NTS	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	RT	APPROVED:	TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

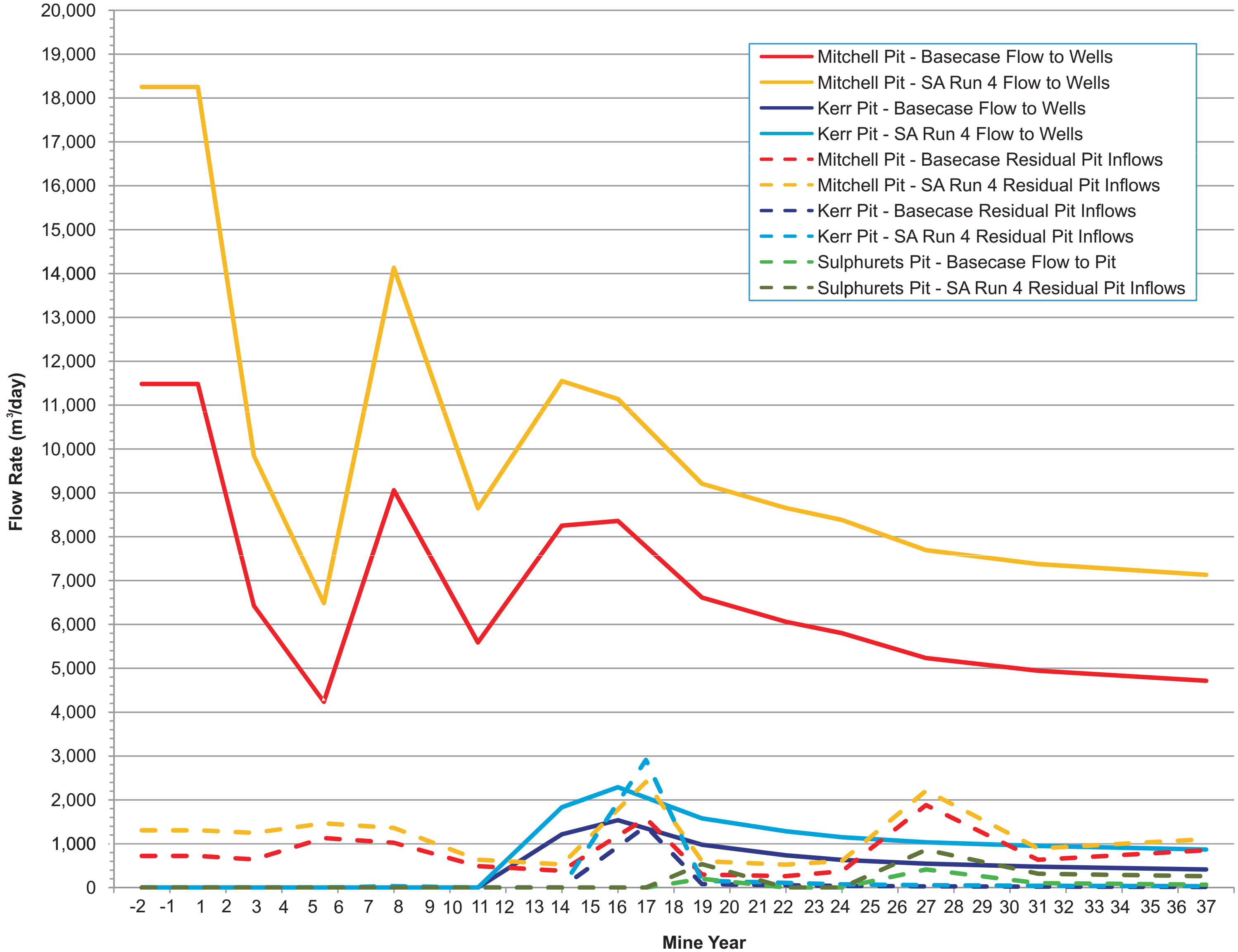
CLIENT:
SEABRIDGE GOLD INC.

PROJECT:
KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE:
SENSITIVITY ANALYSES RESULTS - RUN 3

PROJECT No.:	DWG No.:	REV.:
0638-004	D3	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: TC

BGC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

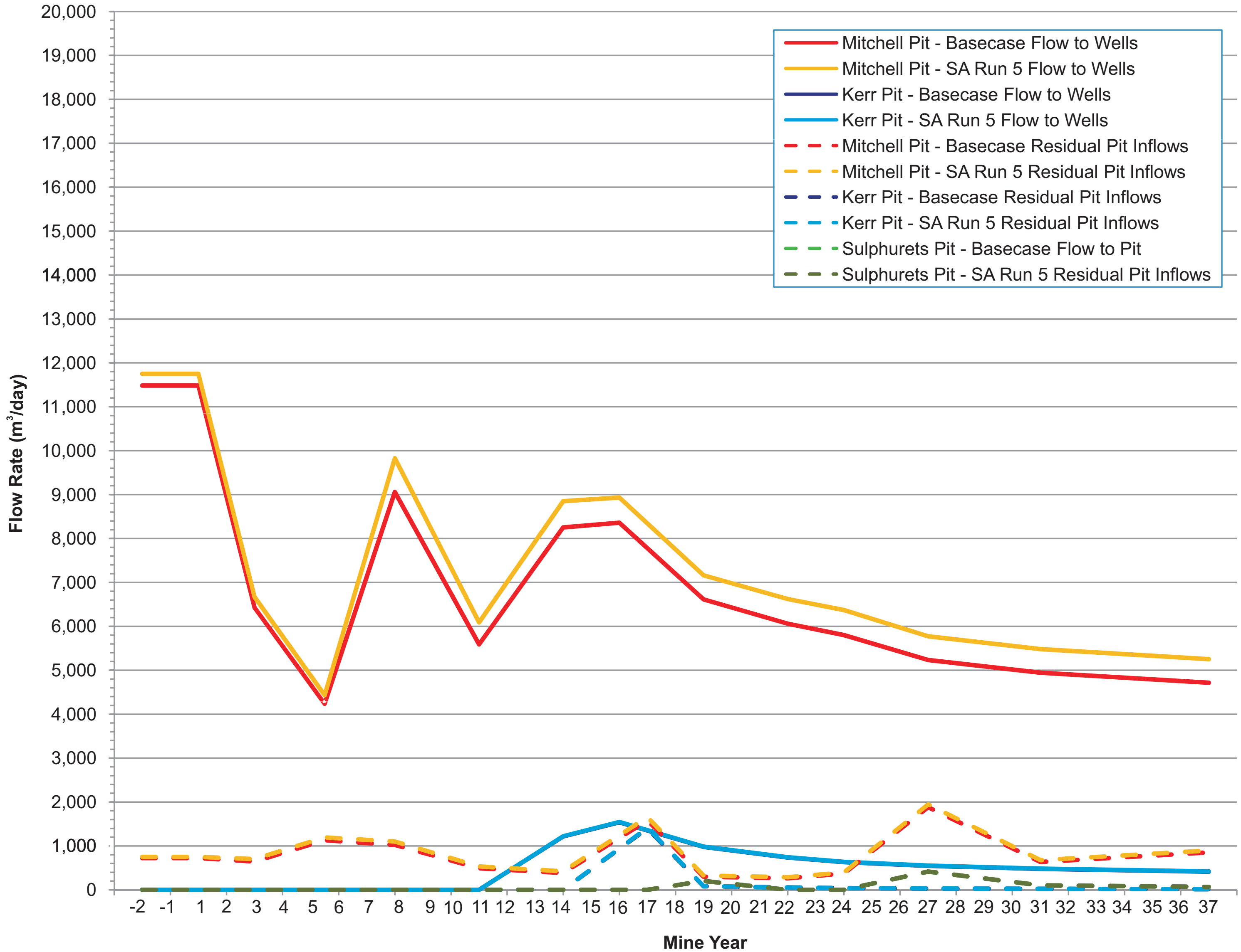
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: SENSITIVITY ANALYSES RESULTS - RUN 4

PROJECT No.:	DWG No.:	REV.:
0638-004	D4	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE: NTS	DESIGNED: RT
DATE: APRIL 2010	CHECKED: RT
DRAWN: RT	APPROVED: TC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

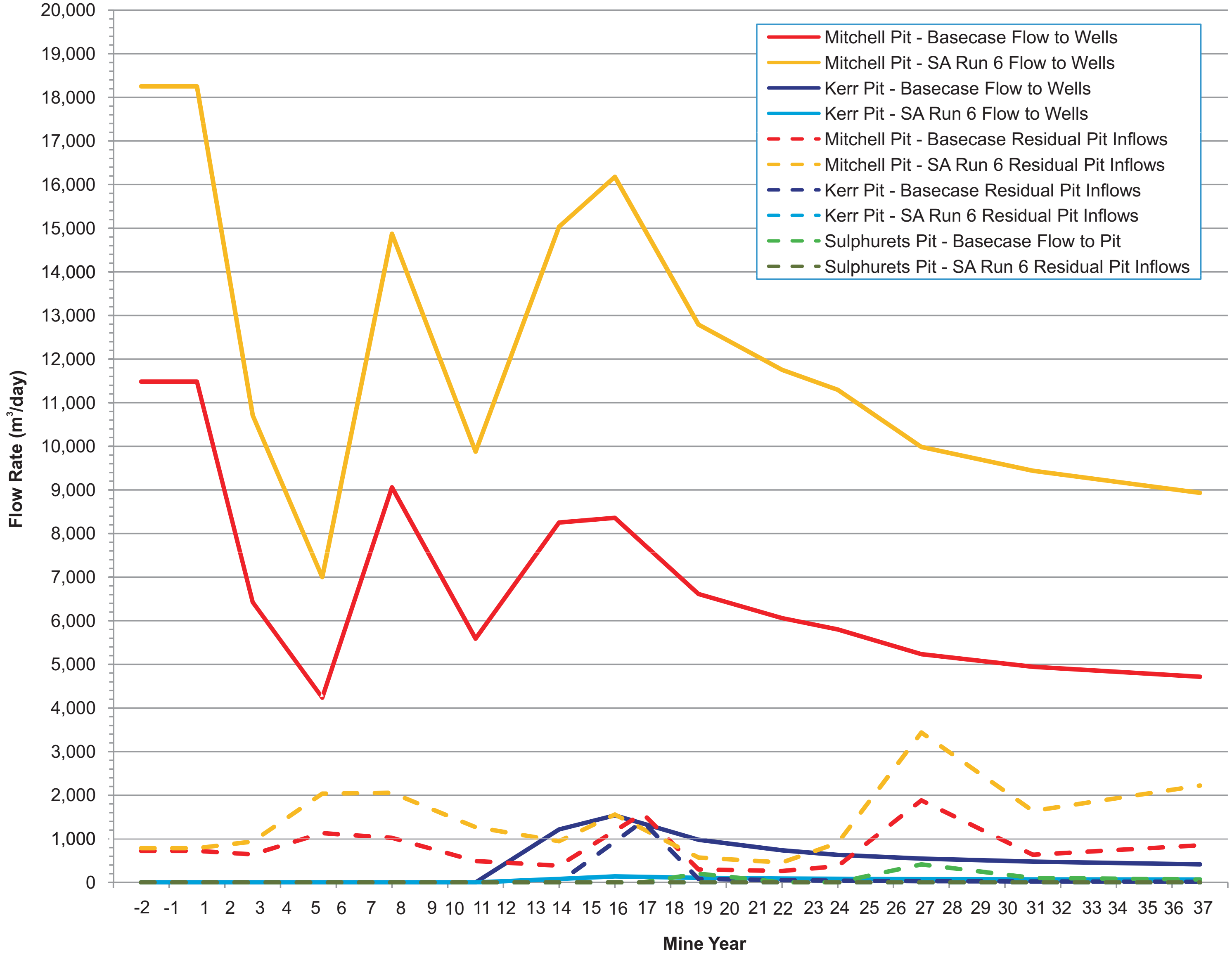
CLIENT: SEABRIDGE GOLD INC.

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

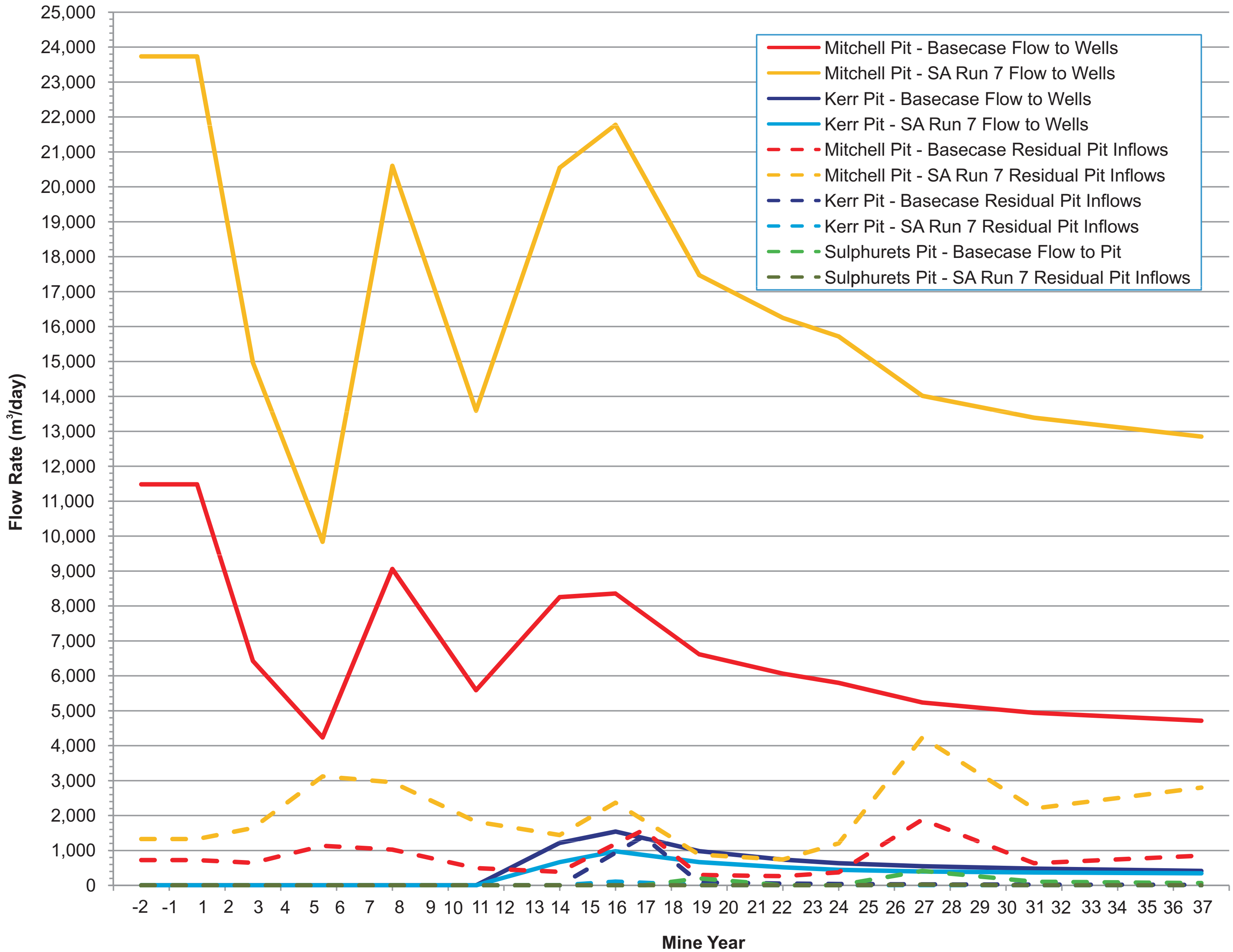
TITLE: SENSITIVITY ANALYSES RESULTS - RUN 5

PROJECT No.:	DWG No.:	REV.:
0638-004	D5	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr



SCALE: NTS	DESIGNED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT		TITLE: SENSITIVITY ANALYSES RESULTS - RUN 6
DRAWN: RT	APPROVED: TC	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 / DWG No.: D6 / REV.: 0



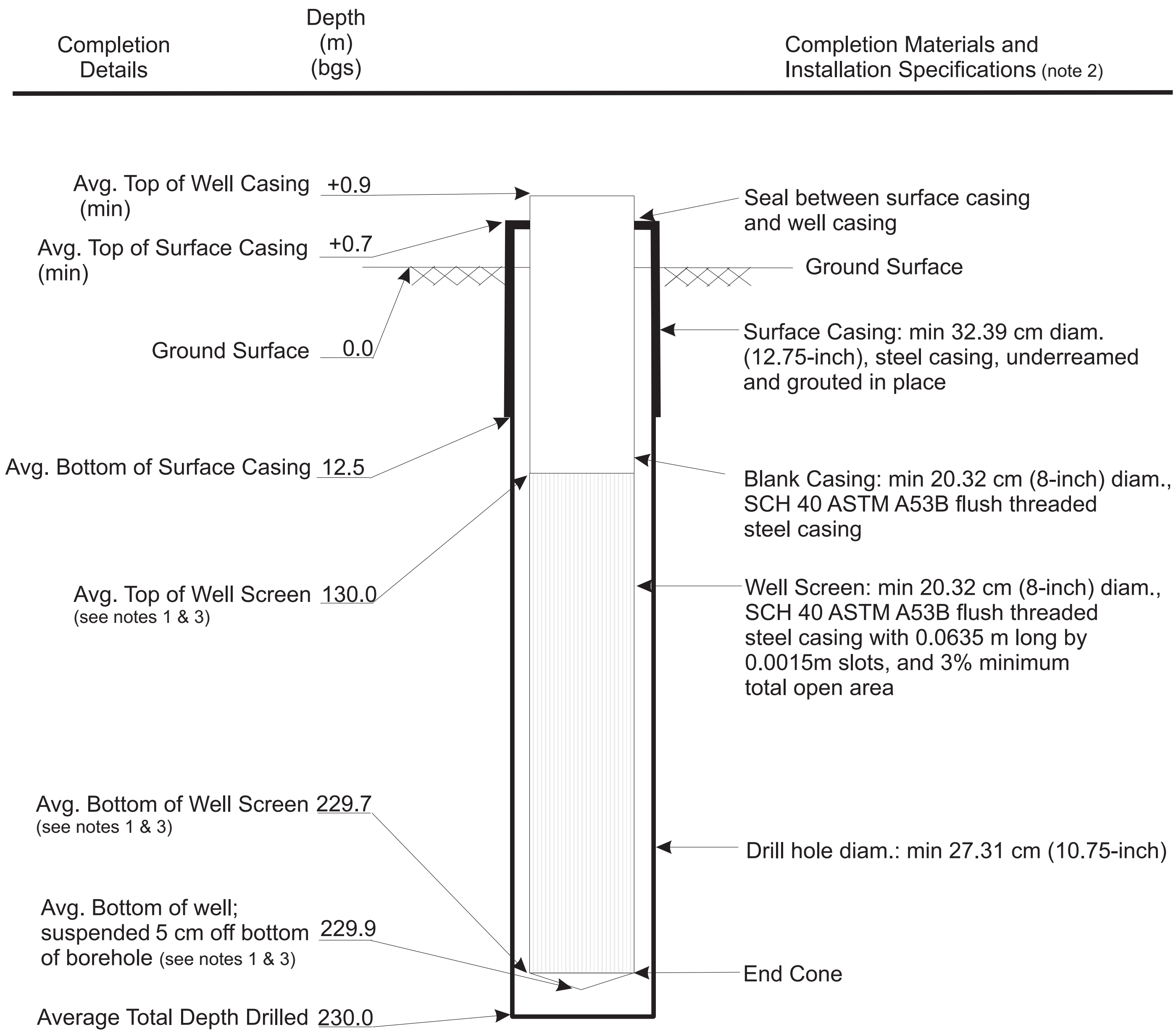
SCALE: NTS	DESIGNED: RT		PROJECT: KSM PROJECT OPEN PIT DEPRESSURIZATION ANALYSES
DATE: APRIL 2010	CHECKED: RT	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	TITLE: SENSITIVITY ANALYSES RESULTS - RUN 7
DRAWN: RT	APPROVED: TC	CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-004 / DWG No.: D7 / REV.: 0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Figures\corel Figures.cdr

APPENDIX E

PRELIMINARY VERTICAL WELL DESIGN

Vertical Dewatering Well Design Schematic - Vertical Well



Notes:
1. Dimensions and depths indicated are for vertical dewatering wells.
2. Material types and specifications noted are based experience at similar sites. Alternate materials may be specified for well construction provided similar material performance can be demonstrated.
3. Anticipated pumping rates per well: 1.3 to 7.6 L/s (20 - 120 US gpm).
4. Drawing is not to scale.

SCALE:	NTS	DESIGNED:	RT
DATE:	APRIL 2010	CHECKED:	RT
DRAWN:	RT	APPROVED:	CT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: KSM PROJECT
OPEN PIT DEPRESSURIZATION ANALYSES

TITLE: DEWATERING WELL DESIGN SCHEMATIC

CLIENT: SEABRIDGE GOLD INC.

PROJECT No.:	DWG No.:	REV.:
0638-004	E1	0

K:\Projects\0638 004 Seabridge\004 KSM Pit Hydrogeo PFS\Report\Appendices\AppendixC_WellSchematic.cdr